NATIONAL CONFERENCE ON PHYSICS - 2023

9 – 11 March 2023

Theme: Innovative Research for Development

Programme & Abstracts Book

Venue: Jahangirnagar University
Savar, Dhaka

Organized by
Bangladesh Physical Society

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List of Sessions

Sl. No.	Session Name	Session Number	Date	Time
1.	Plenary Session		9th March 2023	11:30 – 12:40
2.	Theoretical & Computational Physics - I	IA	"	14:30 – 16:10
3.	Condensed Matter Physics - I	IB	"	14:30 – 16:10
4.	Radiation and Health Physics	IIA	"	16:30 – 18:10
5.	Plasma and Astrophysics	IIB	"	16:30 – 18:10
6.	Materials Science – I	IIIA	10th March 2023	9:00 – 10:40
7.	Nano-Structure Physics	IIIB	"	9:00 – 10:40
8.	Theoretical and Computational Physics - II	IVA	"	11:00 – 12:40
9.	Condensed Matter Physics - II	IVB	"	11:00 – 12:40
10.	Poster Session		"	14:30 – 16:00
11.	Biomedical Physics	VA	"	16:10 – 17:30
12.	Electronics & ICT	VB	"	16:10 – 17:30
13.	Materials Science - II	VIA	11th March 2023	9:00 – 10:40
14.	Environmental Science	VIB	"	9:00 – 10:40
15.	Nuclear Physics	VIIA	"	11:00 – 12:40
16.	Atmospheric Physics	VIIB	"	11:00 – 12:40
17.	Thin Film	VIIIA	"	14:00 – 15:40
18.	Composite Materials	VIIIB		14:00 – 15:40
19.	Physics Education	IX		16:00 – 17:00

List of Sessions Chair(s)

Sl. No.	Session Name	Session Number	Date	Time	Session Chair /Discussant
1.	Plenary Session		9th March 2023	11:30 – 13:00	Prof. Dr. Mesbahuddin Ahmed Prof. Dr. Md. Abu Hashan Bhuiyan
2.	Theoretical & Computational Physics - I	IA	"	14:30 – 16:10	Prof. Dr. Tahmina Ferdous Dr. Abu Zafur Ziauddin Ahmed
3.	Condensed Matter Physics - I	IB	"	14:30 – 16:10	Prof. Dr. A. T. M. Kaosar Jamil Prof. Dr. Mohammad Jellur Rahman
4.	Radiation and Health Physics	IIA	"	16:30 – 18:10	Prof. Dr. Suranjan Kumar Das Md. Sazzad Hossain
5.	Plasma and Astrophysics	IIB	"	16:30 – 18:10	Prof. Dr. M. Salahuddin Prof. Dr. Sharmin Sultana
6.	Materials Science – I	IIIA	10th March 2023	9:00 – 10:40	Prof. Dr. M. Khalilur Rahman Khan Prof. Dr. Md. Abdul Basith
7.	Nano-Structure Physics	IIIB	"	9:00 – 10:40	Dr. A. K. M. Abdul Hakim Prof. Dr. Md. Mohi Uddin
8.	Theoretical and Computational Physics - II	IVA	"	11:00 – 12:40	Prof. Dr. Abdullah Shams Bin Tareq Prof. Dr. Ratan Chandra Gosh
9.	Condensed Matter Physics - II	IVB	"	11:00 – 12:40	Prof. Dr. Md. Nure Alam Abdullah Prof. Dr. Sajal Kumar Majumder
10.	Poster Session		"	14:30 – 16:00	
11.	Biomedical Physics	VA	"	16:10 – 17:30	Prof. Dr. A. K.M. Moinul Haque Meaze Prof. Dr. Hasin Anupama Azhari
12.	Electronics & ICT	VB	"	16:10 – 17:30	Dr. Md. Shakil Ahmed Dr. Mohammad Mahfuz Alam
13.	Materials Science - II	VIA	11th March 2023	9:00 – 10:40	Prof. Dr. Ishtiaque M. Syed Prof. Dr. Mohammad Belal Hossen
14.	Environmental Science	VIB	"	9:00 – 10:40	Prof Dr. Abdul Hannan Dr. Shovon Kumar Kundu
15.	Nuclear Physics	VIIA	"	11:00 – 12:40	Dr. Syed Mohammod Hossain Dr. Mohammad Khalaquzzaman
16.	Atmospheric Physics	VIIB	"	11:00 – 12:40	Dr. Md. Abdul Mannan Dr. Muhammad Abul Kalam Mallik
17.	Thin Film	VIIIA	"	14:00 – 15:40	Prof. Dr. Jiban Podder Dr. Md. Tareq Chowdhury
18.	Composite Materials	VIIIB		14:00 – 15:40	Prof. Dr. Shibendra Shekher Sikder Prof. Dr. Kazi Hanium Maria
19.	Physics Education	IX		16:00 – 17:00	Prof Shamima K. Chowdhury Prof. Dr. G. M. Bhuiyan Prof. Dr. Md. Obaidur Rahman

List of of Invited Speaker(s)

Sl. No.	Session Name	Session Number	Date	Time	Invited Speaker
1.	Plenary Session		9th March 2023	11:30 – 13:00	Prof. Dr. M. Shamsher Ali Prof. Dr. A. A. Mamun
2.	Theoretical & Computational Physics - I	IA	"	14:30 – 16:10	Prof. Dr. Saleh Hasan Naqib
3.	Condensed Matter Physics - I	IB	"	14:30 – 16:10	Prof. Dr. Md. Obaidur Rahman
4.	Radiation and Health Physics	IIA	"	16:30 – 18:10	Dr. Md. Shuza Uddin
5.	Plasma and Astrophysics	IIB	"	16:30 – 18:10	Dr. Md. Khairul Islam
6.	Materials Science – I	IIIA	10th March 2023	9:00 – 10:40	Prof. Dr. Jiban Podder
7.	Nano-Structure Physics	IIIB	"	9:00 – 10:40	Prof. Dr. Swapan K. Roy
8.	Theoretical and Computational Physics - II	IVA	"	11:00 – 12:40	Prof. Dr. G. M. Bhuiyan
9.	Condensed Matter Physics - II	IVB	"	11:00 – 12:40	Prof. Dr. A. K. M. Akther Hossain
10.	Poster Session		"	14:30 – 16:00	
11.	Biomedical Physics	VA	"	16:10 – 17:30	Prof. Dr. Mohammad Abu Sayem Karal
12.	Electronics & ICT	VB	"	16:10 – 17:30	Col Molla Md Zubaer, SPP, te
13.	Materials Science - II	VIA	11th March 2023	9:00 – 10:40	Prof. Dr. Shibendra Shekher Sikder
14.	Environmental Science	VIB	"	9:00 – 10:40	Prof. Dr. Md. Mostafizur Rahman
15.	Nuclear Physics	VIIA	"	11:00 – 12:40	Dr. A. F. M. Masum Rabbani
16.	Atmospheric Physics	VIIB	"	11:00 – 12:40	Prof. Dr. Md. Mahbub Alam
17.	Thin Film	VIIIA	"	14:00 – 15:40	Prof. Dr. Md. Akhtaruzzaman
18.	Composite Materials	VIIIB		14:00 – 15:40	Dr. Abdul Gafur
19.	Physics Education	IX		16:00 – 17:00	

National Conference on Physics – 2023 9 – 11 March 2023

PROGRAMME

DAY – 1: 9th March 2023 (Thursday)

Time: **9:00 – 10:00**
Registration of the Participants

10:00 – 11:00
Inaugural Session

11:00 – 11:30
Refreshment

Venue: **Seminar Hall, Zahir Raihan Auditorium, Jahangirnagar University**

Plenary Session:

Venue: **Seminar Hall, Zahir Raihan Auditorium, Jahangirnagar University**

Time: **11:30 – 12:40**

Chair: Prof. Dr. Mesbahuddin Ahmed
Prof. Dr. Md. Abu Hashan Bhuiyan

Plenary Talk: **[35+35 minutes]**

PT-1: **New Ideas of Physics and Their Implications for Life:** M. Shamsher Ali

PT-2: **Sir Jagadish Chandra Bose: Extra-Ordinary Man of Science:** A. A. Mamun

Lunch Break: **12:40 – 14:30**

Technical Session Programme : Oral Presentation

Session -IA: **Theoretical and Computational Physics-I**

Venue: **Seminar Room, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **14:30 – 16:10**

Chair: Prof. Dr. Tahmina Ferdous
Dr. Abu Zafur Ziauddin Ahmed

Invited Talk: **[20 minutes]**

IT-TCP-I: **Overdoping, Magnetic Effects and Degradation of the Superconducting Tc in Ca Substituted YBCO:** S. H. Naqib

Contributory papers: **[10 minutes each paper]**

TCP-1: **Differentiating between Molecular and Tightly Bound Multiquark States:** Abdullah Shams Bin Tariq

TCP-2: **A Two State Model Study of Magnetic Properties of $Pr_2Re_3Si_5$ Compound:** Sumal Chandra, Samiun Khatun

TCP-3: **Ab Initio Study of Stress Effects on Structural, Electronic, and Optical Properties of Cubic $XAlO_3$ (X= Ce and Pr) Structure:** Prianka Mondal, Kamal Hossain, Farid Ahmed

TCP-4: **Substituting X Cations by Co and Ni in Tuning Physical Properties of Sr_2TiXO_6 Double Perovskites: A DFT Study:** Kamal Hossain, Rabeya Akter Rabu, Shibendra Shekher Sikder, Farid Ahmed

TCP-5: **Computational Study on Physiochemical Properties of Pristine and Transition Metal (Pt, Au) Doped $B_{12}N_{12}$ Fullerene:** Mimi Saha Katha, Aoly Ur Rahman, Uparna Singha, Md. Kabir Uddin Sikder

TCP-6: **Strain Impact on Optical, Spin-Orbit Coupling, and Phonon Properties of Mosse Heterostructure: A DFT Analysis:** Farah B H Pritu, Md Rasidul Islam, Nusrat Jahan, M Mahbubur Rahman

TCP-7: **A DFT Analysis of the Strain Effect on Structure and Properties of Cubic $Mapbi_3$ Perovskites:** Tamanna Binte Rahman, Md Rasidul Islam, Md Mehdi Masud, M Mahbubur Rahman

TCP-8: **Non-Monotonic Potentials for $A+^{36,40}Ar$ Elastic Scattering:** Shahadat Hossain Dipu, Jakir Hossain Ovi and M. Nure Alam Abdullah

Session-IB: **Condensed Matter Physics-I**

Venue: **Room No. 313, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **14:30 – 16:10**

Chair: Prof. Dr. A. T. M. Kaosar Jamil
Prof. Mohammed Jellur Rahman

Invited Talk: **[20 minutes]**

IT-CMP-I: **Theoretical and Experimental NMR, IR Spectra Studies of Paracetamol:** Md Obaidur Rahman, Mohammad Khairul Islam, Umme Habiba

Contributory papers : **[10 minutes each paper]**

CMP-1: **A First-Principles Exploration of Electronic, Mechanical, Optoelectronic, Thermo-Physical, and Lattice Dynamical Properties of $Sntas_2$:** M. I. Naher, M. Mahamudujjaman, A. Tasnim, R. S. Islam, and S. H. Naqib

CMP-2: **A First-Principles Study on Structural, Mechanical, Electronic and Optical Properties of Half-Metallic $CaMSi_2O_6$ (M= Co, Fe, Mn) Clinopyroxenes:** F.Fakhera, N.A.Shahed, S.Khanom, K.Hossain, F.Ahmed

CMP-3: **Static Properties of Superconducting Pyramidal STM Tip In the Presence of a Vortex:** Abul Hasnat Rubel

CMP-4: **A DFT-Based Study of Thermo-Mechanical and Optoelectronic Properties of $Pbtase_2$ Topological Semimetal:** A.S.M. Muhasin Reza, S.H. Naqib

CMP-5: **A Density Functional Theory Based Insights into the Physical Properties of XC (X = Nb, Ta, Ti) Metallic Binary Carbides:** Razu Ahmed, Md. Sohel Rana, Sajidul Islam, Md. Mahamudujjaman, S. H. Naqib

CMP-6: **A Comparative Study of Structural, Elastic, Thermophysical, and Optoelectronic Properties of $CaZn_2X_2$ (X = N, P, As) Semiconductors via Ab-Initio Approach:** Md. Sajidul Islam, Razu Ahmed, Md. Mahamudujjaman, R.S. Islam, S. H. Naqib

CMP-7 **Pressure Dependent Elastic, Electronic, Optical and High-T_c Superconducting State Properties of Monoclinic and Orthorhombic $MgVH_6$:** Md. Ashraful Alam, F. Parvin, S. H. Naqib

CMP-8 **Density Functional Theory Based Investigation of Physical Properties of Sn_4Au:** Md. Abdul Hadi Shah, S.H. Naqib

Tea Break: **16:10 - 16:30**

Session-IIA: **Radiation and Health Physics**

Venue: **Seminar Room, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **16:30 – 18:10**

Chair: Prof. Dr. Suranjan Kumar Das
Mr. Sazzad Hossain

Invited Talk: **[20 minutes]**

IT-RHP: **Production and Decay Data of the Non-standard Positron Emitter Y-86:** Md. Shuza Uddin, Ingo Spahn, M. Shamsuzzoha Basunia, Lee A. Bernstein, Sandor Sudár, Bernd Neumaier, Syed M. Qaim

Contributory papers: **[10 minutes each paper]**

RHP-1: **Evaluation of the Production Routes of Theragnostics ^{157,165}Dy from the Stable Isotopes of Gadolinium and Dysprosium by Projecting Light Particles:** Rifat Amin, Bhuvan Dey, A. K. M. Rezaur Rahman, Md. Mehedy Hasan Tanvir

RHP-2: **Comparison between Feathering Technique, VMAT Technique and Half-Beam Blocked Field Matching Technique in Craniospinal Irradiation:** Parvez Mosharaf , Sujan Mahamud, Md Saiful Islam, Md. Anwarul Islam, Tariqul Islam, Golam Abu Zakaria

RHP-3: **Estimation of Radiological Risk on Public around Rajshahi Medical College Hospital Campus, Bangladesh:** Md Mostafizur Rahman, M. S. Rahman, H. R. Khan, S. Yeasmin

RHP-4: **Dose Calculation in the Lung Region Using AAA Algorithm and Verification by Measurements:** Laila Sharmin, Rajada Khatun, Md. Anwarul Islam, Shirin Akter, Ashrafun Nahar Monika, Umme Sadia Binte Kashem, Afroza Shelly

RHP-5: **Development of Brachytherapy Facility at Institute of Nuclear Medical Physics (INMP): Our Concerns and Suggestions Regarding Radiation Safety in A Brachytherapy Facility:** A. Rahim, M. S. Sultana, M. M. Parvej, M. A. Hasnat, M. J Hosen S. Alim, M. R. Islam & M. M. Ahasan

RHP-6: **A Comparative Study of Dosimetric Calculation among AAA, Acuros XB & Monte Carlo Simulation in Lung Media:** Md Mazharul Islam Mobin, Tanny Bepari, Md Mokhlesur Rahman, Md Anwarul Islam, Fatema Nasreen

RHP-7: **Study on the Variation of PDD of A Medical Linear Accelerator for Different Energy and Field Size at Institute of Nuclear Medical Physics:** M. A. Shabuj, M. A. Hasnat, M. T. Aziz, M. S. Sultana, A. Rahim, M. R. Islam

RHP-8: **Comparison of the Effectiveness between IMRT and 3D-CRT Radiotherapy Method for Treating Lung Cancer: A Brief Overview:** Ringkey Islam, Aoly Ur Rahman, Md. Abul Hasnat, Md. Kabir Uddin Sikder

Session- IIB: **Plasma and Astrophysics**

Venue: **Room No. 313, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Times: **16:30 – 18:10**

Chair: Prof. Dr. M. Salahuddin
Prof. Dr. Sharmin Sultana

Invited Talk: **[20 minutes]**

IT-PA: **Instability of DA Mode in Irradiated Dusty Plasmas with Dust Charge Fluctuation:** M. K. Islam, M. S. Munir, M. A. H. Talukder, M. Salahuddin

Contributory papers: **[10 minutes each paper]**

PA-1: **Phase Shifts Due to Head-On Collision in Multi-Components Unmagnetized Collisional Dusty Plasmas:** Umma Imon, M S Alam

PA-2: **Ion-Acoustic Shock Waves in Magnetized Pair-Ion Plasma:** T.Yeashna, R. K. Shikha, N. A. Chowdhury, A. Mannan, S. Sultana, and A. A. Mamun

PA-3: **Road to Precision Cosmology: Influence of the Local Environment on Weak-Lensing Statistics:** S. A. Ema, M. R. Hossen, K. Bolejko, and G. F. Lewis

PA-4: **Development of Antigravity Device Using Solid State Propulsion:** Md Rabiul Alam, Kamrul Alam

Khan, Md. Abu Sayid Haque, Md. Anzan-Uz-Zaman

PA-5: **Production and Characterization of Series Gliding Arc Air Discharge Plasma Jet:** M. R. Talukder

PA-6: **The Novel Approach of Electronic Brachytherapy for the Treatment of Breast Cancer:** Md Mokhlesur Rahman, Md. Hafizur Rahman, Md. Zulkar Naen, Mohammad Emadul Islam Md. Masud Rana, H.M. Waliullah, and Md. Saiful Islam

PA-7: **Effects of Plasma Activated Water on Growth, Antioxidant Enzyme, Nutritional Composition and Yield of Wheat (*Triticum Aestivum* L.):** Mamunur Rashid and M. R. Talukder

PA-8: **Efficient Degradation of Textile Dye with Multi-Tube Air Bubble Discharge Plasma Jet:** Md. Al-Alim, A. K. Sah, M. M. Rashid and M. R. Talukder

DAY – 2 10th March 2023 (Friday)

Session -IIIA **Materials Science-I**

Venue **Seminar Room, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time **9:00 – 10:40**

Chair: Prof. Dr. M. Khalilur Rahman Khan
Prof. Dr. Mohammed Abdul Basith

Invited Talk: **[20 minutes]**

IT-MS-I: **A State-of-the-art of Nonlinear Optical Single-Crystal for Optoelectronic Applications:** Jiban Podder

Contributory papers : **[10 minutes each paper]**

MS-1: **Structural, Optical, Electrical and Magnetic Properties of Nickel Substituted Manganese-Based $BaTiO_3$ Ceramics:** M. A. H. Sadi, K. N. Munny, F. T. Z. Toma , H. N. Das, M. K. Alam and M. N. I. Khan

MS-2: **Sintering Effect on Electromagnetic Properties of B_2O_3 Incorporated Ni-Cu-Zn Ferrites:** M. A. Gofur, M. N. I. Khan, M. A. Hossain, R. Rashid, N. Begum and S. S. Sikder

MS-3: **Structural and Temperature Dependent Magnetic Properties of Y-Doped Co-Zn Ferrites:** M.D. Hossain, M.N.I. Khan, M.A. Hossain, M.T. Islam, A. Kumar, N. Begum, S.S. Sikder

MS-4: **Zn-Induced Magnetism in $La_{2-X}Sr_xCu_{1-Y}Zn_yO_4$: Relevance to the Suppression of Superconducting Critical Temperature:** R. S. Islam and S. H. Naqib

MS-5: **Effect of Yttrium on Partial Replacement Fe in Mn-Zn Ferrites:** S. S. Acharjee, M N I Khan, M A Hossain, M. D. Hossain H. N. Das and S S Sikder

MS-6: **Structural and Magnetic Properties of Holmium Doped Bi-Ferrites:** T. Tabassum Hredy, M. N. I. Khan, M. A. Basith, M. S. Islam, Rimi Rashid, F. A. Khan and M. K. Alam

MS-7: **Study of the Influence of (Sr, Ni) Substitution on the Cubic $BaTiO_3$ (BTO):** Arpon Chakraborty, M.N.H. Liton, M.S.I. Sarker, M.M. Rahman, M.K.R. Khan

MS-8: **Study of Thortveitite Structure of Zinc Pyrovanadate $Zn_2V_2O_7$ under Pressure:** S. Reza and M. S. Islam

Session-IIIB: **Nano-Structure Physics**

Venue: **Room No. 313, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **9:00 – 10:40**

Chair: Dr. A. K. M. Abdul Hakim

Prof. Dr. Md. Mohi Uddin

Invited Talk: **[20 minutes]**

IT-NSP: **Frequency Stability in Nano-Optomechanical Systems:** Swapan K. Roy and Wayne K. Hiebert

Contributory papers : **[10 minutes each paper]**

NSP-1: **Ferromagnetic Behaviour of Nickel-Doped Zinc Oxide at Room Temperature:** Manika Tun Nafisa, Md. Nazrul Islam Khan and A K M Fazle Kibria

NSP-2: **T Graphene: A High Capacity Anode Material for Mg and Ca Ion Battery:** Obaidullah Bhuiyan, and Siraj Ud Daula Shamim

NSP-3: **Investigation of Structure with XRD Analysis, Impedance Spectroscopy, and Optical Property Analysis of Ni-Mg-Cu-Cd Dense Ceramic Obtain from Nanocrystalline Ferrites:** M. Shahbaz Khan and M. Belal Hossen

NSP-4: **High-Temperature Stable Transition Aluminas Nanoparticles Recovered from Sol–Gel Processed Chitosan-Alox Organic–Inorganic Hybrid Films for Improvement of Flash Point of Petroleum Oil**
Shamsun Nahar, Sazmin Akter, Afia Yasmin

NSP-5: **Structural, Morphological and Magnetic Properties of Lanthanum Doped Cobalt Nanoferrite:** M. S. Islam, I. B. Elius, M. S. Aktar, S. I. Liba, J. Maudood, S. Hossain, H. N. Das and M. N. I. Khan

NSP-6: **Bio-Degradable Microelectric Fiber from Moringa Oleifera Fruit Fiber Reinforced with Safely Functionalized Carbon Nanotubes:** Md Abul Kalam, Salvin Mustakim, Mohammad Jellur Rahman and Md Tushar Uddin

NSP-7: **Nanocrystalline Nickel Copper Zinc Ferrites: Sol-Gel Synthesis, Rietveld Analysis, Cation Distribution, Maximum Entropy Method, Optical Band Gap and Impedance Spectroscopy Study:** Md. Aminul Islam , M. D. I. Bhuyan , M. Belal Hossen , and Md. Moniruzzaman

NSP-8: **Preparation of NiO–SnO_2 Nanoparticles using Azadirachta Indica Leaf and Myristica Fragrans Fruit Extract for Biological Applications:** Md. Somel Islam, Md. Rasadujjaman, Md. Mamun-Or-Rashid, Md. Abdullah Al Mamun

Tea Break: **10:40 - 11:00**

Session-IVA: **Theoretical and Computational Physics-II**

Venue: **Seminar Room, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **11:00 – 12:40**

Chair: Prof. Dr. Shams Bin Tareq
Prof. Dr. Ratan Chandra Gosh

Invited Talk: **[20 minutes]**

IT-TCP-II: **Stochastic boundary approach and grand canonical MD study of non-equilibrium properties of a system in 2-D:** G. M. Bhuiyan

Contributory papers : **[10 minutes each paper]**

TCP-9: **Non-Monotonic Potential Description of $A+^{12}C$ Elastic Scattering:** Jakir Hossain Ovi, Shahadat Hossain Dipu and M. Nure Alam Abdullah

TCP-10: **Density Functional Theory Based Insights into the Physical Properties of XC (X = Nb, Ta, Ti) Metallic Binary Carbides :** Razu Ahmed, Md. Sohel Rana, Sajidul Islam, Md. Mahamudujjaman, S. H. Naqib

TCP-11: **A Comparative Study of the Structural, Elastic, Thermophysical, and Optoelectronic Properties of $CaZn_2X_2$ (X = N, P, As) Semiconductors via Ab-Initio Approach:** Md. Sajidul Islam, Razu Ahmed, Md. Mahamudujjaman, R.S. Islam, S. H. Naqib

TCP-12: **Zn-Induced Magnetism in $La_{2-x}Sr_xCu_{1-y}Zn_yO_4$: Relevance to the Suppression of**

Superconducting Critical Temperature: R. S. Islam and S. H. Naqib

TCP-13: **Influence of Compressive Strain and Tensile Strain on Cubic $FAPbI_3$ Perovskites: A First-Principles Study:** Farjana Mahajabin, Md Rasidul Islam, Md Mehdi Masud, Hind Adawi, M Mahbubur Rahman

TCP-14: **Electronic, Optical, Phonon, and Spin-Orbit Coupling Properties of Janus Wsse using a First-Principles Study:** Sumiya Khan Sujana, Md Rasidul Islam, Md Mehdi Masud, Hind Adawi, M Mahbubur Rahman

TCP-15: **Potential Applications of ScS_2 Monolayer as K-ion Storage Batteries: A First-principles Analysis:** Tusher Kanti Saha, Abdullah Al Roman, Hind Adawi, M Mahbubur Rahman

TCP-16: **The Stability of a De Sitter MTZ Thin Shell Wormhole Using Two Variable Equations of Different States:** Nusrat Jahan Shirin, Al Motasin, Sabrina Akter Dihan, Saifullah Masum, Md. Tauhidul Islam Rony, Bhuvan Dey and Nur Mohammad Eman

Session-IVB: **Condensed Matter Physics-II**

Venue: **Room No. 313, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **11:00 – 12:40**

Chair: Prof. Dr. Md. Nure Alam Abdullah
Prof. Dr. Sajal Kumar Majumder

Invited Talk: **[20 minutes]**

IT-CMP-II: **Multifunctional Metal Oxides: Materials for the 4th IR:** A. K. M. Akther Hossain

Contributory papers : **[10 minutes each paper]**

CMP-9: **Investigations on the Growth, Thermal, Structural and Optical Behaviour of Pure and L-Asparagine Monohydrate Added Magnesium Sulphate Heptahydrate Crystals:** M. A. Rahman, H. N. Das, J. Podder

CMP-10: **Study of New MAX Phase Materials: Sc_2AX (A= Bi, Br), (X=C, N, B) Via Ab-Initio Method:** Ruma Akther, N. Jahan, M. A. Ali

CMP-11: **Mineralogical and Elemental Analysis of Colored Rocks Collected from the Northern Part of Sylhet District:** Md. Salauddin, Sonjoy Das, M. N. I. Khan, Muhammad Shahriar Bashar, Md. Azizul Hoque, Md. Sarowar Hossain, Abdul Hannan

CMP-12: **Josephson Junction Model: Parallelism between Classical Optics and Quantum Phenomena in Superconductor:** M. R. Islam

CMP-13: **A DFT Investigation of the Predicted MAX Phase Y_2AX (A = S, Br; X = C, N) Compound:** Moreum Akter, N. Jahan, M. A. Ali

CMP-14: **Study on Threshold Displacement Energy Tin using Ab-Initio Molecular Dynamics (AIMD):** Sharif Ahmed, Ain-ul Huda, Mohammad Majidur Rahman, J. M. Costantini and Kazuhiro Yasuda

CMP-15: **A DFT Insight of Electronic, Optical and Thermoelectric Properties of Trigonal $NaSbTe_2$ chalcogenide:** M.N.H. Liton, M.S.I. Sarker, M.M. Rahman and M.K.R. Khan

CMP-16: **Electronic and Optical Properties of the Mono-Doped and Co-Doped Zirconium Disulfide Monolayer: A DFT Investigation:** Sayedul Hasan, Mohammad Tanvir Ahmed, Shariful Islam, and Farid Ahmed

Lunch Break: **12:40 – 14:30**

Poster Session: **14:30 – 16:00**

Tea Break: **16:00 – 16:10**

Session-VA: **Bio-Medical Physics**

Venue: **Seminar Room, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **16:10 – 17:30**

Chair: Prof. Dr. A. K. M. Moinul Haque Meaze
Prof. Dr. Hasin Anupama Azhari

Invited Talk: **[20 minutes]**

IT-BMP: **Poration Dynamics of Cell Mimetic Lipid Vesicles Induced by Peptides, Nanoparticles, Electric Field, and Mechanical Tension:** Mohammad Abu Sayem Karal

Contributory papers : **[10 minutes each paper]**

BMP-1: **Evaluation of the Production Routes of the Ragnostics ^{157,165}Dy from the Stable Isotopes of Gadolinium and Dysprosium by Projecting Light Particles:** Rifat Amin, Bhuvan Dey, A. K. M. Rezaur Rahman, Md. Mehedy Hasan Tanvir

BMP-2: **Anionic Magnetite Nanoparticles Induced Membrane Permeation in Lipid Vesicles under Various Membrane Potentials:** Md. Moniruzzaman, Mohammad Abu Sayem Karal, Md. Kabir Ahamed, Sharif Hasan, Md. Abdul Wadud, and Md. Mamun Or Rashid

BMP-3: **Determining the Structural Properties of Small Sn Cluster (Sn_8) with Transition Metals (Ag, Au) Doping: A DFT Study:** A.Md. Ahsan Habib, B. Aoly Ur Rahman, and C. Md. Kabir Uddin Sikder

BMP-4: **Design and Development of an Iot Based Robotic Arm System for Safe Handling of Radioactive** Shamsul Arefin Shibly, Nishat Vasker, Dr. Abdus Sattar Mollah

BMP-5: **Argument and Contention over the Use of Low-Dose Irradiation to COVID-19 Pneumonia: A Comprehensive Review:** Tanny Bepari, Mehadi Hasan Nazmul, Md Mokhlesur Rahman, Shyam Sundor Shaha, Zakaria G. A.

BMP-6: **Irreversible Electroporation of Tissue for Effective Intramolecular Devilery of Biomacromolecules:** Jannatun Naher Nony, Shovon Saha, Md Saif Ishtique, Md. Khorshed Alam

BMP-7: **Monitoring Pulse Rate and Detecting Atrial Fibrillation with a Non-Invasive MEMS Pressure Sensor:** A.Anika Tun Naziba, B. Manika Tun Nafisa, and C. Mohammad Nasir Uddin

BMP-8: **Preoperative Grading of Intracranial Glioma using Magnetic Resonance Imaging: A Cross Sectional Study:** Farida Yasmin, Bibekananda Halder, Hosne Ara Rahman, Partha pratim Saha, Samira Sharmin, Afroza Naznin

Session-VB: **Electronics and ICT**

Venue: **Room No. 313, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **16:10 – 17:30**

Chair: Dr. Shakil Ahmed
Dr. Mohammad Mahfuz Alam

Invited Talk: **[20 minutes]**

IT-EICT: **An Overview and Prospects of Software Defined Radio**: Molla Md. Zubaer

Contributory papers : **[10 minutes each paper]**

EICT-1: **An Iot-Based Weather Monitoring Patch Antenna:** Md. Shaharul Islam, Md. Firoz Ahmed, M. Hasnat Kabir, and Md. Ashraful Islam

EICT-2: **Development of Smart Healthcare System:** Md. Mobinul Islam, Md. Nimuzzaman, Asif Bin Nur, Md. Ashraful Islam and Md. Matiqul Islam

EICT-3: **Microcontroller-Based High-Speed and Secured Data Communication System for National Defense using LASER:** Ariful Alam, Md. Yasir Arafat, Rahul Drabit Chowdhury, Sanat Kumar Roy

EICT-4: **Multimode Photonic Crystal Fiber Having Low Confinement Loss:** Mst. Sabikun Nahar, Akash Kumar Mondol, and M. Hasnat Kabir

EICT-5: **Harmonic Behavior Analysis of a Step Index Mmi Device Realized with Polymer Material:** Noor Afsary, Md. Koushik Alam, and Md Omar Faruk Rasel

EICT-6: **Gastrointestinal Diseases Detection by Analysing Wireless Capsule Endoscopy Images through Deep Learning:** Papia Sultana, Akif Mahdi, M. Hasnat Kabir, Md. Firoz Ahmed, and Md. Ashraful Islam

EICT-7: **Contact Resistance Minimization for the Fabrication of High Efficiency Silicon Solar Cell:** M. A. R. Akand, S. M. A. Zumahi, M. S. Alam, and M. A. S. Haque

EICT-8: **Fueling the Future: Optimizing the Nuclear Fuel Cycle with Machine Learning:** Nishat Vasker , Shamsul Arefin Shibly

Time: **17:30 – 19:00 Cultural Program**

Time: **19:00 – 20:00 Conference Dinner**

DAY – 3: 11th March 2023 (Saturday)

Session –VIA: **Materials Science-II**

Venue: **Seminar Room, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **9:00 – 10:50**

Chair: Prof. Dr. Ishtiaque M. Syed
Prof. Dr. Mohammad Belal Hossen

Invited Talk: **[20 minutes]**

IT-MS-II: **Magnetism of Ferrites and Their Rear Earth doped Research and Their Applications for Electronic and Electrical Device**: S. S. Sikder

Contributory papers : **[10 minutes each paper]**

MS-9: **Synthesis and Characterization of Nd Doped $CoFe_2O_4$ Nanocrystals for Biomedical Applications:** Md. Abdur Razzaque Sarker, Md. Mizanur Rahman

MS-10: **Annealing Time Effect on the Complex Permeability and Magnetization Process of $Co_{72}Fe_8B_{10}Si_{10}$ Metallic Glass Ribbon:** H. Khatun, S. D. Nath and S. S. Sikder

MS-11: **Realizing High Ferromagnetic Behavior of Lanthanum Doped Barium Titanate with Gadolinium Substitution:** T. Hasan, M. N. I. Khan, R. Rashid, H. N. Das, Z. Begum, and M. M. Alam

MS-12: **Elastic, Optoelectronic and Photocatalytic Properties of Semiconducting $CSnBO_3$: A First-Principles Insights:** M. Monira, M. A. Helal, M. N. H. Liton, M. Kamruzzaman and S. Kojima

MS-13: **Synthesis and Characterizations of Co-Ni-Zn Ferrites:** J. Maudood, M. S. Aktar, A.K.M. Zakaria, S.I. Liba, M.S. Islam, S. Hossain

MS-14: **Synthesis and Characterizations of Titanium Doped Nickel-Zinc Ferrite Nanoparticles Prepared by Sol-Gel Method:** M.Farzana, M. K. Alam, M. A. H. Sadi, A. Kumar, M. N. I. Khan, M. S. Islam, M. D. Hossain, R. Rashid and M. S. Islam

MS-15: **Nonradiative Recombination Centers in UV-B Algan MQW with Different Superlattice Periods under the N-Algan Layer Revealed by Photoluminescence Spectroscopy:** M. Ismail Hossain, Yuri Itokazu, Shunsuke Kuwaba, Norihiko Kamata, and Hideki Hirayama

MS-16: **Effect of Organomodified Montmorillonite on Structural, Dielectric, Optical and Electrical Properties of $CuFe_2O_4$ Nanoparticles:** T. Moon, T.C. Paul, S. K. Sen, S. Islam, P. Bala

MS-17: **Synthesis and Characterize the Impact of Yttrium (Y) Doping on Multiferroic properties of Iron (Fe) Based $BaTiO_3$ for Device Application:** K. Sayma, R. Tabassum, M. K. Alam, R. Rashid, H. N. Das, J. I. Khandaker, M. N. I. Khan

Session -VIB: Environmental Science

Venue: **Room No. 313, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **9:00 – 10:50**

Chair: Prof. Dr. Abdul Hannan
Dr. Shovon Kumar Kundo

Invited Talk: **[20 minutes]**

IT-ES: **Recycling of Solar PV panels in Bangladesh along with South and South East Asia**: Md. Mostafizur Rahman, Farah Noshin Chowdhury

Contributory papers : **[10 minutes each paper]**

ES-1: **Emerging Water Contaminations in Our Daily Life and Their Impact on Human Health:** M. Safiur Rahman

ES-2: **The Efficacy of Rare-Earth Doped V_2O_5 Photo Catalyst for Removal of Pollutants from Industrial Waste Water:** Mohammad Humaun Kabir , Md. Zahid Hossain, Md. Abdul Jalil, Md. Mukter Hossain, Md. Ashraf Ali, Mayeen Uddin Khandaker, Debnarayan Jana, Md. Motinur Rahman, M. Khalid Hossain, Md. Mohi Uddin

ES-3: **Hydrogeochemical Investigation of Groundwater in Cumilla District and Appraisal for Agriculture Purposes: :**Konica.J. Fatema , Yeasmin Nahar Jolly, Tasrina Rabia Chowdhury, Shirin Akter, Sushmita Hossain, Bilkis A. Begum, M. Safiur Rahman

ES-4: **Metal Exposure and Risk Assessment of Point Source Wastewater on Fish and Human Health:** K.M. Mamun, Y.N. Jolly, J. Kabir, S. Akter

ES-5: **Appraisal of Heavy Metal Contamination in Roadside Perennial Plants, Soil and Dust of Dhaka South City Corporation, Bangladesh:**
Tasnim Ahshan, Md. Nur-E Alam, M. Safiur Rahman, Shamshad B. Quraishi, Md. Mostafizur Rahman, Tasrina Rabia Choudhury

ES-6: **Radiation-Induced Grafting of Acrylonitrile onto Non-Woven Polypropylene Fabric and Its Amidoximation for the Removal of Toxic Methyl Orange:** Md. Nabul Sardar, Nazia Rahman, Shanaz Sultana, Md. Abdur Rahim Mia, Md. Humayon Kabir

ES-7: **Comparative Study on Pollution Status of Seawater of Coastal and Continental Shelf Zones in the Northern Bay of Bengal:** Ferdousi Begum, Md. Arman Hossain, Farhana Akter, Imtiaz Ahmad Sakib, Md. Abu Bin Hasan Susan

ES-8: **Depth-Wise Elemental Contamination Status in Sediments of the Kaptai Lake, Bangladesh:** Biplob Das, Mohammad Amirul Islam, Umma Tamim, Mohammad Belal Hossen

ES-9: **Radiation Distribution at Workplace: A Case Study:** Tumpa Saha, Mohammad Rajib and Md. Golam Rasul

Tea Break: **10:50 - 11:10**

Session-VIIA: Nuclear Physics

Venue: **Seminar Room, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **11:10 – 12:50**

Chair: Dr. Syed Mohammod Hossain
Dr. Mohammad Khalaquzzaman

Invited Talk: **[20 minutes]**

IT-NP: **Nuclear Power Plant: Safety, Security and Physical Protection:** A. F. M. Masum Rabbani

Contributory papers : **[10 minutes each paper]**

NP-1: **Externally Coupled Neutronics and Thermo-Hydraulics Analysis with MATCOM: Preliminary Results:** S. Islam, A. Hossain, M. A. Motalab, S. Mahmood

NP-2: **Calculation of Individual Fuel Element Burnup for–Identification of Hottest Fuel Element of BAEC TRIGA Research Reactor Using TRIGLAV Code:** M. R. Hasan, M. J. H. Khan and A. S. Mollah

NP-3: **Fuel Composition Optimization of Molten Salt Reactor (MSR) Using Openmc Monte Carlo Code**
Md. Nazirul Huda Anik, Md. Naib Hasan, Md. Rajin Rahman and A S Mollah

NP-4: **Neutronics Modeling of SPERT III E-Core Critical Experiments with STREAM:** Anisur Rahman, Saisundar Mohanty, and Deokjung Lee

NP-5: **Shielding Calculation and Verification for 15MV Medical Linear Accelerator Treatment Facilities:** Nahida Sultana, Md Mokhlesur Rahman, Mohammad Ullah, Md Saiful Islam, Md. Zulkar Naen, Niloy Kumar, Md. Masud Rana and H.M. Waliullah

NP-6: **Uranium Removal from Aqueous Solution Using a Novel Starch-Acrylic Acid-Acrylamide Hydrogel Prepared by Radiation Technique:** N. Rahman, S. Sultana, S. Shahnaz, M. N. Sardar

NP-7: **Study of Radiation Shielding Behavior of Mono-Energetic Photon and N-Beam Using Some Locally Developed RBS, MI & IS Composites:** M. Mahfujur Rahman, M. M. H. Bhuiyan, M. Shamsuzzaman, Sudipta Saha, R. A. Ramon, Rahat Khan, T. Siddiqua, N. Arobi, Mohammad Rajib and S. Sultana

NP-8: **Potentiality of the Capacitor as Low-Cost Radiation Detector: A Brief Review:** Mst. Tania Khatun, Aoly Ur Rahman, M. A. Hasnat, and Md. Kabir Uddin Sikder

Session-VIIB: **Atomspheric Physics**

Venue: **Room No. 313, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **11:10 – 12:50**

Chair: Dr. Md. Abdul mannan
Dr. Muhammad Abul Kalam Mallik

Invited Talk: **[20 minutes]**

IT-AP: **Cold-Related Mortality and Trends of Cold Days in Bangladesh:** Md. Mahbub Alam, A.S.M. Mahtab and Quazi K. Hassan

Contributory papers : **[10 minutes each paper]**

AP-1: **Sensitivity of PBL Parameterization and Cumulus Physics Schemes in WRF-ARW Model on Intensity of Tropical Cyclones 'Amphan' and 'Bulbul' over the Bay of Bengal:** Md. Idris Ali and Md. Mahbub Alam

AP-2: **Study on Upper Air Wind for the Track and Movement of Pre-Monsoon Tropical Cyclone Using WRF Model and ERA Data:** Md. A. E. Akhte and M A K Mallik

AP-3: **Development of Human Comfort Index of a Heat Wave Event of 2016 over Bangladesh Using NWP Models:** Flora Rahman, Md. A. E. Akhter, M. A. K. Mallik

AP-4: **A Study on Extreme Temperature Conditions over Bangladesh During 1990 To 2019:** Gazi Mamunar Rashid, Md. A. E. Akhter, M. M. T. Hossain and M. A. K. Mallik

AP-5: **Variation of Different Meteorological Parameters of TC Aila -A Case Study:** Karno Kumar Mondal, Md. A. E. Akhter and M A K Mallik

AP-6: **Impact of Sea Surface Temperature on Simulating the Track and Intensity of Tropical Cyclone Kyant:** Kh. Hafizur Rahman, M. A. Taher

AP-7: **Thunderstorm Characterizes over Bangladesh on 06-07 May 2020 Using WRF-ARF Model-A Case Study:** M. A. K. Mallik, Md. A. E. Akhter and Md. Shaheenul Islam

AP-8: **Simulation of Cyclone Sitrang and Its Characteristics over the Bay of Bengal Using Weather Research and Forecasting Model:** M. A. K. Mallik, Md. A. E. Akhter and S. M. Quamrul Hassan

Lunch Break: **12:50 – 14:00**

Session-VIIIA: **Thin Film**

Venue: **Seminar Room, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **14:00 – 15:40**

Chair: Porf. Dr. Jiban Podder
Dr. Md. Tareq Chowdhury

Invited Talk: **[20 minutes]**

IT-TF: **Prospects and Challenges of Metal Oxide Electron Transport Materials for Highly Efficient and Stable Perovskite Solar Cells:** Md. Akhtaruzzaman

Contributory papers : **[10 minutes each paper]**

TF-1: **The Effect of Temperature, Incident Angle, and Active Layer Thickness on the Performance of $CH_3NH_3PbI_3$ Perovskite Solar Cell:** Tajrin Akter and Nazia Chawdhury

TF-2: **Numerical Investigations to Evaluate the Device Performance of Lead Free $CH_3NH_3SnBr_3$/CIGS Tandem Cell Comparing with the Single-Layer Solar Cell Using SCAPS ID:** Muhitul Islam, Tanvir Ahmed, Siraj Ud Daula Shamim, Afiya Akter Piya

TF-3: **Influence of Deposition Techniques on Quality and Properties of CuO Thin Films:** Dibakar Dhar, Kazi Md. Amjad Hussain, M. S. Bashar, and Kazi Hanium Maria

TF-4: **Structural and Optical Properties of Aluminium Doped Zinc Selenide Thin Films Synthesized by Thermal Evaporation Technique:** M. Mahbubur Rahman, K. M. A. Hussain, T. Faruqe, and A. T. M. K. Jamil

TF-5: **Study of Cadmium Telluride (CdTe) Thin Film Materials for Detector Application in Radioactivity Measurement:** T. Faruqe, F.T. Z. Toma, J. Parvin, S. Ahmed and K. M. A. Hussain

TF-6: **Structural, Morphological, Optical, and Electrical Analysis of Mn-Doped NiO Thin Films:** S. A. Lucky, M. Sharmin, H. Das, M. S. Bashar and J. Podder

TF-7: **Structural, Morphological, Optical and Electrical Properties of Co Doped CuO Thin Films:** Rabeya Rahman Tofa, Mehnaz Sharmin and Jiban Podder

TF-8: **The Chemistry of Cobalt Oxide Thin Films Studied with High-Pressure Core Level Spectroscopy and Scanning Tunneling Microscope:** Mohammad Alif Arman, L. R. Merte, Edvin Lundgren, and Jan Knudsen

Session-VIIIB: **Composite Materials**

Venue: **Room No. 313, Department of Physics, Jahangirnagar University, Savar, Dhaka**

Time: **14:00 – 15:50**

Prof. Dr. Shibendra Shekher Sikder
Prof. Dr. Kazi Hanium Maria

Invited Talk: **[20 minutes]**

IT-CM: **Poly-Concrete as Structural Material for Control Pollution:** Abdul Gafur

Contributory papers : **[10 minutes each paper]**

CM-1: **Study of Complex Permeability of Chromium -Substituted Ni-Cu-Zn Ferrites Synthesized by Solid State Reaction Method:** Rajon Saha Auntu, S. K. Shil, M. A. Hossain, S. S. Sikder

CM-2: **Synthesis and Characterization of Structural, Magneto-Electric and Optical Properties of $Ca_{0.90}Sr_{0.10}Mn_{1-X}Mo_xO_3$ Ceramics:** S. Afrin, Mohammad J. Miah, H. Begum, R. Rsahid, H. N. Das, N. Begum, M. K. Alam, M.N.I. Khan

CM-3: **Polymer Electrolytes Enhance Dye-Sensitized Solar Cells Conversion Efficiency and Stability: A Short Review:** Md. Shamim Hasan, Md. Riajul Islam Sardar, Aqib Adnan Shafin, Sanjana Afrin Disha, M. Mottakin

CM-4: **Synthesis and Characterization of Multiferroic Composite $(1-X)\ Ba_{0.6}Sr_{0.4}Cr_{0.6}Ti_{0.4}O_3+(X)\ Cofe_{1.8}La_{0.2}O_4$ via Double Sintering Ceramic Technique:** R.Rahman, F.Jahan, A.Anwar, I.N.Esha, M.N.I.Khan, M.S.Bashar, M. K. Alam and Kazi Hanium Maria

CM-5: **A First-Principles Study of Elastic, Electronic and Optical Properties of $MCuO_3$ (M = La and Y) Under Hydrostatic Pressure:** M. Sumaiya, S. A. Shupra, M. A. Helal, M. N. H. Liton, M. Kamruzzaman and A. K. M. Farid Ul-Islam

CM-6: **Structural, Electrical, Magnetic, and Magnetoelectric Properties of Multiferroic Composites Used as Novel Multifunctional Devices:** Sharifa Nasrin, Md. D. Rahaman, and A. K. M. Akther Hossain

CM-7: **Enhanced Dielectric, Magnetic and Optical Properties of Ba-Sr-Ca Titanate Ceramic Materials with Mn- Substitution for Spintronic Devices Application:** Rawnak Tabassum, Z. I. Khandaker, K.Sayma, R. Rashid, R. Hasan, Z, Begum, M.K.Alam, M.N.I. Khan

CM-8: **Lead-Free All-Inorganic $Cs_3Sb_2I_9$ Perovskite Materials Synthesized by Chemical Vapor Deposition and Their Photodetector Application:** Sujit Kumer Shil, Fei Wang and Kin Man Yu

CM-9: **Investigation of Structural, Optical, Magnetic and Electrical Properties of Ni doped $Ba_{0.95}Ca_{0.05}TiO_3$ Ceramics:** Hosneara Begum, Sanjana Afrin, R. Rashid, H. N. Das, Mohammad J. Miah, M.N.I. Khan

Tea Break: **15:50 – 16:00**

<u>Session-IX:</u> **<u>Physics Education</u>**

Time: **16:00 – 17:00**

Pannel Discussion:

Prof. Shamima K. Chowdhury
Prof. Dr. G. M. Bhuiyan
Prof. Dr. Md. Obaidur Rahman

Contributory papers : **[10 minutes each paper]**

PE-1: **Effects of Nonlinear Gravitational Waves on the Electrical Voltage of Bryophyllum Pinnatum at Various Altitudes:** Tawhid Hassan Rifat, Husain Al Sohan Apu, Hasibul Hassan Mobin, Md. Farhad Hossain Moon, Yeasin Md Jafir, Md. Muktadir Rahman Talukder,Md Rabiul Alam,Kamrul Alam Khan

PE-2: **Understanding the Necessity of Updated Syllabus of Physics for Undergraduate Students ----- Establishing Academy and Industry Collaboration in Bangladesh:** Humayra Ferdous, Md. Ehasanul Haque

Time : **17:00 – 18:00** **Closing Ceremony**

List of Posters for Presentation

Session Theoretical and Computational Physics

PP 1. **A First-principles study of pressure induced opto-electronic and thermoelectric properties of $FrCaX_3$ (X = Cl, Br, I) perovskites: Mohammad Abdur Rashid, Md. Borhanul Asfia, and Sahadat Jaman**

PP 2. **A Density Functional Theory Studies of Mechanical, Electronic, and Optical Properties of Cubic $CeAlO_3$ Structure:** Kamal Hossain, Prianka Mondal and Farid Ahmed

PP 3. **A First-principles Calculations to Examine the Impact of Variation in the X+ Cation on Structural, Mechanical, Electronic, and Optical Properties of $XCdCl_3$ Chloroperovskites**: Rabeya Akter Rabu, Kamal Hossain and Farid Ahmed

PP 4. **An Average Model of Volume Dependence Grüneisen Parameter of Solids:** Murchona Rahman, Sweety Akter and Sumal Chandra

PP 5. **Effect of S Substitution on the Physical Properties of $RbTaO_3$:** H. Akter, M. A. Ali, M. M. Hossain, M. M. Uddin, and H. Naqib

PP 6. **Comprehensive Device Modeling and Performance Analysis of Double Perovskite Solar Cells with Diverse ETM and HTM:** Manisha Ahamad and A. K. M. Akther Hossain

PP 7. **Strain-Induced Electronic and Optical Properties of Formamidinium Tin Tri-iodide $CH(NH_2)_2SnI_3$ Perovskite:** Rakibul Islam, Md Rasidul Islam, Nourin Arobi, Hussein A. Miran, M Mahbubur Rahman

PP 8. **Studies of the possibility of a theory of energy emission from black holes without losing quantum information:** Sheikh Jafrul Hassan

Session Plasma and Astrophysics

PP 9. **MACS and Neutron Capture Cross Sections of Branching Point Isotope ^{63}Ni In The S-Process Energy Region:** Raeed Nawaf and A. K. M. Rezaur Rahman

PP 10. **Nonlinear dust-acoustic waves in nonthermal complex plasmas with warm positive dust:** N. A. Antor, A. Mannan , and A A Mamun

PP 11. **Studies On Some Models of Gamma-Ray Bursts, Recent progress, and Future Perspectives:** Md. Imran Hossain Sakib and Anjan Kumar Chowdhury

Session Materials Science

PP 12. **Molecular Orientation Resolved (e, 2e) Cross Sections for CF_4 at 67 eV impact energy**: Khokon Hossen, and Humaira Takia

PP 13. **Efficiency Analysis: Can Solar Energy Fill The Needs Of Energy In Bangladesh?:** Sk Rahat Bin Salam, Asif khan, and Nushrat Jahan Chowdhury

PP 14. **$(1-x)Ba_{0.6}Sr_{0.4}Cr_{0.6}Ti_{0.4}O_3+(x)CoFe_{1.8}La_{0.2}O_4$ Composites: Synthesis and Analysis of Multiferroic Properties via Double Sintering Ceramic Technique:** R. Rahman, F. Jahan, A. Anwar, I. N. Esha, M. N. I. Khan, M. S. Bashar, M. K. Alam and Kazi Hanium Maria

PP 15. **Synthesis and Characterization of Nickel-Doped Barium Titanium Iron Oxide ($Ba_{1-x}Ni_xTi_{0.8}Fe_{0.2}O_3$) Ceramics:** M. A. Elahe, K. Jaman, M. K. Alam, R. Rashid and M. N. I. Khan

PP 16. **Annealing Time and Temperature Effects on Crystallization Kinetics and Activation Energy of $Co_{72}Fe_8B_{10}Si_{10}$ Amorphous Ribbon:** H. Khatun, S. D. Nath and S. S. Sikder

PP 17. **Chalcopyrite Semiconductors of $HgXN_2$ (X=Si, Ge and Sn): A DFT Study for Photovoltaic and Thermo-mechanical Applications:** A. Hossain, M. M. Hossain, M. A. Al, M. M. Uddin, and S. H. Naqib

PP 18. **Influence of Bi_2O_3 addition on the magnetic properties of Li-Cu-Mg-Zn ferrites:** Faruque Ahammed, M. Samir Ullah, Redwan N. Sajjad, M. Hassan, A. H. Badhan, M. Rasel Shikder, M. N. I. Khan and A. T. M. Kaosar Jamil

PP 19. **Effect of hydrostatic pressure on structural, elastic, and optoelectronic properties of $ScCuO_3$ via DFT approach:** S. A. Shupra, M. Sumaiya, M. A. Helal, M. N. H. Liton, M. Kamruzzaman, and A. K. M. Farid Ul Islam

PP 20. **Study on structural, optical, and magnetic properties of La^{3+} doped Cobalt-Zinc nano ferrites:**Nazia Khatun, Mohammad Osman Goni, Mohammad Sajjad Hossain, Suravi Islam and Syed Farid Uddin, Farhad, Md. Al- Mamun, Mohammad Saiful Alam, Md. Saidul Islam, M. S. Habib and Mahmuda Hakim

PP 21. **Effect of Gd substitution on the electromagnetic properties of Mg-Cu-Zn ferrites:** A. H. Badhan, M. Samir Ullah, Zakia Sultana Tithi, Ariful Islam and M. Mizanur Rahman

PP 22. **Magnetocaloric effect of rare-earth-based perovskite manganite for magnetic refrigeration:** M. Masum Billah, M. A. A. Bally, F. A. Khan and M. Samir Ullah

PP 23. **Pressure and temperature dependent exploration elastic anisotropy, acoustic and thermodynamic properties of Cesium Niobate:** M. Monira, M. A. Helal, M. N. H. Liton and M. Kamruzzaman

PP 24. **Characterization of Nano-Structured Magnesium-Aluminum Ferrites Synthesized by Citrate-Gel Auto Combustion Method:** Mohammad. Shahjahan, M. A. Bhuyan, M. S. Hossain, M. A. Haque and D. P. Paul

Session **Nano-Structure Physics**

PP 25. **Structural with Rietveld Refinement Analysis, Cation distribution, Magnetic, Electrical and Dielectric Properties of Al substituted Ni-Cd dense Ceramics Obtained From Nanocrystalline Powder:** Nur Mohammed and M. Belal Hossen

PP 26. **Hydrothermal Synthesis of Cadmium Oxide (CdO) Nanoparticles for Solar Cell Application:** T. I. Hoimontee, E. J. Swapna, N. Jewena, J. I. Khandaker

PP 27. **A Case Study on Toxicity Effects of Metal Oxide Nanoparticles Utilization:** Newton Neogi, Asraf Ibna Helal, Sabbir Hossain Nipu, Tahzib Ibrahim Protik, and MD. Golam Sazid

PP 28. **An overview on modification of Metal Organic Framework:** Tahzib Ibrahim Protik, Sabbir Hossain Nipu, MD. Golam Sazid, and Newton Neogi

PP 29. **A Case Study on photocatalytic acivity of TiO_2 nanomaterials:** Sabbir Hossain Nipu, MD. Golam Sazid, Newton Neogi, and Asraf Ibna Helal

PP 30. **A Case Study on Energy storage applications of Zeolitic Imidazolate Framework:** MD. Golam Sazid, Newton Neogi, Asraf Ibna Helal, Sabbir Hossain Nipu, Tahzib Ibrahim Protik

PP 31. **An overview on TiO_2 nanoparticles as cancer treatment therapy:** Shohanur Rahaman

PP 32. **Structural, Magnetic and Optical Properties of Double Perovskite Y_2CoCrO_6 nanoparticles:** M. A. Islam and M. A. Basith

PP 33. **A Novel Dynamic Method Utilizing Silver Nanoparticles for the Power Generation in Bryophyllum Pinnatum:** Fariya Kabir, Md Meharub Mustakim, Md. Meraj Ali, Md Kawser Ahamed, MD. Shahjahan, MD.Moniruzzaman Mim, Md Rabiul Alam, Md Kamrul Alam Khan

PP 34. **Synthesis and Characterization of Hydroxyapatite and Nickel Ferrite Nano-Composites for Biomedical Application:** Most. Sweety Akter, Md. Mominul Islam, Md. Mahbubul Haque

PP 35. **Structural, Optical, and Electromagnetic properties of Zinc Oxide (ZnO) and Iron-doped Zinc Oxide (Fe: ZnO) nanoparticles:** M. Foyshal, A. Islam, F. Kabir, M. Mizanur Rahman

PP 36. **Investigation of Structural, Optical, Ferroelectric and Electrical Properties of Ce^{3+} Substituted Cu-Zn-Al Nanoferrites:** S. K. Ahmed and M. Belal Hossen

PP 37. **Synthesis of $Ca_{1-x}Sr_xMnO_4$ scheelite novel nanoparticles by sol-gel method:** Md. Masud Parvez, Jobair Maudood, Md. Saiful Islam, Mst. Sanjida Aktar, Md. Al Mamun, Shahzad Hossain

PP 38. **Green Synthesis of Nickel Oxide Nanoparticles from Ocimum Sanctum by a Facile Hydrothermal Method for Biological Applications:** Sonia Akter, Md. Rasadujjaman, Md. Mamun-Or-Rashid, Md. Abdullah Al Mamun

PP 39. **Hydrothermal Synthesis and Characterization of SnO_2 Nanoparticles using Fruit Extract of Myristica fragrans: Antibacterial Activity Application:** Parisha Akther Mona, Md. Rasadujjaman, Md. Mamun-Or-Rashid, Md. Abdullah Al Mamun

Session Environmental Science

PP 40. **Probabilistic and deterministic approaches towards heavy metal accumulation, source identification and impact on ecological and human health in soil-vegetable system:** S. Akter, Y.N. Jolly, J. Kabir and K.M. Mamun

PP 41. **An Experimental Study on Thermal Capacity Measurement for Metal-Based Packed Bed Latent Heat Energy Storage System:** Anika Tun Naziba, Manika Tun Nafisa, and Mohammad Nasir Uddin

PP 42. **Natural Radioactivity Assessment in Various Tiles Used for Building Purposes in Bangladesh** Sopan Das, Nighat Sultana Resma, Rashmi Roy, Shahadat Hossain

PP 43. **Adsorption of Cu(II) ions from Aqueous Solution Using Modified ETFE Film by Radiation Technique:** S. Shahnaz , N. Rahman, S.Sultana, Md. N. Sardar

PP 44. **Edible Oils: An overview of healthful and some insalubrious compounds in some selected brands highly intake by Bangladeshi people:** M. F. Ehasan, R. Sultana, A. K. M. A. Ullah, A.K. M. F. Kibria and A. R. M. Tareq

PP 45. **Water Quality Analysis of Seawater at the Vicinity of St. Martin's Island through Studies of Physicochemical Parameters and Assessment of Heavy Metals:** Imtiaz Ahmed Sakib, Dr. Ferdousi Begum, Farhana Akter

PP 46. **Distribution of naturally occurring radionuclides (^{226}Ra, ^{232}Th, and ^{40}K) in the sediment of Feni river:** Sopan Das, Shamima Zaman, Nighat Sultana Resma, Shaon Bhowmik, Shyamal Ranjan Chakraborty, A.K.M. Rezaur Rahman, Rashmi Roy, Nipa Deb, Shahadat Hossain

PP 47. **An Overview of Vertical Greening Systems, A Process Tree for Green Facades and Living Walls:** A.Saagota Mridha, B.Shohanur Rahaman

Session Nuclear Physics

PP 48. **DFT and DFT+U Insights into the Structural, Electronic, Magnetic, Thermal and Optical Properties of UO_2 :** Minhajul Islam

PP 49. **An Overview of Baec Triga Mark – II Research Reactor (BTRR):** Md. Mostafizur Rahman, Abdullah-Al-Mahmud, Sazzad Hossain, Dr. Md. Abdul Mannan Chowdhury

Session Radiation and Health Physics

PP 50. **A Comparative Lung Dose Calculations Using Egs Energy Based Monte Carlo Simulation and Anisotropic Analytical Algorithm (AAA) and Verify with Practical Measurement, A CIRS Thorax Phantom Study:** A. Md Saiful Islam , B. Md Mokhlesur Rahman , C. Md. Anwarul Islam , D. Mehrab Hassan Udoy , E. Parvez Mosharaf , F. Md Zulkar Naen , G. Nahida Sultana , and H. Niloy Kumar

PP 51. **A review of LLW management: Bangladesh Perspective :** Khairum Haque Orthi, O. Chandrow

PP 52. **Measurement of neutron dose in radiotherapy with 15 MV photon beam from medical LINAC:** Mst. Ummey Habiba Musfika, HM Jamil, Md. Shakilur Rahman, AKM Moinul Haque Meaze

PP 53. **Estimation of Radiological Risk on Public around Khulna Medical College Hospital Campus, Bangladesh:** Md. Mostafizur Rahman, M. S. Rahman, H. R. Khan, S. Yeasmin

PP 54. **Estimation of Radiological Risk on public around Chittagong Medical College Hospital Campus, Bangladesh:** Arun Chowhan, M. S. Rahman, S. Yeasmin, Md. Kabir Uddin Sikder

PP 55. **Real-time Radiation Monitoring in Mymensingh Medical College Hospital Campus and Estimation of Radiological Risk on Worker & Public:** Mostafa Amir Faisal, M. S. Rahman, J. Islam, K. N. Sakib, M. M. Tasnim, S. Yeasmin

PP 56. **Dosimetric Evaluation of treatment Plans of 3DCRT, IMRT, and VMAT in Rectum Cancer:** Niloy Kumar, Md. Mokhlesur Rahman, Sujan Mahamud, Md. Atiquzzaman, Md Saiful Islam, Nahida Sultana, Md.Zulkar Naen, Prokash Nath

PP 57. **Estimation of Effective Dose to Patients From ^{18}F-Fdg Whole-Body Pet/Ct Examinations:** Shupti Sarker, Md. Juwel Hosen, Md. Masud Parvej , and Md. Monirul Haque

PP 58. **The Rising Trend of Proton Therapy Use in Cancer Treatment:** M Rafiqul Islam, Tanvir Ahmed Biman and Hiroshi Watabe

PP 59. **Consequences of Radon Air Pollution in Bangladesh and Risk of Lung Cancer:** Rayhan Alam, Juwel Hosen, Abul Hasnat, Fatema Tuz Zohra, Masud Parvej, M Rafiqul Islam, M Monjur Ahasan

PP 60. **Use of High Frequency Ultraound in Detection and Localization of Soft Tissue Foreign Body: A Case Series:** Farida Yasmin, Hosne Ara Rahman, Partha Pratim Saha, Samira Sharmin, Afroza Naznin

PP 61. **Synthesis and Characterization of $ZnLiBO_3$ for Thermoluminescence Dosimetry:** Homaira Afia Mimi, Md. Raghib Rahat, A.K.M. Mizanur Rahman, Md. Al-Mamun, Md. Kamruzzaman

PP 62. **Depth-wise variation of natural radioactivity and evaluation of radiological hazards in sediment cores of the Sundarban, Bangladesh:** Shaiful Kabir, Mohammad Amirul Islam, U. Tamim, Mohammad Belal Hossen

PP 63. **Synthesis and Investigation of Structural, and Thermoluminescence Properties of $LiCaPO_4$ Phosphor for TL Radiation Dosimetry Applications:** Md. Raghib Rahan, Homaira Afia Mimi, A.K.M. Mizanur Rahman, Md. Al-Mamun, Md. Kamruzzaman

Session Bio-Medical Physics

PP 64. **Platelet poor plasma (ppp) separation from blood and its application as a supplement in cell growth media:** Mahbuba Kader Meem , Sadia Islam, Sujan Mahamud, Swapan Kumar Sarkar, and Nazmul Haque

PP 65. **A DFT Investigation on Structural Properties of Transition Metal (V, Nb, and Ta) Doped in GaN Nanotube:** A. Eshrat Ashraf Ema, B. Aoly Ur Rahman, and C. Md. Kabir Uddin Sikder

Session Atomspheric Physics

PP 66 **Scenario of cold wave conditions during 1990 to 2019 in Bangladesh:** Shahanaj Sultana and M. A. K Mallik

Session Electronics and ICT

PP 67 **A Modified S-G Filtering Technique to Design a Digital Dose Rate Meter Using Geiger–Mueller Counter:** Md. Motinur Rahman, M. Z. H. Majumder, S. Saha, T.T. Suki, F. Akter, M.K. Hossain, M.A.U. Zaman, F. Hafiz, M.S. Alam and M.A.S. Haque

PP 68. **Microcontroller Based Digital System for Monitoring and Analyzing Seismic Activity:** Nishat Tasnim, Md. Ridwanul Hasan, Ariful Alam

PP 69. **Design a 3D Virtual Laboratory Simulator for Physics Education:** Prieom Mojumder, Tanmoy Mandal, M. Hasnat Kabir*, Md. Firoz Ahmed and Md. Ashraful Islam

PP 70. **Analysis the Performance of Triangular Patch Antenna at THz Band:** Rakibul Hasan Masum, Md. Ashraful Islam, Md. Matiqul Islam, Md. Firoz Ahmed, Md. Hasnat Kabir

PP 71. **Design and Analysis of the Performance of Elliptical Patch Antenna for IoT-Based Application:** Huzzatul Islam, Asraful Al Noman, Rakibul Hasan Masum, Md. Ashraful Islam, and Md. Matiqul Islam

PP 72. **Development of Low-Cost IoT-Based Water Purity Identification System:** Risad Mia, Md. Ashraful Islam, Md. Reaz Hossain, Md. Matiqul Islam and Md. Hasib

PP 73. **Enhancement of IoT Based Smart Home Security System:** Asif Bin Nur, Md. Hasib, Md. Ashraful Islam, Risad Mia and Md. Matiqul Islam

PP 74. **Design and Implementation of a Web-based Application for University Class Scheduling and Rescheduling:** Shehjad Mobin, Sanzida Afrin, Md. Firoz Ahmed, Md. Ashraful Islam, and M. Hasnat Kabir

PP 75. **Saving Lives with IoT an Innovative Approach to Earthquake Rescue Operations:** Hasibul Hassan Mobin, MD Tanvir Shakil, Md.Farhad Hossain Moon, Hussain Opu, Tawhid Hassan

PP 76. **Revolutionizing Gas Supply in Bangladesh and A Smart Solution to Overcome the Natural Gas Crisis:** Tawhid Hassan Rifat, MD Tanvir Shakil, Hussain Opu, Hasibul Hassan Mobin, Md. Farhad Hossain Moon

PP 77. **Aquatic Automation: Revolutionizing Fish Farming:** Hussain al Sohan Apu, MD: Tanvir Shakil, Tawhid Hassan Rifat, Hasibul Hassan Mobin, Md. Farhad Hossain Moon

PP 78. **Optimized and Safe Internet of Medical Things (IoMT) via Federated Machine Learning for Diagnosing Human Skin Diseases:** Mahmudul Hoque Mahmud, S. M. Hasan Mahmud

PP 79. **Detection of Cardiovascular Diseases (CVDs) with Federated Learning System:** Anika Tun Naziba, Manika Tun Nafisa, and Mohammad Nasir Uddin

Session Others

PP 80. **Improvement of Productivity of a Sewing Line by Using Line Balancing Technique:** Md. Taibur Rahman Tushar, Nafiz Mehmud Khan, Sweety Shahinur, Md. Mahmudul Habib, Shohel Mia

PP 81. **TiO_2 photoanode modification by garlic-extracted MnO_2 nanoparticles for dye-sensitized solar cells (DSSC) application:** Ziniya Aktar Zaba, Sapan Kumar Sen, M S Manir, Md. Abdus Sattar

PP 82. **Comprehensive Comparison between IMRT and VMAT treatment techniques for Preoperative Rectal Cancer:** Kazim Uddin Olin

PP 83. **Natural and Artificial Radioactivity Level in Sediment of the Pasur River:** S. H. Sakib, M. S. Sakib, M. C. Bhakto, M. S. Khatun and F. Nahid

PP 84. **Synthesis and Characterization of Graphene Oxide Reinforced Cobalt Doped Bismuth Titanate Nanocomposites:** A. R. Ridoy, M. A. Mamun, M. R. Rahman

PP 85. **Structural and Optical Properties of $Bi_{25}FeNiO_{40}$@MWCNTs Nanocomposites Synthesized by Hydrothermal in-situ Growth Method:** Nazmus Saki, M. Al-Mamu, Farzana Nahi

PP 86. **Thickness-Dependent Plasma Polymerized N-Vinyl-2-Pyrrolidone Thin Films: Investigation of Structural and Optical Properties:** S. M. Kanti Saha, M. R. Talukder, S. J. Ahmed, and A. T. M. K. Jamil

PP 87. **Optimizing The Cell Performance of MnO_2-treated Electron Transport Layer Based Perovskite Solar Cell:** Monirul Islam Uzzal, Md. Mosharraf Hossain Bhuiyan, Serajum Manir

PP 88. **Improving the Cell Efficiency of Dye-Sensitized Solar Cell byIncorporating Carbon Nanotubes with Titanium Dioxide:** Monirul Islam Uzzal, Md.Mosharraf Hossain Bhuiyan, Serajum Manir, Syeda Jafri Shahrin

National Conference on Physics – 2023

9 – 11 March 2023

ABSTRACTS
FOR PLENARY TALK

Venue:
Seminar Hall, Zahir Raihan Auditorium
Jahangirnagar University

Bangladesh Physical Society

Plenary Session

PT-1: New Ideas of Physics and Their Implications for Life

M. Shamsher Ali

Introduction:

Richard Feynman, one of the most celebrated physicists of the 20th century is said to have remarked: "If one looks into any object in its minutest details, it becomes a part of physics". The significance of this remark becomes apparent to even a common man when an ECG is explained to him showing how tiny voltages are developed across tissues, when the dependence of photosynthesis on the emission of light from the sun is made clear to him, when the presence of a number of systems in the human body namely a mechanical system, an acoustic system, a chemical system, a biochemical system, an electrical system, a computer system etc which all work in synergy are pointed out or when attention is drawn to the fact that the light emitted by the fire-fly is one of the examples of the matrix element (conversion of chemical energy into electromagnetic energy) of the complete Energy Conversion Matrix. The common man is then bound to exclaim "Oh, Physics is everywhere". Yes physics is indeed everywhere and the agenda of the physicists is to find out the laws of physics in every work of nature. In fact, the domain of physics stretches from the smallest of the small ($\mathbf{10^{-15}}$ cm in particle physics) to the biggest of the big (the farthest extent of the Universe $\mathbf{10^{+28}}$ cm in astrophysics). And the contributions of physics to all aspects of life and environment, material and non-material, have indeed changed the face of the world. When these things are explained to politicians and planners in governments, their immediate reply is: we want tangible results in a short time. If the politicians only knew that it takes time for every idea of physics or for that matter in any branch of science to make its impact on the society. Every time a discovery/innovation in physics had been made, it took a certain time period for that discovery/ innovation to make an impact on the society. This has been illustrated below with a few examples:

Ideas of Physics and their applications

a) In 1820, Danish physicist Oersted observed that when a compass needle was brought near a current carrying wire, it swung. Electricity and magnetism were now seen to be knit together through this accidental observation. Following this observation researches were made and within twenty five years electrical generators and motors were developed and telegraph was invented. Within 60 years the incandescent lamp was invented and electrification of the world began.

b) In 1883, it was observed by Thomas Edison that if a metal plate were sealed into a light bulb near the heated filament, an electric current would travel across the vacuum between the filament and the plate in one direction but not in the other. This is what we call Edison effect. Within 40 years of this discovery, radio became a household affair. Within 60 years, television was replacing radio and electronics was being used to build computers.

c) In 1896 French Physicist Bequerel noted that a photographic filament wrapped in a black paper was fogged by the nearby presence of a uranium compound. This observation gave rise to the science of radioactivity. Within 25 years after this observation, atomic physicists were smashing atoms. And within another 25 years they even smashed cities. Within 60 years nuclear power stations were being used for the generation of electricity.

d) In 1903 the Wright brothers flew the first heavier man air flying machine which hopped a few feet through the air and came down after a few seconds. In 60 years, that first airplane gave rise to descendents including jet liners traveling across oceans.

e) In 1926, physicist Goddard fired a rocket into the air which reached a height of 124 feet and a speed of 60 miles per hour. Within 35 years, Sputnik was in orbit and within 45 years man landed on the Moon. Within 60 years, man began his journey into the Cosmos.

f) In 1944, a substance called DNA was studied. It revolutionized the life sciences with DNA- based molecular biology. In 1953 (less than ten years), using the X-ray diffraction technique of the English physicist M.H.F Wilkins to study nucleic acid, F.H.C. Crick and J.D Watson working at Cambridge University were able to determine the structure of the double helical structure of DNA, the hereditary blue print of life (For their work in this field Wilkins, Watson and Crick shared the 1962 Nobel prize for Medicine and Physiology). If we add 60 years to 1944, we see that a little before 2004, the Human Genome Project was completed by two teams independently. Dolly and Jefferson have now become household names. And clandestine efforts are now being made to clone the human being.

g) In November 1947 physicists John Bardeen and Walter Brattain observed that when Electrical contacts were applied to a crystal of germanium, the output power was larger than the input. William Shockley saw the potential in this and worked over the next few months greatly expanding the knowledge of semiconductor and is considered by many to be the father of the transistor. In 1956, John Bardeen, Walter H Brattain and William Shockley received the Nobel Prize in Physics for inventing the first silicon based transistor. If we add 60 (sixty) years to 1947, we see that already by 2007, the micro-electronics revolution had taken place and the globalization of the world had begun through the use of the Information Super Highway.

In all of these examples, one notices a magic number 60 years which happens to be the time gap between the discovery of a phenomenon and its full technological flowering for the benefit of the society. I have highlighted this point in some detail only to emphasize that governments of developing countries should not always expect very quick dividends from investments in physics and other branches of science.

New Ideas of Physics and their implications for life

Now a days this gap between a discovery and its applications has been considerably reduced mainly because the number of investigators has increased with improved communication between them and researchers do not have to build every equipment themselves; a number of equipment can be purchased off the shelf. Also international collaboration in science has increased manifold. CERN provides a wonderful example of collaboration. CERN was created in 1954 and if the magic number 60 years is added to it, what could we expect from it in 2014 ? May be some new chapters in particle physics could be opened and it is indeed very interesting to note that in 2012 the finding of Higgs Boson formed part of reality! In 2013 Peter Higgs and Francois Englert received the Nobel Prize for the discovery of the Higgs Boson.

Politicians of many countries have been questioning for quite some time the luxury (in their language) of going in for expensive high energy physics research involving huge expensive accelerators. History however is witness of many dividends from high energy research. “WWW” which originated at CERN, where the First International Conference on the World-Wide -Web was held in May, 1994 paved the way for today’s Information Super Highway. Leon lederman (Nobel laureate in physics and author of the book 'God Particle' with Dick Teresi) and Christopher Hill in their book' Beyond The God particle' have asserted that the Web is now blended into the entire telecommunications system and that the economic valuation and impact of the World Wide Web is inestimable.

Furthermore, the production of high magnetic fields, attainment of low temperatures, high vacuum and the emergence of super fast computers are additional remarkable spin-offs of such researches. The results obtained from high energy researches are beginning to satisfy the basic quest of the human mind “What are the ultimate building blocks of nature”? In the process, some clues to the mystery of how the universe began also started becoming available. Thus, high energy physics has been able to combine the studies of the very small with the studies of the very large through cosmology.

Finally, the international collaboration that was evinced in the LHC (Large Hadron Collider) experiments both in terms of fabrication of bits and piece of experimental hardware as well as of detection software and computer calculations in the pursuit of the Higgs Boson to provide the missing particle of the Standard Model have been a remarkable achievement of science unparalleled in the history of mankind. If such collaboration could be achieved in the process of disarmament and other peace building initiatives, heaven would be realized right on this earth.

From what has been said so far, it is clear that the number of things on which physics researches can be made seems to be limitless. What one chooses to research on depends on the one hand on the needs of the society (as the tax payers interests cannot simply be ignored) and on the other, the physicists' urge to explain the universe since after all what has been achieved ,we have yet to have a complete theory of the Universe. This latter aspect of physics research can be best promoted through regional and international collaboration.

Conclusion

In conclusion, it must be pointed out that the general impression existing in the minds of many that the days of physics are over is not really correct. There are still many challenges of physics and physics-related technologies: safe nuclear waste disposal; finding out nuclear energy-releasing reactions bypassing the uranium chain reaction; increasing the efficiency of solar cells; attainment of room temperature super conductivity; achieving Nano technology on a much wider scale and finally arriving at the final theory for everything. Each of these challenging ideas of physics has its implications for life. To this end, all governments should provide the necessary funds for R and D work in physics. And international collaborative projects following the models of ICTP, CERN and other international institutes/ laboratories must be undertaken. Many Asian countries cannot go for big science in physics. However, the world must not be deprived of the talents of the Asian and other developing countrie's physicists. Thus, it is proper that while a greater part of attention of physicists is focused on the application of physics for the solution of the problems of life and environment, international collaboration in physics is launched on a significant scale in the greater interest of participating in 'Big Science' for the development of nations.

(The author Prof. Dr. M. Shamsher Ali, a theoretical nuclear physicist, is Professor Emeritus of Southeast University, Dhaka, Bangladesh and immediate Past President, Bangladesh Academy of Sciences.)

PT-2: Sir Jagadish Chandra Bose: Extra-Ordinary Man of Science

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Abstract

Sir Jagadish Chandra Bose was born on 30 November 1858 in Munsiganj (Bikrampur) and died on 23 November 1937 in Gridih (Jharkhand). He is an 'extraordinary man of science'. He was the world renowned physicist (inventor of radio-waves) as well as the world renowned botanist (inventor of feelings/life of plants).

Sir Jagadish Chandra Bose is now known as the greatest Bengali scientist of all times. A scientist having such pioneering contributions in both physics and biology is very rare (only one!). He brings lots of honour for our entire Bengali Nation. He was a broad-minded scientist, and was supposed to get the Noble Prize. Sir Jagadish Chandra Bose was, is and will be a very big source of our inspiration to go ahead with our research further and further. **Sir Jagadish Chandra Bose had physically left us about 85 years ago, but spiritually he was with us, is with us, and will be with us forever.**

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*Fellow of the World Academy of Sciences.

National Conference on Physics – 2023

9 – 11 March 2023

ABSTRACTS
FOR INVITED TALK

Venue:
Department of Physics
Jahangirnagar University

Bangladesh Physical Society

Invited Talk: Session-IA: Theoretical and Computational Physics - I

IT-TCP-I: Over doping, Magnetic Effects and Degradation of the Superconducting T_c in Ca Substituted YBCO

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Ca substitution in place of Y increases the hole content (p) in the CuO_2 planes of $Y_{1-x}Ca_xBa_2Cu_3O_{7-\delta}$ high-T_c superconductors. We have explored the charge transport and magnetic properties of high-quality sintered $Y_{1-x}Ca_xBa_2Cu_3O_{7-\delta}$ in this study with different levels of Ca substitution. Quite surprisingly, non-magnetic Ca was found to induce paramagnetic enhancement in the bulk magnetic susceptibility. The magnetic moment survives in the superconducting states. The increment in the magnetic susceptibility is nonlinear as a function of the Ca content (x). At the same time, the superconducting transition temperature, T_c, also decreases weakly with increasing Ca content. We believe the unusual magnetic effect and degradation of the T_c are intimately linked and propose a model where Ca substitution not only donates holes to the CuO_2 planes but also give rise to a narrow impurity band responsible for the magnetic effect and decrement of the T_c.
Keywords: Copper oxide superconductors; Ca substituted YBCO, Magnetic susceptibility; Superconducting critical temperature

Invited Talk: Session-IB: Condensed Matter Physics –I

IT-CMP-I: Theoretical and Experimental NMR, IR Spectra Studies of Paracetamol

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NMR and IR spectra of paracetamol have been measured for powder crystals. Ab initio calculations of its equilibrium geometry and vibrational spectra were carried out for spectrum interpretation. Differences between the experimental IR spectra of crystalline samples have been analyzed. Variations of molecular structure from the isolated state to molecular crystal were estimated based on the difference between the optimized molecular parameters of free molecules and the experimental bond lengths and angles evaluated for the crystal forms of the title compounds. The role of hydrogen bonds in the structure of molecular crystals of paracetamol is investigated.
Key words: pharmaceuticals, ab initio calculation, molecular crystals, hydrogen bond, intermolecular interaction.

Invited Talk: Session-IIA: Radiation and Health Physics

IT-RHP: Production and Decay Data of the Non-standard Positron Emitter Y-86

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The positron-emitting radionuclide ^{86g}Y ($T_{½}$ = 14.7 h) is the most important imaging radionuclide for radiation dosimetry being used in combination with β^- emitting ^{90}Y-labelled therapeutics ($T_{½}$ = 2.7 d). Currently, the demand for this radionuclide is continuing. This approach demands a precise knowledge of the positron emission probability of the PET nuclide which was till recently rather uncertain for ^{86}Y. Several nuclear reactions have been investigated for the formation of ^{86}Y. The most feasible method recommended up to date is

the proton induced reaction on highly enriched ^{86}Sr. In view of discrepancies in the data, that route was recently investigated in details in the scope of a large international collaboration.
The excitation functions of the ^{86}Sr(p,xn)-reactions induced on highly enriched [^{86}Sr]$SrCO_3$ targets were investigated using stacked target irradiation technique with two different cyclotrons at FZJ (Germany) and one at LBNL (USA) using protons up to 44.5 MeV. Thin samples of 96.4 % enriched $^{86}SrCO_3$ were prepared by sedimentation and, after irradiation with protons in a stacked-form, the induced radioactivity was measured by high-resolution γ-ray spectrometry. From the measured activities, the cross sections for the formation of products were determined. In addition to the main product ^{86g}Y the most important potential contaminants ^{85m,g}Y and ^{87m,g}Y were also investigated. The same was done for deuteron-induced reactions on ^{86}Sr. The experimental results were compared with the results of nuclear model calculations using the codes TALYS.
Based on the cross-section measurements, many of which have been done for the first time in this work, the two production routes of ^{86}Y were compared. From the yield point of view the production of ^{86}Y via both proton and deuteron induced reactions on enriched ^{86}Sr is feasible. An accurate estimation of the isotopic impurities ^{87m,g}Y and ^{88}Y showed that > 98 % pure ^{86}Y is produced using the 96.4 % enriched ^{86}Sr target. The level of the impurity would be considerably reduced if ~ 99 % enriched target could be made available. Both the yield and the radionuclidic impurity considerations show that the ^{86}Sr(p,n)-reaction should be the most beneficial route.
For determining the positron emission intensity of ^{86}Y, a source of high radionuclidic purity was prepared and measurement was performed using high-resolution HPGe detector γ-ray spectroscopy and X-ray spectroscopic analyses. The determined value is in excellent agreement with a recent result deduced from an extensive decay scheme study. The new results should strengthen the database for improving the internal dose calculation while using ^{86}Y for PET measurement in theranostic studies together with ^{90}Y.

Invited Talk: Session-IIB: Plasma and Astrophysics

IT-PA: Instability of DA Mode in Irradiated Dusty Plasmas with Dust Charge Fluctuation

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Plasma physics is one of the most active research areas in modern physics. Conventional plasma applications include Natural Phenomenon, Fusion energy, Lighting, Semiconductor chip manufacture (etching, deposition), High power lasers, etc. Controlled Thermonuclear Fusion is a potential source of safe, non-carbon emitting and virtually limitless energy. The High-confinement mode of operation gives possibility to achieve the fusion reactor called International Thermonuclear Experimental Reactor (ITER). ITER is currently under construction in France.
Plasma based technologies are growing rapidly to support the modern life. These technologies become a key underlying technology to future economic development and environmental control. In addition, plasma science is also expanding to understand both laboratory and natural phenomena. The field of dusty/complex plasmas has been a major growth area in plasma science over the last decades, applicable to diverse phenomena in nature, in the laboratory and in industry. Research on quantum plasma is also expanding to understand the more accurate description of metallic properties, the metallic nanostructures, the physics of semiconductor, etc. It is a pleasure to inform you that Jahangirnagar University, Dhaka University, Khulna University, Pabna University and Military Inst. of Nuclear Sci. & Tech. teach plasma physics as well as nuclear fusion to cope with the progress of plasma sciences and plasma-based technologies.
In this paper, we have studied the instability of the dust acoustic (DA) mode in irradiated, streaming and collisional dusty plasmas to understand the photoelectric effects on the dusty plasma properties in the space and laboratory. In this study, both cases of unmagnetized and magnetized dusty plasmas are considered. The radiation effects on DA mode are included through the dust charge fluctuation (DCF). So far, in the DCF model, the piled up electrons on the dust grains are neutralized through the absorption of ions by the dust grain. On the other hand, in the present DCF model, photoelectron emission is included. In this model, the piled up electrons on the dust grains are considered to be reached to its equilibrium value through the combined effects of absorption of ions by the dust grain and the emission of electrons from the dust grain surface by irradiation [1, 2]. In this case, the work function of the dust grain's material is considered to be higher than the photon energy and hence, the dust grains are considered to be negatively charged.
In this study, we found that the DA mode becomes unstable significantly due to photoelectric effect compared to the streaming of electrons and collision of the charged particles with the neutrals in both unmagnetized and magnetized cases. Since, the instability of the DA mode due to photoelectric effect make the dusty plasma

unstable, i.e., plasma parameters such as plasma density and temperature are fluctuated, it is thus concluded that the present study should be applied specially in understanding the formation of radar echoes in the polar mesosphere and communication of information from satellite to the Earth in the presence of solar radiation [3].

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Invited Talk: Session-IIIA: Materials Science – I

IT-MS-I: A State-of-the-art of Nonlinear Optical Single-Crystal for Optoelectronic Applications

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Crystallization of single crystal has been developed as an important field over the many years, both for basic research and industrial applications in many scientific disciplines. The rapid development of optical communication system has led to a demand for nonlinear optical materials for high performance in electronics, optoelectronics devices. Single crystal plays an important role in the development of microelectronics, optoelectronics and fast electronic applications. Nonlinear optical materials will be the key elements for future photonic technologies based on the fact that photons are capable of processing information with the speed of light. Inorganic materials are much more matured in their NLO applications. Most commercial materials are inorganic especially, for high power use. The advent of high intensity lasers coupled with the recent advances in crystal technology has led to rapid progress in the field of nonlinear optics. The growth of crystal from solutions is the most widespread method of crystal growing and is very popular in growing several technologically important crystals. From a technological point of interest, some important singles crystals have been grown in a laboratory from low temperature solution growth technique. Further, the growth mechanism, nucleation kinetics, origin of nonlinearities and the effect of impurities on the habit modification of some NLO crystals viz. KDP, ADP, KDP-ADP mixed, KAP, KCl, AO, Urea, Thiourea, TGS, L-alanine, and others single crystals like $MgSO_4$, $ZnSO_4$, K_2SO_4, in pure and doped with transition metals and their structural, mechanical and optical properties are to be discussed in details. Hence, the present lecture also addresses the accumulated experience of a couple of years working in the field of crystal growth research at BUET.

Invited Talk: Session-IIIB: Nano-Structure Physics

IT-NSP: Frequency Stability in Nano-Optomechanical Systems

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Recent applications of nanomechanical resonators (NEMS) ranging from precision watch to smart phone require more insight on their frequency stability to bridge the gap between experiments and theories. Frequency stability, often known as Allan deviation, is the key metric to quantify nanomechanical sensitivity. Current state of knowledge shows that frequency stability as well as NEMS sensitivity degrades with damping (quality factor, Q), which makes it difficult to use these devices in ambient condition. Nano-optomechanics has previously been used by us [1] to show that the damping effect on nanomechanical sensitivity can be overcome by pushing the device up to its intrinsic linear dynamic range (DR). This study proved that mechanical sensitivity can be independent of damping if corresponding DR is attainable. As a result, the hypothesis behind the Robin formula was initially proven from a high vacuum to atmospheric pressure. However, till today, it is not possible for a mechanical device, such as AFM cantilever to attain its intrinsic DR. So, the validity of Robin's formula is still

under doubt, particularly for limited dynamic range. Here, we demonstrate that frequency stability of nano-optomechanical systems (NOMS) decreases with damping by purposefully maintaining constant DR at different damping levels which supports Robin's formula for nano-optomechanical systems.
Key words: NEME, NOMS, Frequency stability, Quality factor, Mechanical sensitivity.
Reference:
[1] Swapan K Roy *et al.* "Improving mechanical sensor performance through larger damping." *Science* 360, no. 6394 (2018): eaar5220. DOI: 10.1126/science.aar5220

Invited Talk: Session-IVA: Theoretical and Computational Physics - II

Stochastic boundary approach and grand canonical MD study of non-equilibrium properties of a system in 2-D

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Particles are injected with certain momenta from a particle reservoir into a 2-D rectangular system with stochastic boundary condition. Three sides of the rectangular system are bounded by three rigid walls and the open side is coupled with the reservoir characterized by pressure (p), temperature (T) and chemical potential (μ). Motion of the particles is tracked by employing the grand canonical molecular dynamics simulation technique and, non-equilibrium properties of the system such as pressure, number of particles are calculated as a function of μ. It is interesting to note that after long time the particle distribution in the system becomes Gaussian. Results obtained agree well with other simulation data.
Keywords: Particle reservoir, stochastic boundary condition, grand canonical approach, Molecular dynamics

Invited Talk: Session-IVB: Condensed Matter Physics – II

IT-CMP-II: Multifunctional Metal Oxides: Materials for the 4th IR

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Recent and current research projects on various multifunctional metal oxides and their composites carried out at the experimental solid state physics laboratory of the Department of Physics, Bangladesh University of Engineering & Technology will be described. For technological development and to meet the new demands of the 4th Industrial Revolution, there is a constant need for advanced multifunctional materials with improved properties. The materials with perovskite and spinel structures have continued to attract the interest of Scientists and Engineers because of their fascinating properties that are suitable for many applications such as memory devices, IR detectors, electrodes, magnetic read/write heads, bolometer, and in optoelectronics. Therefore, perovskite and spinel types of materials can be considered as a treasure box of smart materials. The chemistry of perovskites in the ideal case can be described as ABO_3. The A cation and the O anion form together a close-packed array. The B cations are located in the octahedral voids created by the O anions of subsequent layers. On the other hand, AB_2O_4 spinel-type materials can be treated as natural superlattices as they have tetrahedral A-site and Octahedral B-sites. Various cations can be placed on A-site and B-sites to tune the properties of perovskite and spinel types of materials. Depending on A-site and B-site cations, the perovskite-type of materials can be colossal magnetoresistive, dielectric, conductive, magnetic, superconductive, and optical materials, and spinel-type materials can be ferromagnetic, antiferromagnetic, spin glass and even paramagnetic materials. Experimental results of various properties of some of the perovskite and spinel materials will be described thoroughly. Spinel-perovskite composites show magnetoelectric coupling. There is a scope of designing smart multiferroic materials from spinel-perovskite composites for future technology.
Keywords: Perovskite, Spinel, Ferromagnetic, Colossal Magnetoresistance, and Multiferroics.

Invited Talk: Session-VA: Biomedical Physics

IT-BMP: Poration Dynamics of Cell Mimetic Lipid Vesicles Induced by Peptides, Nanoparticles, Electric Field, and Mechanical Tension

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Vesicles are essentially closed, spherical structures composed of a lipid bilayer ranging in diameter from nano to micrometers. Antimicrobial peptides (AMPs), nanoparticles (NPs), electric field, and mechanical tension formed pores in the membranes of cell-mimetic giant unilamellar vesicles (GUVs). AMPs have been identified and isolated from a diverse group of organisms, comprising amphibians, invertebrates, plants, and mammals. It has a natural defensive power against pathogens such as bacteria, viruses, and fungi due to its bactericidal and fungicidal activity. AMP is a prominent candidate of future antibiotics that will be obtained from natural sources. The emission of NPs from different sources into the environment is one of the main reasons for the substantial mortality and morbidity. Medical implants, magnetic resonance imaging contrast agents, pesticides, and food processing are some other sources of NPs that enter the human body. Such NPs damage healthy cells by forming pores in their membranes, leading to different types of diseases such as cardiovascular failure, respiratory disorders, and Alzheimer's. The deformation and compactness (C_{om}) of a GUV induced by 3.33 μg/mL NPs are presented in Fig. 1.

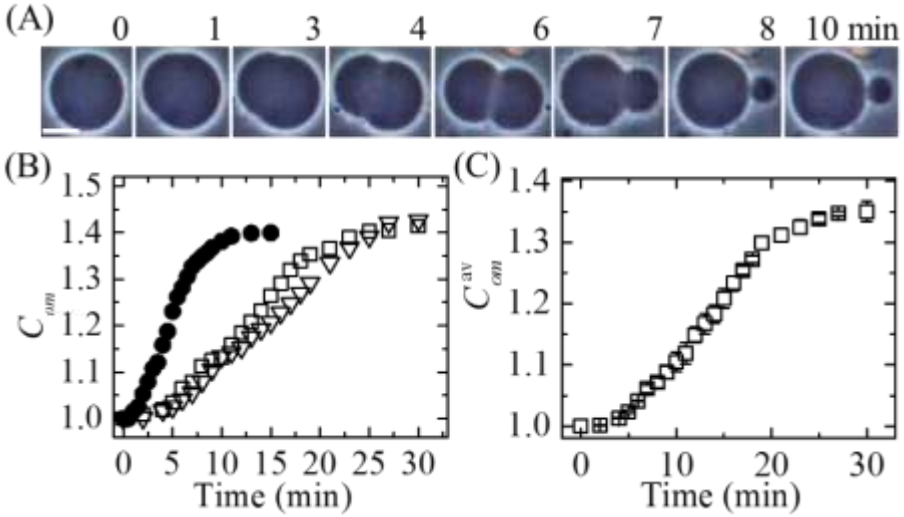

Fig. 1: (A) Phase contrast images shows the deformation of a 'single GUV'. The numbers above each image show the time in minutes after starting the addition of NPs. Scale bar is 10 μm. (B) The time course of the change of compactness of GUVs, filled circles (●) correspond to images shown in (A). (B) Under the same condition as in (A) the time course of the change in compactness of two other 'single GUVs' in one independent experiment. (C) Time dependent average compactness of GUVs.

Irreversible electroporation (IRE) is a technique in which an ultra-short pulse with a high electric field has been found to be successful in destroying certain tumor or cancer cells. The electrical field induces poration in cells or vesicles, leading to their ablation (or rupture) at a localized zone. Mechanical tension in the lipid bilayer is generally applied by micropipette aspiration techniques. When such tension exceeds the critical level, poration occurs in the membranes, leading to the rupture of GUVs. This technique is used to evaluate the mechanical strength of membranes, the elasticity of membranes, the bending rigidity of membranes, and the critical tension for vesicle rupture. An illustration for calculating the rate constant of rupture of GUVs is presented in Fig. 2.

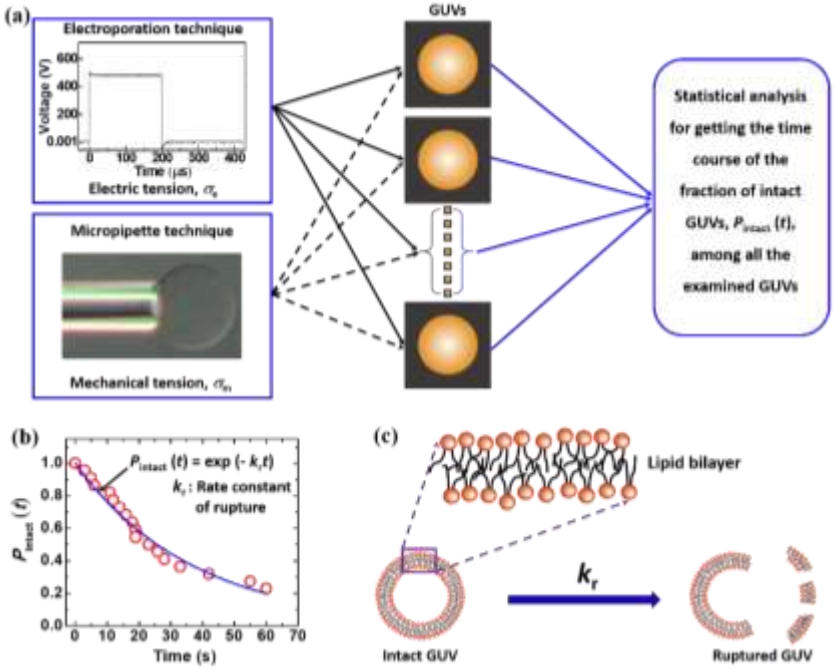

Fig. 2: (A) Electric tension or mechanical tension is applied to several 'single GUVs'. (B) Calculation of the rate constant of rupture. (C) Transition from the intact GUV to the ruptured GUV.
Hence, the poration mechanism due to AMPs, NPs, IRE, and mechanical tension in lipid membranes and biomembranes is important to understand the rupture of cell-mimetic GUVs and real cells. These studies may aid in the application of these techniques in a variety of medical and biomedical fields.

Invited Talk: Session-VB: Electronics and ICT

IT-EICT: An Overview and Prospects of Software Defined Radio

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Rapid advancement in wireless communication has added multiple applications with increasing number of protocols and services. Traditional radio communication devices are protocol and band specific and thus pose a great limitation for interoperability. Software Defined Radio (SDR) overcomes this limitation with great flexibility. In this invited talk, an overview and architecture of SDR is presented. Recent development in SDR, prospects and challenges are also discussed in brief. Finally, a short demonstration on SDR application is presented.

Invited Talk: Session-VIA: Materials Science – II

IT-MS-II: Magnetism of Ferrites and Their Rear Earth doped Research and Their Applications for Electronic and Electrical Device

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Magnetic properties of ferrite materials very different from free atom or the bulk system and heir influenced particle size are involved direction of magnetization. The term magnetism is derived from in Asia Minor where loadstone means magnetic iron ore or magnetite, Fe_3O_4. Iron is only metal is easily magnetized when placed in magnetic field and includes Ni, Co, steel. Carbon steel is common material used for permanent magnet is magnetized created its own persistent magnetic field but more efficient as including certain ferroceramics and

their alloy of Fr, Al, Cu, Ni, Co, some rare-earth metal. Ferrites respond strongly to a magnetic field are ability of a material to magnetize or to strength the magnetic field is it vicinity is by magnetic permeability. Some materials are very weekly attracted magnetic field having permeability's slightly greater than that of free space are called permanent magnet and these type of is refrigerator magnet used to hold notes a refrigerator door. Ferrites are the ferrimagnetic mixed oxides having formula MFe_2O_4, where M is divalent metal ion such as Mg^{2+}, Mn^{2+}, Cu^{2+}, Zn^{2+}, Cd^{2+}, Co^{2+}, Fe^{2+} etc., and owing to important role of electrical and electronic industry depends on magnetic response properties are extensively used.

Especially soft ferrites, polycrystalline and also rear earth doped ferrites have received attention due to good magnetic properties and high electrical resistivity over a wide range of frequencies from a few Hz up to GHz. Spinel ferrites and also rear earth doped ferrites are commonly used in many electronic and magnetic devices due to high permeability and low magnetic loss. Recent every item of electronic equipment produced contains some ferromagnetic spinel ferrites frequently used loudspeakers, motors, radar, absorber, antenna rods, proximity sensors, humidity sensors, deflection yokes, memory devices, recording heads, electromagnetic interference suppressors, broadband transformers, filters, inductor etc. Ferrites and rear earth doped ferrite material are posses to combined magnetic properties and insulators are extensively investigated subject to great interest in many technological applications from both fundamental physical sciences and applied research point of view. Magnetic dilution of materials is introducing sub lattices by substitute nonmagnetic ions in lattice, frustration and or disorder occurs leading to collapse of collinearly ferromagnetic phases by local spin canting exhibiting a wide spectrum of magnetic ordering applied for antiferromagnetic, ferrimagnetic, re-entrant spin glass, spin glass, cluster spin glass properties.

Now a day's ceramic materials, means ferrites and also doped rear earth ingredients are mixed, pre fired, crushed/milled, dried, required shaped and finally pressed or extruded and fired into their final hard, brittle state. The used of their ferrites are certain applications depend on structural, electrical, magnetic and transport properties are sensitive condition of preparation technique as well as amount substitution of metal and nonmetal elemental or rear earth ions. Most of ferrites preparations in Bangladesh different research laboratories and Universities are prepared by conventional double ceramic technique or solid state reaction technique and sol-gel technique and characterized. Characterization studies like XRD, SEM, TEM, thermal analysis simultaneously DTA/TGA, VSM, Impedance Analyzer, B-H loop tracer and MÖssbauer spectroscopy analysis are utilized. Mankind is always eager to explain the world in which he is living and how this beautiful complex machinery works. The ferrites and rear earth ferrites research goal for studies are design new materials for future advances in technology and need to know a spin glass behavior with a manifestation of non equilibrium dynamics, such as aging, rejuvenation and memory effect.

Invited Talk: Session-VIB: Environmental Science

IT-ES: Recycling of Solar PV panels in Bangladesh along with South and South East Asia

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The sustainable development goal (SDG) 7 of the UN averring **c**lean and affordable energy urges the world to adapt to the renewable energy technologies; a major such technology is the solar PV panels. Presently, the increasing trend of solar panel establishments and potential waste production at the end-of-life has exacerbated electronic waste (e-waste) situation; thus, necessitating the need to recycle these e-wastes for further, 'Cleaning of this Cleaner Energy'. This paper draws on the recycling status of solar PV panels in the countries such as Bangladesh as well as, South and South East Asian countries. The study revealed that the recycling trend in these countries were in a nascent stage. Majorly since the established solar panels have mostly not reached a recyclable phase yet considering the 20-25 years life span of the panels. However, it is only a matter of time the overburden of such wastes may bore on these countries (as waste generated estimated globally to be 78 million tons by 2050). As a result, we implore upon the necessity of policy making, properly defining these wastes, employing proper establishments and groups to recycle the waste and subsequently adhere to a circular economy model in the solar panel establishments for the environmental safeguard.
Keywords: e-waste; circular economy; PV panels; recycling of e-waste

Invited Talk: Session-VIIA: Nuclear Physics

IT-NP: Nuclear Power Plant: Safety, Security and Physical Protection

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The present work is an investigation on safety, security and physical protection of the proposed Rooppur Nuclear Power Plant. Before going to that aspect an analysis has been done in the work for finding a suitable energy mix for Bangladesh. Nuclear seems to be an important component and is the final option. In the work background radiation level of the RNPP site has been measured. Besides this peace time data, external whole body dose values at 0.5, 1.0 and 2.0 km site boundary have also been ascertained in case a radiological accident happens in the reactor. While discussing the aspects to select a suitable power reactor for Bangladesh a GEN III+ reactor is proposed that suits well. And considering the engineering, security and other relevant aspects a VVER of 1000 MW (e) seems to be the right choice for the country. Design basis threat has been assessed for the RNPP. In doing so international level data on the threat of the last one hundred years have been discussed. National data of 1945-2010 have also been discussed for this purpose. The security aspects of the RNPP have been analyzed in the work. For ensuring the security of the installation a battalion of 741 man-power strength has been proposed. Before establishing a nuclear power plant its security aspects must be thoroughly studied for achieving the approval from concerned international bodies. The present work is expected to substantiate that. A set of recommendations on making a suitable infrastructure and taking preparation on legal aspects have been put forward in the work. These recommendations will help the concerned authority to think, plan and initiate activities related to safety, security and physical protection of the RNPP in Bangladesh.

Invited Talk: Session-VIIB: Atmospheric Physics

IT-AP: Cold-Related Mortality and Trends of Cold Days in Bangladesh

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In this research, the division-wise cold-related death database has been developed in Bangladesh for the winter of 2009-2021 using the data collected from online newspapers. The cold-related mortality data have been analyzed to determine the demographical dynamics and spatiotemporal variability in Bangladesh. The comprehensive cold-related mortality database has been prepared for 8 administrative divisions of Bangladesh for the winter of 2009–2021 and systematically removing the redundant records. The winter months have been separated into 1st and 2nd 10-day periods and the remaining days of the months to identify the division-level cold-related mortality. The number of cold days during the winters of 1990-91 to 2020-21 has decreased per decade in Khulna (2.78), Sreemangal (2.14), and Cumilla (2.08) and increased per decade at Chuadanga (3.21), Syedpur (1.43), and Khepupara (1.15) stations. The decreasing trends of cold days were significant at Khulna (99%), Cumilla, and Sylhet (90%) and the increasing trend was significant at Khepupara (99%). The total number of cold-related mortality was found 1249 with an average of 104.1 during the winters of 2009-10 to 2020-21 in Bangladesh. The cold-related death was found highest in the division of Rangpur (36.51%) and the second highest in the division of Rajshahi (16.49%). The cold-related mortality was found maximum in January (55.56%) and the next higher mortality was in December (45.48%). The highest cold-related mortality has been observed during 21-31 December (40.75%), and the second highest was during 11-20 January (22.98%). All cases of cold-related mortality were found within 21°C of the daily maximum temperature (T_{max}). The maximum number of cold-related mortality was observed (50.68%) among children aged under 6 years followed by senior citizens (20.42%) of 65 years and above. The common causes of death in Bangladesh are natural cold (75.5%), cold-related illnesses (10.65%), and burning due to campfires (5.8%). The findings of this study will inspire policymakers to understand the significance of taking imperative actions that ensure the in-danger populations from cold-related risks in Bangladesh.
Keywords: disaster; mortality; campfire; demography; cold wave

Invited Talk: Session-VIIIA: Thin Film

IT-TF: Prospects and Challenges of Metal Oxide Electron Transport Materials for Highly Efficient and Stable Perovskite Solar Cells

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Perovskite solar cell (PSC) has become one of the fastest developing technologies in the photovoltaic field due to its outstanding optoelectronic properties, including high absorption within the ultraviolet (UV) and visible light region (around 300-800nm), adjustable band gap, long carrier diffusion, excellent charge mobility, and a low-cost and simple deposition method. Despite the current progress of PSCs, there are a number of issues that currently restrict the commercialization of PSCs due to their efficiency, stability, reproducibility, and fabrication in a large area [1]. The ETL not only plays a crucial role in extracting photogenerated electrons from the perovskite absorber layer but also has a significant impact on the device degradation process and stability. Therefore, an ideal electron transport material (ETM) should have high optical transmittance, a matching energy level, high electron mobility, and good thermal and photochemical stability to attain high-performance PSCs. The transmittance of ETL should be as high as possible to avoid the loss of photon energy. Various types of metal oxides, such as TiO_2, ZnO, SnO_2, SiO_2, ZrO_2, CdS, WO_3 etc. have been widely used as ETL in PSCs [2]. Among them, TiO_2, SnO2, and ZnO are the most commonly used in PSCs. The TiO_2 has low electrical conductivity and electron mobility, which limits the electron collection and transportation, limiting the further enhancement in device performances for PSCs. Besides that, another major disadvantage of TiO_2 is the formation of oxygen vacancies at the surface and grain boundaries due to its exposure to UV light, which results in an increase in defects and severe charge carrier recombination in PSCs. SnO_2 is another potential candidate for ETLs widely used in PSCs due to its high optical transparency and electron mobility, suitable energy level match with the perovskite layer, and easy fabrication process. However, SnO_2 materials have suffered from many bulk and high surface defects. Considering the current limitations of TiO_2 and SnO_2, the n-type semiconductor ZnO seems to be a promising candidate for ETL because of its higher electron mobility, low-cost fabrication process, and processability. However, the application of ZnO as ETL in PSCs is still limited due to the poor crystallinity of ZnO and large amounts of defects, as well as the energy barrier at the interface of the ZnO/Perovskite layers which limits the sufficient charge extraction, resulting in low PCE and stability. Therefore, for further enhancement of the operational stability of PSCs, simultaneous system engineerings such as interface modification of the ETL/absorber layer, tuning of the crystallinity, morphology, and defect engineering should be considered to realize their full potential.

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Invited Talk: Session-VIIIB: Composite Materials

IT-CM: Poly-Concrete as Structural Material for Control Pollution

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National Conference on Physics – 2023

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Venue:
Department of Physics
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Bangladesh Physical Society

9th March 2023 (Thursday)

Session-IA: Theoretical and Computational Physics-I

TCP-1: Differentiating between Molecular and Tightly Bound Multiquark States

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Observations of heavy multiquark candidates at various experiments have now more-or-less established several tetraquark and a few pentaquark states as part of the hadronic spectrum. This has led to renewed interest in exotic QCD spectroscopy. These new states require a 3+ quark interpretation; however, it is still far from clear if these are tightly bound hadrons or loosely bound hadronic molecules. Approaches to address this issue are discussed. Possible input from lattice QCD is proposed.

TCP-2: A Two State Model Study of Magnetic Properties of $Pr_2Re_3Si_5$ Compound

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The rare earth intermetallic compound having the general formula $R_2T_3X_5$, where R denotes the rare earth, T denotes the transition metal, and X= Si or Ge. The formulas are often referred as 2-3-5 compounds. Recent study in this series of Pr-based compounds show interesting properties such as Ising-type magnetic ordering, anisotropic magnetic susceptibility, anomalous electrical resistivity and heat capacity [1]. There are several theory are established to investigate the anomalous properties, such as crystal electric field (CEF), interconfigurational fluctuation (ICF), and two state Weiss model [2-3]. Among the physical properties we studied the magnetic susceptibility and other associated properties such as Bohr magneton number and contribution of electron number by the two-state model. We found that the model calculation nice agree the susceptibility of experimental data for this compound. We obtain the Bohr magneton number 3.40μ_B in the model. The atomic Bohr magneton is 3.58μ_B. On the other hand the magnetic moment calculation from the nuclear heat capacity is obtained 3.2μ_B. The contribution electron number is obtained 1.9 in the model calculation. In the SCF band calculation the electron number is 1.58 for the PrO_2 compound.

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TCP-3: Ab Initio Study of Stress Effects on Structural, Electronic, and Optical Properties of Cubic $Xalo_3$ (X= Ce and Pr) Structure

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The cubic $CeAlO_3$ and $PrAlO_3$ structures have been subjected to uniaxial stresses of up to 300 GPa in our study. We used the density functional theory-based first-principles calculations in the CASTEP package by taking a GGA + U approach. Prior research has noticed the stress's effect on the crystals' tetragonal phase. Similarly to the tetragonal phase, the cubic

phase of pure structures is also half-metallic. Squeezing the structures causes them to deform and decrease volume and lattice parameters when the pressure is increased. The stress-dependent narrowing of the half-metallic gap suggests that, at extreme pressures, such a transition from half-metal to metal may occur in some formations. $CeAlO_3$'s absorption coefficient, optical conductivity, and plasmon peaks are all blue-shifted due to uniaxial stress in the UV region. Maximum absorption has shown in the ultraviolet area for both structures, pointing to potential spintronics and optoelectronics uses.

Keywords: CASTEP; DFT; Perovskite; Half-Metallic.

TCP-4: Substituting X Cations by Co and Ni in Tuning Physical Properties of Sr_2TiXO_6 Double Perovskites: A DFT Study

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We report some unclarified physical properties of cubic Sr_2TiXO_6 (X=Co and Ni) perovskites by utilising the ultrasoft pseudopotentials based on the density functional theory (DFT). We employed the CASTEP simulation code to explore the structural, mechanical, electronic and magnetic properties of cubic (space group Pm-3m) Sr_2TiCoO_6 (STC)and Sr_2TiNiO_6 (STN) perovskites. However, STN perovskite in our study is a novel composition, and no previous experimental and theoretical works have been found IN the literature review. The determined lattice constants for considered perovskites are 7.78Å and 7.77Å for STC and STN, respectively. The elastic stiffness constants C_{ij} calculation was conducted using PBEsol approximation and found that STC and STN perovskite structures are mechanically stable. The mechanical properties of polycrystalline materials, including their anisotropic factor (A), bulk modulus (B), shear modulus (G), young modulus (Y), and Poisson's ratio (σ), have been observed. The famous Pug's ratio (G/B) values for STC and STN perovskites lie beyond the critical limit and align well with the other parameters suggesting that they are mechanically ductile. The observed Debye temperature and melting points for all the compounds are prime indicators of their high-temperature thermoelectric application. The analysis of electronic band structure and density of states through GGA+U approximation suggested that both structures are metallic. The magnetic properties analysis of STC composition indicates antiferromagnetic behavior dominates with a magnetic moment of 1.8 μ_B while STN is found as nonmagnetic. All of the computational results for STC and STN are in good accord with the available experimental data, indicating that our work is reliable.

Keywords: CASTEP; DFT; Perovskite; Metallic; Ductile.

TCP-5: Computational Study on Physiochemical Properties of Pristine and Transition Metal (Pt, Au) Doped $B_{12}N_{12}$ Fullerene

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In recent times, researchers have been interested in size-dependent nanoclusters because of their distinct physiochemical properties and their technological applications [1]. Due to their unique spherical shape, hydrophobic property, low toxicity, and hydrophobic features, various nanoclusters, such as fullerene, nanocages, nano-cones, nanosheets, etc. are particularly promising prospects for developing anti-cancer drug delivery techniques [2]. The structural property of the $B_{12}N_{12}$ cluster is significantly changed after doping with transition metals – Gold (Au), Platinum (Pt) which has been investigated using density functional theory (DFT) with B3LYP /LanL2DZ basis function in Gaussian 09 program [3]. The average value of the bond length of pristine $B_{12}N_{12}$ is 1.93 Å. After being doped with two transition metals Pt and Au, in two distinct positions, the average value of the bond length of $B_{12}N_{12}$ have changed to 1.60 Å ~ 1.62 Å, which refers to that doping enhances the stability of the doped fullerene. In addition, the average binding energy of the pristine cluster (- 6.88 eV) is lower than that of the doped fullerene (- 6.66 eV ~ - 6.50 eV). This indicates that the doping increased the potential reactivity of the concerning fullerene [3]. Therefore, transition metal (Pt, Au) doped $B_{12}N_{12}$ is a potential candidate for anticancer drug delivery approaches as well as other biomedical applications [2].

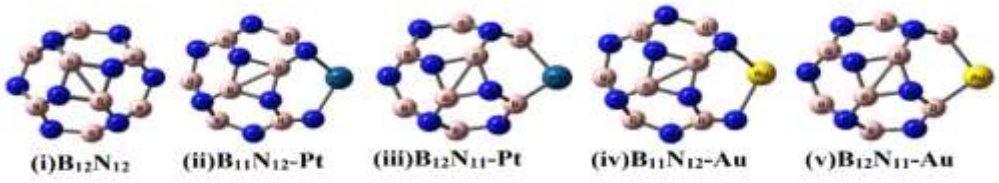

Fig.1: Stable configuration of pristine and TM (Pt, Au) doped $B_{12}N_{12}$ fullerene.

Keywords: Boron nitride, Fullerene, DFT, Transition metal, Nanoclusters.

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TCP-6: Strain Impact on Optical, Spin-Orbit Coupling, and Phonon Properties of Mosse Heterostructure: A DFT Analysis

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Effective modulation of electronic and optical properties for Van der Waals heterostructures benefit spintronics and optoelectronic devices. Janus MoSSe, in two dimensions, has superior electronic properties, optical properties, dielectric properties, spin-orbit coupling properties, and phonon properties. Based on these characteristics, we use first-principles-based density functional (DFT) theory calculations to examine the impact of biaxial compressive and tensile strain ranges of -6% to +6% on the structural, optical, spin-orbit coupling, and phonon properties of two-dimensional MoSSe. At K-point, MoSSe possesses a direct band gap of 1.6658 eV, making it a semiconductor. Yet, when the tensile strain is applied, the bandgap of MoSSe is declines. On the other hand, the bandgap of MoSSe rises due to the compressive strain. With the photon energy of 2.5 eV, the optical absorption of MoSSe is three times stronger than other photon energy level. The MoSSe heterostructure has a greater optical absorption coefficient in the visible light band than two monolayers, according to our calculations of its dielectric constant and optical absorption. The peaks of the dielectric constant of MoSSe move to the lower photon energy when compressive strain is increased; in contrast, the peaks shift towards the higher photon energy when tensile strain is increased. This suggests that the spin-orbit coupling (SOC) in MoSSe heterostructures can be enhanced under strain, which has implications for spintronics. The effect of strain can be used to tailor the phonon behaviors of MoSSe, which can be useful for controlling the thermal and mechanical properties of the material. The tunability of the electronic and optical properties of the material under strain can be harnessed to design novel devices such as strain sensors, optoelectronic modulators, and detectors.

TCP-7: A DFT Analysis of the Strain Effect on Structure and Properties of Cubic $Mapbi_3$ Perovskites

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In this report, we used a first-principles density functional theory (DFT) calculations to investigate the effect of strain ranges from -6% to +6% on considering various properties such as structural, optical, electrical, and mechanical properties of $CH_3NH_3PbI_3$ ($MAPbI_3$) perovskites. At R-point of electronic band structures, the unrestrained planar $CH_3NH_3PbI_3$ molecule exhibits a direct optical bandgap of 1.661 eV. However, the bandgap of $CH_3NH_3PbI_3$ perovskite corroborated an ascendent tendency due to increasing tensile strain; on the contrary, the bandgap showed a decreasing trend with increasing the compressive strain. The $CH_3NH_3PbI_3$ perovskites revealed strong absorption capabilities in the visible region of the solar spectra, as evidenced in the optical studies, including dielectric functions, absorption coefficients, and electron loss functions. The peak of the dielectric constant moves towards low to high photon energy with increasing compressive strain. The light system of the solar cell using this property the perovskite materials such as $MAPbI_3$. Now a day, the perovskite materials also use in electronic storage device. The severe acute respiratory coronavirus 2 (SARS-CoV-2) infection has been one of the most infectious disease, perovskite nanocrystals, to suppress the coronavirus.

TCP-8: Non-Monotonic Potentials for $A+^{36,40}Ar$ Elastic Scattering

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Within the context of the optical model, the experimental angular distributions of $\alpha+^{36,40}Ar$ elastic scattering have been investigated using the non-monotonic (NM) type of complex potential. The NM potential bears a soft repulsive core in addition to its attractive feature and for which the volume integral per nucleon pair for the real part is generally around □100 MeV.fm^3. To reproduce the experimental angular distributions of □$+^{36,40}$Ar elastic scattering in the energy range $E_\alpha = 18.0 - 29.2$ MeV, the empirically adjusted volume and surface imaginary potentials are required in concurrence with the real component of the NM potential. The □$+^{36,40}$Ar elastic scattering data in the aforesaid energy range are investigated using two sets of real potentials: one with unshifted Gaussian repulsive core (Set-1) and the other with shifted Gaussian repulsive core (Set-2). The volume integrals per nucleon pair for the real part of the potentials obtained in this work are as follows: $J_R/(4A) = -94.81$ to -51.61 MeV.fm^3 for ^{36}Ar and $J_R/(4A) = -87.72$ to -68.74 MeV.fm^3 for ^{40}Ar with Set-1 potentials; while $J_R/(4A) = -100.20$ to -61.28 MeV.fm^3 for ^{36}Ar and $J_R/(4A) = -66.46$ to -27.16 MeV.fm3 for ^{40}Ar with Set-2 potentials. Similar quality of fits to the data using both Set-1 and Set-2 suggests that the potentials in the central region of the targets ^{36,40}Ar are not that significant in reproducing the cross sections for □$+^{36,40}$Ar elastic scattering.
Keywords: Elastic scattering, optical model, non-monotonic potential, volume integrals.

Session-IB: Condensed Matter Physics-I

CMP-1: A First-Principles Exploration of Electronic, Mechanical, Optoelectronic, Thermo-Physical, and Lattice Dynamical Properties of $Sntas_2$

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$SnTaS_2$ is a ternary layered semimetal exhibiting low-temperature type-II superconductivity. We have studied the electronic, elastic, bonding, phonon, optoelectronic, and thermophysical properties of $SnTaS_2$ by employing the density functional theory (DFT) based ab-initio calculations. The electronic band structure and electronic energy density of states explained the semi-metallic nature of the material. The elastic constants and phonon dispersion calculations confirmed both mechanical and dynamical stability of $SnTaS_2$. An in-depth study of elastic parameters of $SnTaS_2$ confirms high ductility with good machinability, dry lubricity, strong anisotropy, and layered character. Thermo-physical studies found that $SnTaS_2$ has comparatively low Debye temperature, melting temperature, and thermal conductivity compared to other layered metallic ternaries. Moreover, the chemical bonding of the compound, interpreted by calculating the electronic energy density of states, electron density distribution, elastic properties, and Mulliken bond population analysis, has mixed character with significant covalent and ionic contributions. Significant anisotropy in sound velocity in the compound also confirms the layered structure and anisotropy in the bonding strengths along different crystallographic axes. The low energy refractive index and the absorption coefficient are large in the mid-ultraviolet region for $SnTaS_2$. The reflectivity is fairly nonselective over a wide range of photon energy. All the energy dependent optical

parameters show metallic features completely aligned to the underlying electronic density of states and band structure results.
Keywords: Mechanical properties; Band structure; Optoelectronic properties; Thermo-physical properties; DFT.

CMP-2: A First-Principles Study on Structural, Mechanical, Electronic and Optical Properties of Half-Metallic $Camsi_2o_6$ (M= Co, Fe, Mn) Clinopyroxenes

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Ca-based pyroxene structures have gained significant attention due to the higher abundances of calcium in the earth's crust and relatively easy synthesis process. Here, we have analyzed the structural, mechanical, elastic, thermal, and optoelectronic properties of $CaMSi_2O_6$ (M = Co, Fe, Mn) pyroxene structures
in the monoclinic phase using the first-principles density functional theory (DFT) approach using CASTEP code. The lattice constants of the simulated structures in ferromagnetic (FM) orientations using GGA-WC and GGA-PBSOL were consistent with the available experimental data. Using the Born stability criteria, these structures are considered mechanically stable. These are elastically anisotropic and brittle compounds. The melting temperatures are in the order of 10^3 K, which symbolizes these as potential candidates for high-temperature applications. The band structure alongside the electronic density of states at the Fermi level reveals half metallicity of these structures. $CaMnSi_2O_6$ structure has a maximum half-metallic gap of around 4.60 eV. The remaining two structures have an indirect band gap in the visible photon range given as 3.14 eV, and 2.65 eV for $CaCoSi_2O_6$, and $CaFeSi_2O_6$, respectively. Observing optical and electronic properties shows that the compounds hold a promising future to be utilized in the optoelectronic and plasmonic fields.

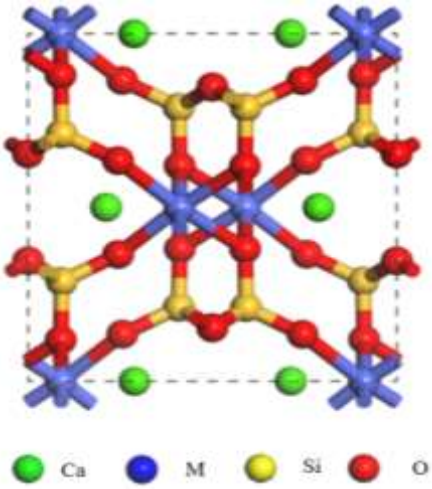

Fig. 1: Crystal structure of $CaMSi_2O_6$ (M = Co, Fe, Mn).
Keywords: Pyroxenes, DFT, CASTEP, Half-metal.

CMP-3: Static Properties of Superconducting Pyramidal STM Tip In the Presence of a Vortex

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The scanning tunnelling microscope (STM) is a popular real-space superconducting vortex imaging technology used in various magnetic fields. The superconducting tip improves image resolution, while the pyramidal shape improves the tip's critical properties. Stationary properties of a superconducting STM tip are studied in the presence of a vortex by applying three-dimensional Ginzburg-Landau formalism. The free energy of the tip is studied in detail to analyze different vortex states. Vortex states and stability range of the tip are studied in the presence of different diameters and heights of the vortex. The phase of the order parameter of corresponding vortex states of the tip is observed in the orthogonal plane to the vortex. Cooper pairs and corresponding

screening current density are studied in the different positions of the tip. Obtained results are important to comprehend the static phenomenon of the STM tip in real-life applications.

CMP-4: A DFT-Based Study of Thermo-Mechanical and Optoelectronic Properties of $Pbtase_2$ Topological Semimetal

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$PbTaSe_2$ is a non-centrosymmetric topological semimetal. In this work, we have explored the structural, elastic, mechanical, bonding, electronic, acoustic, thermal, and optical properties of $PbTaSe_2$ The electronic bond structure calculations confirm semi-metallic character. Fermi surface topology shows both electron and hole sheets. The single crystal elastic constants reveal that $PbTaSe_2$ is elastically stable. The compound is soft, brittle, and highly machinable at the same time. It also possesses very high level of dry lubricity. Various anisotropy indicators suggest that $PbTaSe_2$ is elastically anisotropic with layered character. The phonon dynamics has been investigated. Phonon dispersion plot shows that the compound is dynamically stable with a clear frequency gap between the acoustic and optical branches. The Debye temperature, phonon thermal conductivity, and melting temperature of $PbTaSe_2$ is low. The compound has low Grüneisen parameter. The bonding character is mainly dominated by ionic bonding with some metallic contribution. The optical parameters have been studied in detail. The optical spectra reveal metallic features. The compound reflects visible light very efficiently (reflectance above 60%). It is also an efficient absorber of the ultraviolet light. The compound exhibits significant optical anisotropy with respect to the polarization directions of the incident electric field.
Keywords: Topological semimetal; Elastic properties; Thermal properties; Optoelectronic properties; Density functional theory

CMP-5: A Density Functional Theory Based Insights into the Physical Properties of XC (X = Nb, Ta, Ti) Metallic Binary Carbides

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Binary metallic carbides belong to technologically prominent class of materials. We have explored the structural, mechanical, electronic, optical, and some thermophysical properties of XC (X = Nb, Ta, Ti) binary metallic carbides in details employing density functional theory based first-principles method. Some of the results are novel. Other results are in good agreement with available experimental and theoretical studies, where available. This ensures the reliability of the present first-principles calculations. Study of elastic constants and moduli shows that XC (X = Nb. Ta, Ti) compounds possess low level of elastic anisotropy, reasonably good machinability, mixed bonding characteristics with ionic and covalent contributions, brittle nature and high Vickers hardness with high Debye temperature. The mechanical stability conditions are fulfilled. The bulk modulus and Young's modulus of TiC are lower than those of NbC and TaC. XC (X = Nb, Ta, Ti) compounds are hard compounds suitable for heavy duty engineering applications. The electronic band structures with high electronic energy density of states at the Fermi level reveal metallic character of XC (X = Nb, Ta, Ti) compounds. Presence of both covalent and ionic bondings are evident from the charge density distribution maps of XC (X = Nb, Ta, Ti) compounds. The vibrational properties such as phonon dispersion curves and phonon density of states for XC (X = Nb, Ta, Ti) compounds, are also calculated. Positive phonon frequencies at the Γ-point suggest that the solids under investigation are dynamically stable and capable of efficient thermal transport. The optical parameters are found to be almost isotropic. The optical absorption, reflectivity spectra, and the static index of refractive of XC (X = Nb, Ta, Ti) show that the compounds hold promise to be used in optoelectronic device sectors. Debye temperature, melting temperature, lattice thermal conductivity, and minimum phonon thermal conductivity of the compounds under study are high and show excellent correspondence with the elastic and bonding characteristics. Extremely high melting temperature of TaC indicates that TaC is a good candidate material for high-temperature applications.

CMP-6: A Comparative Study of Structural, Elastic, Thermophysical, and Optoelectronic Properties of $CaZn_2X_2$ (X = N, P, As) Semiconductors via Ab-Initio Approach

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We present a detailed first principles density functional theory (DFT) calculations to study the structural, elastic, lattice dynamical, optoelectronic and thermophysical properties of Zn based ternary semiconductors $CaZn_2X_2$ (X = N, P, As). The unit cells of all the compounds are optimized using the Perdew Burke Ernzerhoff (PBE) generalized gradient approximation (GGA). The obtained lattice parameters are in excellent agreement with the experimental data and other theoretical findings. With the optimized unit cell geometries of $CaZn_2X_2$ (X = N, P, As), the elastic constants are calculated. We obtain six independent elastic constants from the computations, i.e., C_{11}, C_{12}, C_{13}, C_{14}, C_{33} and C_{44}. These elastic constants satisfied the mechanical stability criteria. The comprehensive studies of elastic constants and moduli show that $CaZn_2X_2$ compounds possess reasonably good machinability, relatively high Vickers hardness, relatively low Debye temperature and high minimum thermal conductivity. The phonon dispersion curves and phonon density of states are investigated for the first time for the materials $CaZn_2P_2$ and $CaZn_2As_2$. It is observed from the phonon dispersion curves that the bulk $CaZn_2X_2$ compounds are dynamically stable at zero pressure. Electronic properties have been studied through the band structures, density of states and charge distribution analyses. HSE06 (hybrid) functional is used to estimate the band gaps accurately. The electronic band structures show that $CaZn_2N_2$ and $CaZn_2As_2$ possess direct bandgaps, while the compound $CaZn_2P_2$ show indirect band gap. It is observed that the band gap decreases by changing the anion X from N to As. Energy dependent optoelectronic parameters correspond well with the electronic energy density of states features. We have thoroughly discussed these semiconductors' reflectivity, absorption coefficient, refractive index, dielectric function, optical conductivity and loss function. The optical absorption, reflectivity spectra and the refractive index of $CaZn_2X_2$ show that the compounds hold promise to be used in optoelectronic devices.
Keywords: Zn based ternary semiconductors; Density functional theory; Elastic properties; Thermophysical properties; Optoelectronic properties.

CMP-7: Pressure Dependent Elastic, Electronic, Optical and High-T_c Superconducting State Properties of Monoclinic and Orthorhombic $Mgvh_6$

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Density functional theory with the GGA-PBE approximation has been used to investigate the structural, mechanical, electronic, hardness, thermal, and optoelectronic properties under pressure for predicted monoclinic ($P2_1/m$) and orthorhombic ($Pmn2_1$) structures of $MgVH_6$. We have studied optical properties for monoclinic structure at 0 GPa and orthorhombic structure at 100 GPa only considering reported phase stability. Both of the structures of $MgVH_6$ are thermodynamically stable. Monoclinic structure is mechanically stable, but orthorhombic structure is mechanically unstable in our calculations for the pressures considered. Monoclinic ($P2_1/m$) is ductile in the pressure range 0 GPa to 15 GPa; on the other hand, orthorhombic ($Pmn2_1$) is brittle in nature at 100 GPa and becomes ductile for pressures in the range from 125 GPa to 200 GPa. Hardness calculations indicate superhard character of the orthorhombic ($Pmn2_1$) structure at 100 GPa. The melting temperature of orthorhombic crystal is also very high. This agrees with the bulk modulus, Debye temperature, and hardness calculations. We have calculated theoretically the superconducting transition temperature (T_c) at different pressures only for the orthorhombic ($Pmn2_1$) structure following a previous study. The estimated values of transition temperatures are within 88.55 K to 22.11 K in the pressure range from 100 GPa to 200 GPa.
Keywords: Ternary hydride superconductors; DFT calculations; Elastic properties; Optoelectronic properties; Thermophysical properties.

CMP-8: Density Functional Theory Based Investigation of Physical Properties of Sn_4Au

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Pressure-dependent physical properties of the topological semimetal Sn_4Au have been investigated via first-principles study within the density functional theory. A close agreement is found while comparing the calculated structural parameters at ambient pressure with the relatively small number of experimental data available. The estimated results of formation energy indicate that the presented Sn_4Au is energetically stable and synthesizable. The pressure dependence of the normalized lattice parameters and the single-crystal elastic constants together with their subsequent features is investigated. The compound under study is classified as ductile in view of estimated Poisson's ratio, Pugh's ratio and Cauchy pressure. The elastic anisotropy indices including three-dimensional contour plots exhibit anisotropic nature in which induction of pressure reduces its isotropy. The thermo-physical properties by means of Debye temperatures along with sound velocities and minimum thermal conductivities have been predicted. In addition, the electronic, optical and superconducting properties are investigated in which the electronic band structure reveals the metallic behavior of this compound and the density of states enhances with increasing pressures. Mixed bonding characteristics are found with ionic and covalent contributions. Various optical properties are computed within the Kramer–Kronig relation and discussed in detail with different pressures. The investigated compound might be used as coating materials to avoid solar heating as they exhibit reasonable reflectivity.
Keywords: Topological semimetal; Elastic properties; Optoelectronic properties; Thermo-mechanical properties; Superconductivity.

Session-IIA: Radiation and Health Physics

RHP-1: Evaluation of the Production Routes of Theragnostics ^{157,165}Dy from the Stable Isotopes of Gadolinium and Dysprosium by Projecting Light Particles.

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Nuclear medicine uses ^{157}Dy and ^{165}Dy extensively for both diagnostic and therapeutic purposes. It is necessary to evaluate existing and promising alternative production routes for these two radioisotopes from different elements. In this study, TALYS 1.96 is used to theoretically estimate the production cross-sections and yields of ^{157,165}Dy from potential reactions with energies ranging from 0.001 to 200 MeV. The most suitable and cost-effective techniques for producing ^{157}Dy from gadolinium and dysprosium isotopes are alpha-induced ^{156}Gd and neutron-induced ^{161}Dy. Neutron-induced ^{164}Dy is the most potential route to produce ^{165}Dy from dysprosium isotopes. For the prospective reactions, these calculations are compared with EMPIRE 3.2.3 and TENDL-2019 data to understand the consistency of the computation.
Keywords: Dysposium, Terbium, Radiotheragnostics, Yield estimation, Nuclear medicine, Light beam reaction.

RHP-2: Comparison between Feathering Technique, VMAT Technique and Half-Beam Blocked Field Matching Technique in Craniospinal Irradiation

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Introduction: Craniospinal Irradiation (CSI) is used for treatment of medulloblastoma and other brain tumors, which tend to spread via Cerebro-spinal Fluid (CSF). Craniospinal irradiation (CSI) is technically challenging because of the need to cover a complex clinical target volume (CTV) that includes the whole brain and the whole length of the spinal axis and the covering meninges.
Materials & Method: A total number of 3 patients treated with CSI were retrospectively identified. At the cranial field, lateral parallel opposed field was created for feathering and half-beam blocked technique for two patients and a single arc from 179° to 181° was used for one patient. In the spine field, two spinal fields were created and the junction between the cranial and spine fields were shifted twice with an extension of 0.5 – 1 cm upon delivering every 8 – 12 Gy in feathering technique. Cervicothoracic and lumbosacral spine field was created for half-beam blocked technique and for homogeneous dose distribution field-in-field method and field alignment option for field matching were used. For VMAT, two spine field with two isocenter and single arc were used.
Result & Discussion: For all the techniques the max dose of spinal cord is well within the tolerance limit, but in half-beam blocked, it is minimal than two other techniques. For almost all OARs, the average mean dose in half-beam blocked technique is less than two other techniques.
Conclusion: For craniospinal irradiation (CSI), the Half-Beam blocked field matching technique provide a more homogeneous dose to the PTV while reducing dose to multiple critical organs when compared with the feathering and VMAT technique. For all the plans, the plan evaluation and calculated mean homogeneity index value reveals that no critical organ receiving excess doses.
Keywords: Radiotherapy, Techniques for CSI, VMAT, Feathering, Half-Beam Blocked.
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RHP-3: Estimation of Radiological Risk on Public around Rajshahi Medical College Hospital Campus, Bangladesh

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Ionizing radiation has great beneficial application in the hospital and its usage increases with the socio-economic development of the country. It is reported in the international reports/articles that public are getting maximum radiation about 96% from the hospital among man-made sources. There are possible short-term and long-term risks associated to public with very low doses of ionizing radiation. Healthcare workers and public are getting radiation from the hospitals during diagnosis & treatment of patients. Even though, modern radiation generating equipments have significantly enhanced patient care, improper or unsafe handling of the radiation generating equipments & radioactive substances may also cause probable health risks to patients, workers and also public. So, real-time radiation monitoring around the Rajshahi Medical College Hospital (RMCH) was performed to identify the radiation hazard arising from medical usage of the ionizing radiation. The objective of the study is to monitor the real-time radiation around large hospital campus such as RMCH and estimation of radiological risk on public based on annual effective dose. The real-time radiation monitoring around the RMCH campus was carried out using digital portable radiation monitoring devices from September-November 2021 and those devices were placed at 1meter above the ground on tripod. 32 locations around the RMCH campus were selected for monitoring the real-time radiation and data collection time for each monitoring point (MP) was 1.0 hour. The MPs were marked-out using the Global Positioning System (GPS) device. The real-time radiation dose rates around the RMCH campus were ranged from 0.049-0.278 $\mu Sv.h^{-1}$ (mean: 0.137± 0.008 $\mu Sv.h^{-1}$). The annual effective dose to the public due to radiation was varied from 0.086-0.487 mSv. The excess life-time cancer risk (ELCR) on public who are residing nearby the hospital were ranged from 0.355×10^{-3} to 2.01×10^{-3} (mean: 0.994×10^{-3}). ELCR on public around the RMCH campus are higher than that of the prescribed limit of the International Commission on Radiological Protection (ICRP). It is observed from the study that in every thousand people, one of them is at the risk of cancer caused by the scattered radiation exposure from the hospital without any knowledge of being exposed to ionizing radiation. Healthcare workers must handle the radiation generating equipments & radioactive substances as per national regulations and IAEA guidelines for minimizing risk on public who are residing nearby area of the hospital.
Keywords: Hospital; Radiation; In-Situ; ELCR; Public.

RHP-4: Dose Calculation in the Lung Region Using AAA Algorithm and Verification by Measurements

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Background: In radiotherapy practices, dose optimization is very important. Algorithm validation and software testing of a dose calculation algorithm used in radiotherapy treatment planning system (RTPS) is a challenging job to some extent, because of the unavailability of proper dosimetry phantoms. The purpose of this research study is to calculate the dose in the lung region using Anisotropic Analytical Algorithm (AAA) and find the percentage deviation by practical measurement using a homogeneous IMRT Thorax phantom.
Materials & Methods: The IMRT Thorax phantom (CIRS- 002LFC) has been scanned by a GE LightSpeed CT-Simulator (16 slices) with proper laser alignment. IBA Farmer type Ionization Chamber (FC65-P) has been inserted into the lung region and scanned the phantom with 2.5 mm slice spacing. A Planning Target Volume (PTV) has been contoured based on the active length of the chamber. The 3D CRT, IMRT, and VMAT plan have been planned for 200 cGy by Eclipse (Version 13.7) planning system using AAA algorithm for 6 and 10 MV beam energies. All the plans have been delivered on the same phantom in the same setup condition, unlike CT simulation. The delivered doses have been recorded by IBA Dose 1 electrometer.
Results: The percentage deviation between the calculated and measured doses of 3DCRT, IMRT, and VMAT plan for 6 and 10 MV beams were 2.55%, 1.43%, 1.276% and 2.11%, 1.59%, and 2.33% respectively.
Conclusion: The results showed a good agreement between calculations and measurements within 3% for the lung region. The CIRS-002LFC phantom is a wonderful tool for point dose verification for all planning techniques.
Keywords: AAA, RTPS, PTV, Algorithm, 3DCRT, IMRT, VMAT
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RHP-5: Development of Brachytherapy Facility at Institute of Nuclear Medical Physics (INMP): Our Concerns and Suggestions Regarding Radiation Safety in A Brachytherapy Facility

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Brachytherapy is one type of radiation therapy techniques for cancer patient with sealed radioactive sources. The source may be placed inside the tissue or very close to the tissue to be treated. In the case of localized cancer, high dose to the tumor and relatively low dose to the surrounding normal tissue can be delivered using brachytherapy techniques. Generally, it is used for the treatment of head & neck cancer, breast cancer, cervix cancer, prostate cancer etc. As the source is an ionizing radiation source, it has harmful biological effect on living cells. Due to radiation exposure, different types of effects e.g., abnormal cell division, permanent modification of cell, cell death etc., may occur. It also can affect the next generation of the person who receives radiation. Hence, brachytherapy room must have special facilities to limit the radiation dose received by the other patients, employees, and public present in the adjacent area to permissible dose limit. In Bangladesh, the number of brachytherapy facilities is increasing. A brachytherapy facility is also being developed at Institute of Nuclear Medical Physics (INMP), AERE, savar, Dhaka, under Bangladesh Atomic Energy Commission (BAEC). We have calculated and evaluated the shielding thickness for radiobiological protection for a single Co-60 brachytherapy source of activity 2 Ci for this facility. Since, there are some important parameters whose changes may convert a properly shielded treatment room into an unsafe one, in this study, we have suggested

some recommendations for the treatment room so that the whole environment will be safe. This study may easily help to construct or modify a brachytherapy facility and to conduct it with adequate protection.

RHP-6: A Comparative Study of Dosimetric Calculation among AAA, Acuros XB & Monte Carlo Simulation in Lung Media

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Introduction: This study aims to calculate the impact of MC simulation in an inhomogeneous lung medium where there is much perturbation. The goal of this project is to research and verify the dosimetric results compared with different dose calculation algorithms.
Medthod & Materials: The study was conducted in 2 phases. In the first phase, a new Varian 2100CD linear accelerator was modeled and commissioned according to vendor specifications using BEAMnrc code. In the second phase, the dose was calculated in a rectilinear voxel phantom using the DOSXYZnrc Monte Carlo code. These codes allowed for the simulation of radiotherapy treatment units and produced data that was matched close to a realistic clinical beam. TPS density of phantom material (water: 1.000g/cm3, lung:0.251g/cm3) was assigned which helps to calculate dose to medium. The homogeneous phantom (water) dimension was 01x01x.25 cm voxel size along the z-axis was 0.25 mm and for profile voxel size used 01x0.2x01 cm3 along the x and y axes for beam profile & phantom size was 40x40x30 cm3. The lung phantom dimension was 01x01x0.5 cm along the z-axis & its phantom size was 40x40x30 cm. SSD was chosen 100 cm and the number of history was 1x108 for decreasing uncertainty in the result of dose calculation not exceeding 1%. For 6 MV photon energy, PDD was scored in all phantoms for field sizes 10 and 20 cm2 and normalized at depth of maximum dose of 10 cm. Scandose match software compared MC simulated data with measured data and other TPS algorithms. The gamma index, using global methods, was implemented in 3%/3 mm, 2%/2 mm criteria.
Result & Discussion: The design of Varian 2100CD linac has been validated with a spectrum energy of 6.4 MV and FWHM of 0.35 cm. In homogeneous media, the average gamma pass rate of PDD for 3%/3mm, 2%/2mm, and 1%/1mm were 100% for all criteria and in the case of beam profile for 3%/3mm, 2%/2mm were 100%, 95.2% respectively. In inhomogeneous media (i.e, lung medium) AAA calculation and simulated data showed a more significant deviation of gamma pass rate 89.5% with 3%/3mm. In comparison, in the same gamma criteria, the AXB calculation in the lung medium and simulated data showed a small deviation where the gamma pass rate was 100%. In the case of the lung medium, AXB and MC simulated data demonstrate good agreement.
Conclusion: The PDD and beam profile were calculated using MC simulation and found good outcomes with measured data in a homogeneous medium. In an inhomogeneous lung medium, AAA has little lack of calculation accuracy compared to AXB and MC. MC simulation gave a much better result.
Keywords: Lung cancer, Monte Carlo simulation, AAA, AXB, TPS, Inhomogeneous media

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RHP-7: Study on the Variation of PDD of A Medical Linear Accelerator for Different Energy and Field Size at Institute of Nuclear Medical Physics

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For Medical Linear Accelerator(LINAC), the Percentage Depth Dose (PDD) varies with field size and energy of the beam. We used a water phantom (IBA Blue Phantom^2) for measuring the PDD for photon beam energies of 6 MV and 15 MV for Field Sizes 5×5, 10×10, 20×20, 30×30 cm^2 of a Medical Linac (Varian Clinac iX) installed at Institute of Nuclear Medical Physics. The setup was- SSD: 100 cm, Dose Rate: 400 MU/Min. Two ionization chambers – were used and these were connected to a computer via Common Control Unit (CCU). The PDD was measured at the centre axis. The "myQA Accept" software was used to get the dosimetric data.

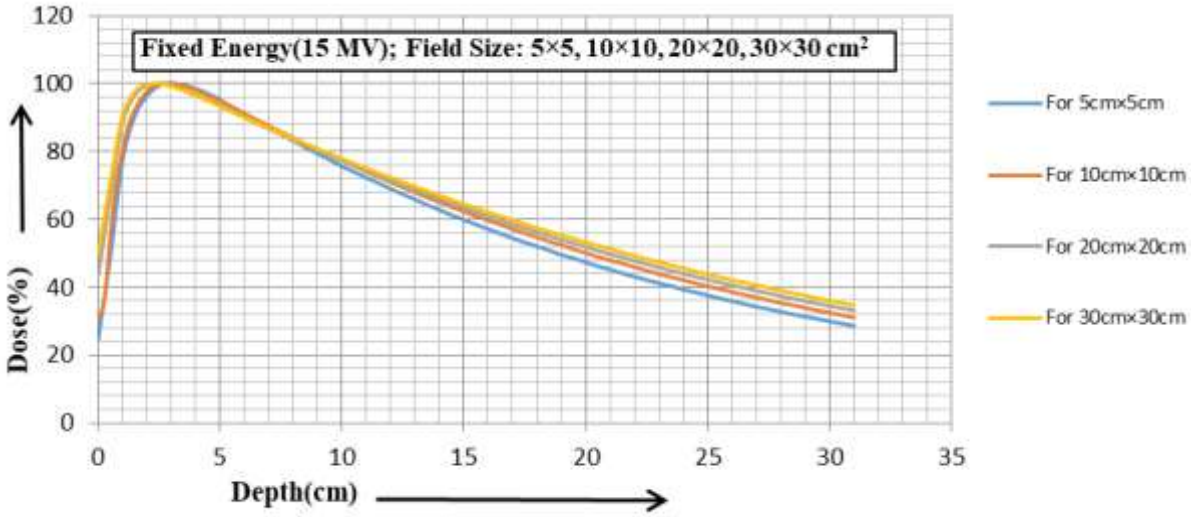

Fig.1: Variation of the PDD with Depth of water phantom.

The PDD varies with the changes in photon energy, depth, SSD and field size. The PDDs characteristics of medical Linac are very important for the perfection in radiotherapy treatment planning. From this work we can conclude that, PDD is a function of energy and beam having higher energy has more penetration.
Keywords: Medical LINAC, PDD, Phantom, Field Size, Energy.

RHP-8: Comparison of the Effectiveness between IMRT and 3D-CRT Radiotherapy Method for Treating Lung Cancer: A Brief Overview

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Lung cancer is associated with high mortality rates due to its fast-growing and unfavorable outlook which is due to active or passive tobacco smoking [1]. To treat lung cancer, there are commonly two types of radiotherapy that are Three-Dimensional Conformal Radio Therapy (3D-CRT) and Intensity Modulated Radio Therapy (IMRT) [2]. Amon these two methods, IMRT is considered to be a more effective treatment approach than 3D-CRT due to achieving better target coverage, dose homogeneity, and minimizing damage to healthy organs [3]. In this work, the effectiveness of 3D-CRT and IMRT for treating lung cancer is based on analyzing dose-volume histograms, as well as outcomes such as survival rates and toxicity levels. For inflicting radiotherapy, the IMRT method provides a more precise form of treatment approach in comparison to 3D-CRT, as it is capable of achieving better conformal dose coverage to the planning target volume (PTV) [2]. Also, the organ at risk parameter for the IMRT method is lower than 3D-CRT for the spinal cord which signifies that the IMRT method is safer in case of spinal paralyzing issues [2]. Also, delivering a high radiation dose through IMRT results in a lower average percentage of lung tissue being exposed to radiation compared to using 3D-CRT [1]. In light of previous literature, IMRT is more effective than 3D-CRT for overall survival for lung cancer patients.
Keywords: Radiotherapy, IMRT, 3D-CRT, Lung Cancer Treatment

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Session-IIB: Plasma and Astrophysics

PA-1: Phase Shifts Due to Head-On Collision in Multi-Components Unmagnetized Collisional Dusty Plasmas

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The study of non-linear waves [1, 2] in dusty plasma is very important because of its incredible applications in astrophysics environments such as comet tails, planet rings, planet magnetospheres, earth ionospheres, and laboratory plasma environments [3, 4]. Seadawy and Iqbal [5] have investigated dust ion acoustic solitary waves (DIASWs) unmagnetized collisional dusty plasma comprising positively charged ions, negatively charged cold dust, thermal electrons, ionized electrons, and immovable background neutral particles. However, imperative physical phenomena as seen in space and astrophysical plasmas are apprehended by linear and non-linear analysis with interaction of waves and phase shifts due to head-on collisions [2, 3]. This study investigates the consequences of the head-on collision of dust ion acoustic waves (DIAWs) in a multi-component unmagnetized collisional dusty plasma consisting of positively charged ions, negatively charged cold dust, q-nonextensive distributed electrons, and immovable background neutral particles. The normalized hydrodynamics fluid equations are considered as [5]: $\frac{\partial n_d}{\partial t}+\frac{\partial (u_d n_d)}{\partial x}=0$, $\frac{\partial u_d}{\partial t}+u_d\frac{\partial u_d}{\partial x}-\beta_d\frac{\partial \varphi}{\partial x}+\nu_{dn}u_d=0$, $\frac{\partial n_{ip}}{\partial t}+\frac{\partial (u_{ip}n_{ip})}{\partial x}-R_i+R_L=0$, $\frac{\partial (u_{ip}n_{ip})}{\partial t}+\frac{\partial (u_{ip}u_{ip}^2)}{\partial x}+n_{ip}\frac{\partial \varphi}{\partial x}+\sigma_i\frac{\partial n_{ip}}{\partial x}+n_{ip}\nu_{id}(u_i-u_d)+\nu_{in}(u_{ip}n_{ip})=0$, and $\delta\frac{\partial^2\varphi}{\partial x^2}=n_e-\delta n_{ip}+(\delta-1)n_d$. Where the ion creation term is defined by $R_i=\nu_L\left[1+\frac{\Delta\sigma}{\sigma_0}\varphi+\frac{1}{2\sigma_0}\left(\frac{d^2\varphi}{d\varphi^2}\right)\varphi^2+\cdots\right]$, ion loss term is defined by $R_L=\nu_L n_i$, and the number density of non-extensive electrons express as, $n_e=1+\frac{q+1}{2}\varphi+\frac{(1+q)(3-q)}{8}\varphi^2+\cdots$. n_{ip} is the positively charged ion density, n_d is the negatively charged cold dust density, n_e is the electron density which are normalized by n_{i0^p}, n_{d0}, n_{e0}, respectively. u_{ip} and u_d are the velocity of positively charged ion and negatively charged cold dust, respectively which are normalized by ion acoustic speed $c_i=\left(\frac{T_i}{m_i}\right)^{1/2}$, φ is the electrostatic potential normalized by $\frac{T_e}{e}$, the space and time variables x and t are normalized by Debye length $\lambda_D=\sqrt{(\varepsilon_0 T_e/e^2 n_{ip_0})}$ for ion and period of ion plasma $\omega_{ip}=\sqrt{(e^2 n_{ip_0}/\varepsilon_0 m_i)}$, respectively, T_i is the ion temperature, T_e is the electron temperature, m_i is the ion mass; ν_{dn}, ν_{id} , ν_{in}, and ν_L are the dust ion, ion dust and ion neutral collsional frequency, and rate of ion loss, respectively, which are normalized by ω_{ip} and $R_i\omega_{ip}n_{ip_0}$, respectively. e is the electronic charge, $\sigma=\sigma(\varphi)$ is the ionization cross section, $\sigma(\varphi)=\sigma_0$ at $\sigma=0$, $\sigma_i=T_i/T_e$, $\beta_d=z_{d0}m_d/m_i$, $\delta=n_{ip_0}/n_e$, and q is the entropic index. The phase shifts due to head-on collision of two counters propagating DIAWs are derived employing extended Poincaré Lighthill Kuo (ePLK) method. The obtained phase shifts for right and left traveling DIAWs are $\Delta X_0=2\varepsilon^2\frac{N}{M}\varphi_{ram}W_r$ and $\Delta X_0=2\varepsilon^2\frac{N}{M}\varphi_{lam}W_l$, respectively, where $\varphi_{ram}=\varphi_{lam}=3U_0/A$ and $W_r=W_l=\sqrt{(4B/U_0)}$ are the amplitude and width of the both right and left traveling DIAWs in their initial state, U_0 indicates the constant velocity of the frame of references, $A=-\frac{1}{2}\left[\frac{3\beta_d}{2V}-\frac{3V^2-\sigma_i}{2V(V^2-\sigma_i)}+\frac{(V^2-\sigma_i)^2}{2V}\left\{\frac{q(3-q)}{4\delta}+\frac{1}{4\delta}\right\}\right]$,$B=\frac{(V^2-\sigma_i)^2}{4V}$, $M=2V$,

$N = \frac{1}{2}\left[\frac{(V^2-\sigma_i)^2\{q(3-q)+1\}}{8V\delta} - \frac{\beta_d}{2V} + \frac{(V^2+\sigma_i)}{2V(V^2-\sigma_i)}\right]$, and the phase velocity, V one can be determined from the dispersion relation $(q+1)V^2 - \{\sigma_i(q+1) + 2\delta + 2(\delta-1)\beta_d\}V^2 + 2\sigma_i(\delta-1)\beta_d = 0$. In this study, both positive and negative phase shifts become produce. The effects of physical parameters concern in the problem on the phase shifts due to head-on collision are investigated and found that the parameters play a crucial role to change the phase shifts.

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PA-2: Ion-Acoustic Shock Waves in Magnetized Pair-Ion Plasma

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A theoretical investigation associated with obliquely propagating ion-acoustic shock waves (IASHWs) in a three-component magnetized plasma having inertialess non-extensive electrons, inertial warm positive, and negative ions has been performed. A Burgers equation is derived by employing the reductive perturbation method. The plasma model supports both positive and negative shock structures. It is found that the positive and negative shock wave potentials increase with the oblique angle (δ) which arises due to the external magnetic field. It is also observed that the magnitude of the amplitude of positive and negative shock waves is not affected by the variation of the ion kinematic viscosity but the steepness of the positive and negative shock waves decreases with ion kinematic viscosity. The implications of our findings in space and laboratory plasmas are briefly discussed.

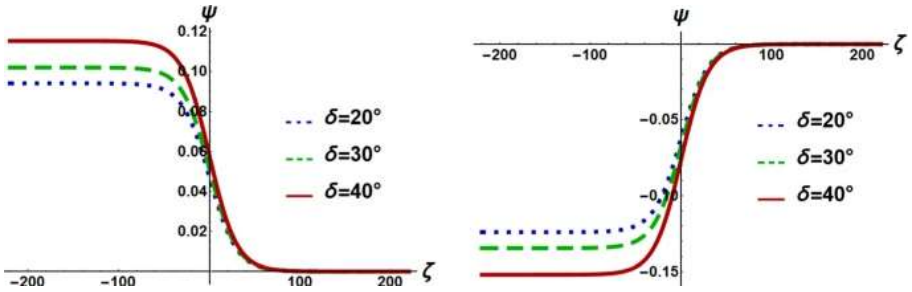

Fig.1: Graphical Abstract

Keywords: Shock wave, Pair Ions, Nonextensive q-distribution, Magnetized Plasma

PA-3: Road to Precision Cosmology: Influence of the Local Environment on Weak-Lensing Statistics

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One of the most promising techniques for understanding the evolution of the universe is the mapping of mass distribution of large-scale structures (LSS). Weak gravitational lensing (WL), which subtly alters the shape of

distant sources, is one of the effective tools for assessing the mass distribution of LSS of the universe. Though the standard cosmological model assumes that matter is homogeneously distributed throughout the universe, gravitational influences over the life of the universe have led to mass clustering on a range of scales. Hence, we expect that, in our inhomogeneous universe, the view of an observer will be influenced by the location and the local environment, resulting in an observer-dependent view based upon their location within the LSS of the universe. Here, we study the one-point probability distribution functions and angular power spectrum of WL statistical quantities (e.g., convergence, shear, and magnification) numerically and analyse the local environmental dependence on WL statistics. We use potentials from the relativistic N-body simulation gevolution [1], solve null geodesics by running ray-tracing algorithms, and then calculate WL statistics. We derive constraints on the cosmological parameters from the WL angular power spectrum and comment on the local environment's influence on WL statistics. We find tighter constraints on the cosmological matter density parameter Ω_m above redshift z = 0.2, which means over this redshift the local environment's impact is minor. The outcomes of this study will have direct consequences for the future surveys (e.g., Euclid [2], the Large Synoptic Survey Telescope [3], etc.), where percent-level-precision is necessary.

Keywords: weak gravitational lensing, large-scale structure, dark matter, numerical simulations.

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PA-4: Development of Antigravity Device Using Solid State Propulsion

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Solid state or Ion propulsion accelerated by charged particle typically N_2 ion colliding with neutral molecule can get a net momentum transfer collision under an electric field termed as Electrohydrodynamic thruster (EHD) at ambient temperature. Ion Propulsion is based on corona discharge where ions produced at emitter collide with neutral atoms move forward to collector electrode. An emitter electrode, an air gap, and a collector electrode make up the single stage (SS) thruster that we are currently working with. As the strength of the electric field close to a conductor's surface is inversely proportional to the radius of the conductor and proportionate to the voltage applied, [**E=V/d**], corona discharge is more likely to occur in small diameter conductor due to the higher electric field intensity near its surface [2].The collector Aluminum foil curvature radius **R** should be smooth becoming not large and sharp edge.If any part of foil is not smooth, then it can easily produce spark or arc with emitter electrode which results to automatic cuts of power line[3]. Finally, here we present the working principal and experimental demonstration of EHD propulsion of an SS thruster which might be employed to anticipate devices like drone.

Minimum Required Current Calculation:

T=Id/μ, where **μ** is ion mobility [$1.8*10^{-4}$ m^2 V^{-1} $s^{-1} \leq \mu \leq 2.5*10^{-4}$ m^2 V^{-1} s^{-1}].

For lifter weight of 4.06 gm and considering **μ** = $1.8*10^{-4}$ m^2 V^{-1} s^{-1}, we get F= 0.04 N. Our inter electrode distance d =3.5 cm. So, according to the above formula we require minimum 205uA dc current to overcome F [T>F] and levitate the prototype.

(a)  (b)

Fig.1: (a)Lifter weight (b)Lifter Experimental Setup.

Keywords: Gravity, Electrohydrodynamic (EHD), Corona Discharge, Sparking, Lifter.

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PA-5: Production and Characterization of Series Gliding Arc Air Discharge Plasma Jet

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Series arc air discharge plasma jet system has been designed and the discharge has been produced. Optical emission spectroscopic data reveal that the relative population densities of $N_2(C^3\Pi_u)$ and $N_2^+(B^2\Sigma_u^+)$ are increasing with the increase of the number of series arc electrodes. Electron, rotational and vibrational temperatures, electron density are increasing with increasing the number of series electrodes due to the fact that the electrons gain more energies from each pair of series electrodes from their corresponding applied electric fields, where multiplication of electron energies are taking place. Due to increasing T_e, excitation and ionization frequencies are increasing and thereby increasing n_e and population densities of the species.
Keywords: Arc discharge plasma jet, Species density, Series discharges.

Gliding arc discharge (GAD) plasma is, highly efficient (~80%) nonequilibrium source, used for different applications, e.g., for radical productions, wastewater treatment, materials processing, sterilization, and so on. The present experiment is designed for the enhanced productions of radicals. Fig. 1 shows the series GAD air plasma source. The setup is consisted with a 0-10kV, 0.5-3kHz power supply, specially designed series gliding arc discharge jet systems, an optical emission spectroscope (OES) used for the identification of species produced in the discharge, high voltage probe and current probe in combination with a digital oscilloscope. The gap between the consecutive series power electrodes is 2mm, while the gap between the power and ground electrode is 5mm. The power dissipated in the discharge is dependent on the number of series arc electrodes and therefore, power dissipated in the discharge increases with the increase of electrodes. The major peaks produced in air discharge are $N_2(C^3\Pi_u - B^3\Pi_g)$ and $N_2^+(B^2\Sigma_u^+ - X^2\Sigma_g^+)$. It is observed from the OES data that the relative population densities of $N_2(C^3\Pi_u)$ and $N_2^+(B^2\Sigma_u^+)$ are increasing with the increase of the number of series arc electrodes. Electron temperature (T_e) and density (n_e) are determined by intensity ratio method, while the rotational (T_r) and vibrational (T_v) temperatures are determined by fitting the $N_2(C^3\Pi_u - B^3\Pi_g)$ band transition with massiveOES software [3]. T_e, T_r, T_v and n_e are increasing with increasing the number of series electrodes due to the fact that the electrons gain more energies from each pair of series electrodes from their corresponding applied electric field, where multiplication of electron energies are taking place. Due to increasing T_e more excitation and ionization events are occurring in each pair of electrodes and thereby increasing n_e. Consequently, species densities are also increasing.

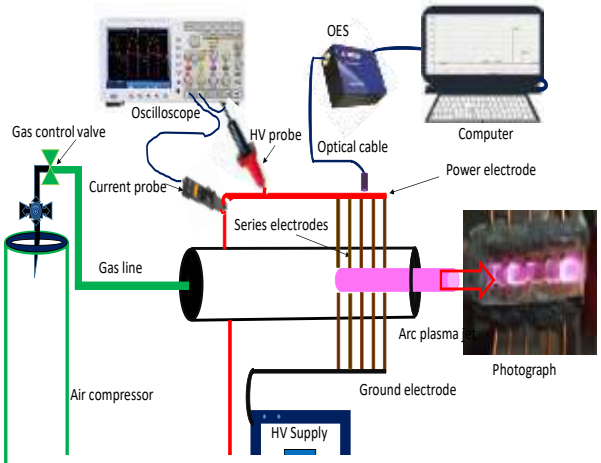

Fig. 1. Series gliding arc air discharge plasma

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PA-6: The Novel Approach of Electronic Brachytherapy for the Treatment of Breast Cancer

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Electronic brachytherapy (EBT) uses miniaturized X-ray sources instead of radionuclides to deliver high doses of radiation. The main objective of electronic brachytherapy is to deliver a low dose to organs at risk, reduce dose to the personnel of the Radiotherapy department, no leakage radiation in the off state, less shielding, and no radioactive waste. EBT provides the photon energy of 50kV to 100kV widely used in the treatment of skin cancer, the treatment of cervical cancers, and the treatment of intra-operative radiotherapy (IORT) in the breast in addition to other treatment sites. The Xoft Axxent brachytherapy system is the only electronic brachytherapy system specifically used in the treatment of cervical cancers and IORT.
Materials and Methods: The study is based on secondary data which is collected from different publications such as PubMed, MEDLINE, BMC-Part of Springer Nature, Google Scholar, and IMEDPUB.
Result and Discussions: The dose fall-off with 50 kVp X-rays is quite rapid compared to the Ir-192 source which would help the treating physician to reduce the complications to adjacent normal tissues and may also contribute to dose escalation. The Xoft Axxent brachytherapy system uses a 2.25 mm miniaturized X-ray tube and it provides a high dose rate where 21Gray in a single session is used for IORT.
Conclusion: Electronic brachytherapy is an encouraging technology that has more potential to replace the existing radionuclide-based brachytherapy procedures. Nevertheless, it is highly anticipated that the design of a miniaturized X-ray tube closer to the dimension of an Ir-192 wire is not too far away, and the new era of electronic brachytherapy has just initiated.
Keywords: Electronic brachytherapy (EBT); Intra-operative radiotherapy (IORT) and Organs at Risk.
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PA-7: Effects of Plasma Activated Water on Growth, Antioxidant Enzyme, Nutritional Composition and Yield of Wheat (*Triticum Aestivum* L.)

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The field study was designed to investigate the effects of wheat (*Triticum aestivum L*) seed treatment with a submerged multi-tube air discharge plasma jet for the treatment duration of 5, 10, and 15 min. The treated seeds were sown in the field. The growth parameters, photosynthetic pigments and enzymatic activities, total soluble sugar (TSS), protein (TSP) in leaves, roots and grains in plants and finally yields were studied. The results reveal that the plant height, fresh weight, total chlorophyll, carotene, CAT, APX and SOD in leaves and roots, and TSS and TSP in grains were increased by 15.02%, 67.73%, 23.90%, 36.94%, 50.09%, 46.38%, 8.09%, 2.08%, 37.50%, 35.40%, 4.11%, and 48.57%, respectively. Wheat (*Triticum aestivum L.*) is one of the most staple cereal crops all over the world. In Bangladesh, agricultural land is decreasing because of housing, industrialization

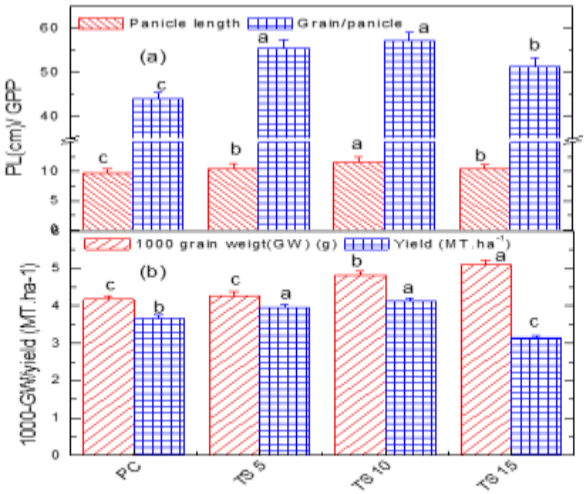

Fig. 1: (a) Length of panicle (PL) and grain per panicle (GPP), and (b) 1000-grain weight (GW) and yield of wheat.

and river erosion. Therefore, it is our major concern to find out an alternative way to meet up the upgrowing demand of foods. Plasma activated water (PAW) contains reactive oxygen (ROS) and nitrogen species (RNS). RNS adsorption in the seed coat increases due to plasma seed treatment and thereby increases water imbibition in the seed [1]. ROS as produced in water enhances the biological processes including growth, development, biotic response, and signaling network of plants [2]. However, the results showed that the plant height, stem diameter and fresh weight were increased by 15.02%, 11.92% and 67.73%, respectively, compared to PC. The concentrations of chlorophyll and carotene were enhanced by 23.90% and 36.94% respectively. APX, SOD and CAT in leaves and roots were increased by 8.09%, 2.08%, 37.50%, 35.40%, and 50.09%, 46.38%, respectively, compared to PC. The concentrations of TSS and TSP in grains were enhanced by 4.11% and 48.57% respectively. Finally, the yield of wheat was increased by 12.26%.

Keywords: Plasma Activated Water (PAWs); Enzymatic activity; Total soluble sugar; Total soluble protein.

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PA-8: Efficient Degradation of Textile Dye with Multi-Tube Air Bubble Discharge Plasma Jet

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Textile dye wastewater was treated with multi-tube (2-4) air bubble discharge plasma jet for under different discharge gap (5-15mm). pH was decreased but the electrical conductivity was increased of the plasma treated wastewater due to plasma treatment. UV-VIS spectra reveal that the decolorization efficiency is enhanced with increasing discharge gap as well as the number of electrodes. The maximum efficiency of 90% was obtained at 10-min treatment.

Textile wastewater (WW) is becoming a threat to environment [1] in Bangladesh. Therefore, atmospheric pressure (AP) plasma can be considered as the prospective technology out of different technological approaches. Because, AP air discharge plasma produces reactive oxygen and nitrogen species (RONS) and that can be utilized for the decolorization of WW. The model WW was prepared with industrial grade textile Remazol blue (RB) and mixing with deionized (DI) water with concentration of 10mg.L^{-1}. The schematic of the experimental setup is shown in Fig. 1. The setup is consisted with a 0-15 kV, 0.05-3kHz power supply, specially designed multi-tube air bubbles production systems, an optical emission spectroscope used for the identification of species produced in the gas phase as well as in the liquid phase, high voltage probe and current probe in combination with a digital oscilloscope. The dissipated power is calculated by integrating the voltage and current over a period. The major peaks produced in air discharge are $N_2(C^3\Pi_u - B^3\Pi_g)$ and $N_2^+(B^2\Sigma_u^+ - X^2\Sigma_g^+)$. pH and wastewater electrical conductivity (EC) were measured by digital pH and EC meters, respectively. Optical absorbance of the treated WW was measured with UV-VIS absorption spectrometer. FTIR of the treated WW was also taken. It is found that pH is reduced while EC is increased with treatment time and number of capillary electrodes because of increasing H^+ concentration in WW. The absorbance (at 600 nm) of treated WW is decreased with the increasing treatment duration as well as with increasing number of electrodes. The maximum efficiency of 90% is obtained with 3 and 4 electrodes at 15 mm discharge length for 10 min treatment. Due to longer jet length as well as the increased number of electrodes will eventually produce more RONS in the plasma-liquid interface and in the bulk are responsible for the improvement of decolorization efficiency. FTIR spectra have produced peaks at 3344 (N-H stretching of aliphatic primary amine), 2887 (C-H stretching of alkane), 2137 (C≡C stretching of alkyne), 1641(C=C stretching of alkene), 1456(Vinyl C-H in-plane bend), 1359 (S=O stretching of sulfonate) and 1242 (C-N stretching of amine). The chemical bonds (C=C) that is responsible for the absorbance of light in RB dye interacts with RONS produced through plasma-liquid interaction are broken or shifted.

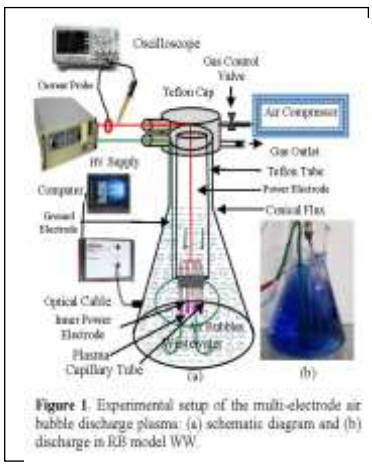

Figure 1. Experimental setup of the multi-electrode air bubble discharge plasma: (a) schematic diagram and (b) discharge in RB model WW.

Keywords: Air bubble discharge plasma jet, Dye decolorization, Remazol blue wastewater.

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10th March 2023 (Friday)

Session-IIIA: Materials Science-I

MS-1: Structural, Optical, Electrical and Magnetic Properties of Nickel Substituted Manganese-Based Batio3 Ceramics

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Nickel-substituted Manganese-based $Ba_{1-x}Ni_xTi_{0.97}Mn_{0.03}O_3$ (x= 0.0, 0.1, 0.2, 0.3, and 0.4) ceramics were synthesized via the solid-state reaction method. All the samples were mixed thoroughly and pre-sintered at 350ºC. After that, pellet and ring-shaped samples were sintered at 1250 ºC for three hours. X-ray diffraction (XRD) revealed a single phase of a tetragonal structure without extra peaks. The lattice parameter (a) exhibited a non-linear variation while the crystallite size (D) observed 21-29 nm with the Nickel content. Lower values of dielectric constant (ε) and loss factor were observed compared to the un-doped sample. Fourier Transform Infrared spectroscopy (FTIR) confirmed the presence of Ti-O bonds in the perovskite structure. The optical band gap was between ~2.5-3.1 eV, and dynamic light scattering (DLS) revealed a narrow particle size distribution. An increase in resistivity was observed while zeta potential decreased with Nickel content. The saturation magnetization (M_s), coercive field (H_c), remnant magnetization (M_r), and Bohr magneton (μ_B) were measured by Physical Property Measurement System (PPMS). The change in A-B interaction explained the variation of Ms Due to Ni and Mn atoms, and the values of H_c indicate the soft ferromagnetic nature. Based on these observed results, Ni-substituted Mn-based $BaTiO_3$ ceramics can be used in multilayer ceramic capacitors.
Keywords: X-ray Diffraction, Dielectric constant, Zeta potential, Dynamic Light Scattering, Ceramics.

MS-2: Sintering Effect on Electromagnetic Properties of B_2O_3 Incorporated Ni-Cu-Zn Ferrites

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Ni-Cu-Zn ferrites are well-known technological magnetic materials used to manufacture multilayer chip inductors and applications in various electrical devices. The present work is focused on the influence of substitutions and sintering addition Bi_2O_3 on structural, transport, and electromagnetic properties of Ni- Cu-Zn ferrites. Ferrite samples of the composition $Ni_{0.28}Cu_{0.10}Zn_{0.62}Fe_2O_4$ + x wt.% the concentration of sintering additives was varies 0.2wt.% to 0.8wt.% with the incorporation of Bi_2O_3 were prepared by using the solid state reaction technique sintered at 1150˚C and 1200˚C with 6 hours holding time. The X-ray diffraction analysis revealed that all the samples are crystalline in single-phase cubic spinel structure. The lattice parameter of $Ni_{0.28}Cu_{0.10}Zn_{0.62}Fe_2O_4$ + x wt. % Bi_2O_3 slightly decreases with the increase of x content. The average grain growth by increasing Bi_2O_3 content inter diffusion as results after > 0.4wt.% Bi_2O_3 content abnormal grain growth. Curie temperature (Tc) decreases continuously with the increase of Bi_2O_3 additive in the same ferrite samples. In the magnetization process, all the samples are soft magnetic behavior. Initial permeability (μi) decreases with increasing doped Bi_2O_3 content in ferrite samples; hence, the highest quality factor value is found for x = 0.4 within the range 20 kHz to 2MHz. The μi shows a flat profile from 1 kHz to 4MHz indicating frequency stability for all the ferrite samples. The improved electromagnetic properties of the composition might be attributed to better densification and visible grain size. DC resistivity decreases with increasing temperature. The dielectric constant is found to decrease continuously with increasing frequency and remain almost constant

at a higher frequency range. The dielectric behavior of the experiment ferrite samples is explained based on the mechanism of the dielectric polarization and conduction process.
Keywords: Ni-Cu-Zn ferrites, Solid-state reaction technique, Permeability, Dielectric properties

MS-3: Structural and Temperature Dependent Magnetic Properties of Y-Doped Co-Zn Ferrites

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Rare earth Y-doped $Co_{0.25}Zn_{0.75}Y_xFe_{2-x}O_4$ (where x=0.0, 0.02, 0.04, 0.08) ferrites were prepared via the solid-state reaction technique. The X-ray diffraction pattern indicates the spinel cubic structure of the samples. The Nelson-Riley function confirmed that the structural lattice parameter was increased by adding Y-content. The bulk density of the samples was always smaller than the X-ray density, where porosity follows the opposite density trend. The FESEM micrographs provide that the average grain size was increased from 1.41 μm to 2.34 μm with the substitution of Y-content. The Ferromagnetic properties were investigated using the hysteresis loop, where saturation magnetization was decreased as Y-concentration was increased. The increment of Y concentration also changed other fundamental properties of the ferrites, such as coercivity (H_c), retentivity (M_r), etc. The magnetic hysteresis loop properties were also studied at three different temperatures (80 K, 200 K and 300 K). The saturation magnetization of the $Co_{0.25}Zn_{0.75}Y_xFe_{2-x}O_4$ ferrites were increased gradually with decreasing temperature. The real permeability of the samples was stable in a long frequency range (1 kHz to 100 MHz), and imaginary permeability was decreased at lower frequency region. The magnetic loss tangent was reduced at the initial applied field and became constant at higher frequencies. These Y-doped Co-Zn ferrites may be strong candidates for high frequency and magnetic storage devices.
Keywords: Ferrite; Nelson-Riley function; FESEM; Hysteresis loop; Permeability.

MS-4: Zn-Induced Magnetism in $La_{2-X}Sr_xCu_{1-Y}Zn_yO_4$: Relevance to the Suppression of Superconducting Critical Temperature

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Substitution of isovalent non-magnetic defects, such as Zn, in CuO_2 plane strongly influences the magnetic properties of hole doped copper-oxide superconductors. The physics behind the enhanced uniform magnetic susceptibility, χ, in Zn substituted cuprates can be understood in two different ways. Defect induced magnetic behavior can be due to the independent localized moments in the vicinity of Zn arising from the strong electronic/magnetic correlations in the host compounds. Another way of looking at the enhancement is due to transfer of quasiparticle spectral weight and creation of weakly localized low energy electronic states associated with each Zn atom in place of an in-plane Cu. If the second scenario is correct, one should expect a direct correspondence between Zn induced suppression of superconducting transition temperature, T_c, and the extent of the enhanced magnetic susceptibility at low temperature. In this case, the low-T enhancement of χ would be due to weakly localized quasiparticle states at low energy, and these electronic states will not contribute to Cooper pairing. This possibility is explored here by analyzing the $\chi(T)$ data for $La_{2-x}Sr_xCu_{1-y}Zn_yO_4$ with different hole contents, p (= x), and Zn concentrations (y). Results of the analysis support this scenario.
Keywords: High-T_c cuprates; effect of disorder; magnetic susceptibility

MS-5: Effect of Yttrium on Partial Replacement Fe in Mn-Zn Ferrites

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The soft Mn-Zn ferrites are a group of spinel ferrites with excellent optical, magnetic, and electrical properties. However, Researchers are still trying to tune their physical properties for application in diversified fields.

Therefore, in the current project, we focused on the rare earth Y doped spinel Mn-Zn ferrites by standard solid-state reaction method of the composition Mn0.5Zn0.5YxFe2-xO4 where x = 0.00, 0.02, 0.04, 0.06, 0.08 and 0.10 sintered at 1200 °C with two hours holding time. The X-ray diffraction analysis revealed that rare earth Y substituted Fe in Mn-Zn samples showed additional peaks in a secondary phase YFeO3. The lattice constant primarily increased from 8.45Å to 8.46 Å up to x = 0.04 and then partially decreased to 8.43 Å following Vegard's law. The X-ray density of this composition is slightly greater than that of their bulk densities due to the existence of some pores in the bulk sample. With increasing grain sizes, the porosity of the compositions gradually decreased. The initial permeability decreases with increasing Y ions in ferrite except for x = 0.06. The saturation magnetization (M_s), coercivity (H_c), and the remanent induction (M_r) were determined from the M –H curve at room temperature. The decrease of MS with increasing Y substitutions is explained in Neel's collinear two sub-lattices magnetization model and Yafet-Kittels non-collinear magnetization model. The electrical DC resistivity decreases with increasing temperature for all studied samples means the semiconducting nature of Y-substituted Mn-Zn ferrites. The dielectric constant was found to decrease continuously with increasing frequency and remain almost constant at a higher frequency range. Dielectric polarization and conduction processes arise due to these local displacements of electrons that the dielectric constants.

Keywords: Mn-Y-Zn ferrites, Lattice constant, Permeability, Dielectric constant.

MS-6: Structural and Magnetic Properties of Holmium Doped Bi-Ferrites

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Holmium doped Bi-ferrites (BFO) with composition $Bi_{1-x}Ho_xFeO_3$ ($0.0 \leq x \leq 0.1$) were synthesized by solid state reaction route to observe the influence of Ho on BFO's structural and magnetic properties [1]. The X-ray diffraction patterns confirmed the rhombohedral distorted perovskite crystal structure for all the prepared samples with space group R3c. The crystallite sizes of the BFO were found to decrease with the increase of Ho concentration up to x = 0.06 (25 nm), beyond which the crystallite size was increased. The dense microstructure and average grain diameter were observed from the FESEM images. EDS spectra confirmed the elemental composition of BFO compared to the doping concentrations of Holmium. The M-H hysteresis loop for Bismuth Ferrite is clearly visib, le and the magnetization (M_T) at 300 K was increased with Holmium doping compared to pristine Bismuth Ferrite [2]. The magnetization at 2 T increases from 0.030 emu/g for x = 0.0 to 0.98 emu/g for x = 0.10. This increase could be ascribed to the small amount of Ho doping, Ho-Ho and Ho-Fe magnetic interactions were generated in addition to the Fe-Fe interactio, ns which has contributed significantly to the increasing saturation magnetization.

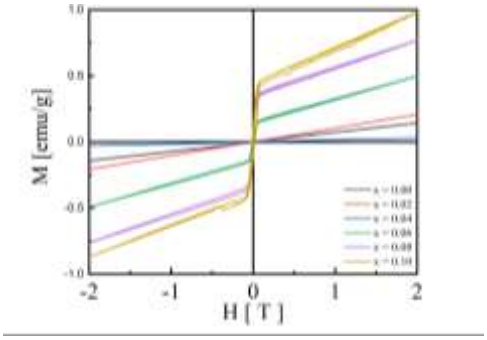

Fig. 1: Magnetic hysteresis curve (M-H) for $Bi_{1-x}Ho_xFeO_3$ at 300 K.

Keywords: Bismuth ferrites, Solid state reaction, Rhombohedral, Perovskite, Crystallite size, Microstructure, Magnetization.

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MS-7: Study of the Influence of (Sr, Ni) Substitution on the Cubic Batio$_3$ (BTO)

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Perovskite materials have garnered significant attention in recent years for their potential applications in modern cutting-edge technology, particularly in the fields of energy, electronics, photo-catalysis, medical imaging devices, etc. $BaTiO_3$ (BTO) is one of the most studied perovskite materials for its various exciting properties. A crucial strategy to modify the properties of these materials and enhance their performance is doping, or the introduction of impurities into their crystal structure. Herein, pure and (Sr, Ni) co-doped $BaTiO_3$ nanocrystals, i.e., $Sr_{0.5}Ba_{0.5}Ni_xTi_{1-x}O_3$ (x = 0.1, 0.2) were synthesized using the solid-state reaction method, and their structural, electrical, and optical properties were investigated. To synthesize the crystals, the calcination temperature was chosen to be 1000 °C. X-ray diffraction (XRD) studies support their cubic perovskite structure with space group Pm-3m. The lattice constants and crystallite sizes drop at first and then increase. Scanning electron microscopy (SEM) and energy dispersive X-ray (EDX) analysis confirm the large grain size of the crystals as well as the presence of Ba, Ti, O, Sr, and Ni compositions. Moreover, the experimental weight percent of the atoms approaches the theoretical weight percent. The Fourier-transform infrared spectroscopy (FTIR) analysis confirms that the Ti-O bond is strengthened with the doping concentration. The electrical measurements revealed a higher activation energy in the high temperature regime compared to the low temperature regime. The UV-Vis spectroscopy results revealed that the samples were strong absorbers in the ultraviolet region, making them promising materials for applications in the energy and optoelectronics industries.
Keywords: $BaTiO_3$; Solid-state reaction; Structural properties; Electrical properties; Optical properties

MS-8: Study of Thortveitite Structure of Zinc Pyrovanadate $Zn_2V_2O_7$ under Pressure

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We perform a pressure-driven study of zinc pyrovanadate $Zn_2V_2O_7$ using first-principles approach under the framework of density functional theory (DFT). $Zn_2V_2O_7$ crystalizes in a monoclinic (α-phase) structure with the space group C2/c at ambient pressure. In comparison with the ambient phase, there are five different high-pressure phases like β, γ, κ, δ and post γ, found at 0.7, 3.8, 4.8, 5.3 and 10.8 GPa, respectively. The detailed crystallographic analysis as well as their structures are consistent with the theory reported in the literature. All phases including the ambient phase are mechanically stable, elastically anisotropic and also malleable. The energy dispersion of these studied phases reveals that they are indirect band gap semiconductor with wide band gap energy. The band gap energies follow a reduced trend with pressure except κ-phase. The effective masses for all of these studied phases have been computed from their corresponding band structures. The values of energy gaps obtained from the band structures are almost similar to the optical band gap from the optical absorption spectra, estimated by Wood-Tauc theory.

Session-IIIB: Nano-Structure Physics

NSP-1: Ferromagnetic Behaviour of Nickel-Doped Zinc Oxide at Room Temperature

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Nickel (Ni) doped (3.5 wt%) Zinc oxide (ZnO) nanoparticles were synthesized by well adopted co-precipitation technique in view to reveal their influence on the ferromagnetic property of ZnO at room temperature. The structural and surface morphological features of the achieved nanoparticles were studied through X-ray diffraction (XRD) and Scanning electron microscopy (SEM) techniques, respectively. To understand the impact of Ni doping on the ZnO nanostructure,

photoluminescence and Fourier transform infrared (FTIR) spectroscopic analyses were also carried out. Secondary phases of NiO and NiO_2 were found in the grown matrix of nanoparticles. Slight agglomeration of particles is evidenced in the SEM micrograph. Photoluminescence study informed the existence of lattice defects, including interstitials and vacancies in the synthesized nanostructures. The bandgap measurements of the Ni-doped nanoparticles showed a slight redshift to 3.21 eV. Vibrating sample magnetometer studies informed that the synthesized 3.5 wt% Ni-doped ZnO nanoparticles consisted of appreciable ferromagnetic property at the room temperature. The experimental observations showed that the Ni-doped (3.5 wt%) ZnO nanoparticles have good potential for future spintronics device applications.
Keywords: Ferromagnetic, Ni-doped ZnO, Photoluminescence, Lattice defects, Spintronics.

NSP-2: T Graphene: A High Capacity Anode Material for Mg and Ca Ion Battery

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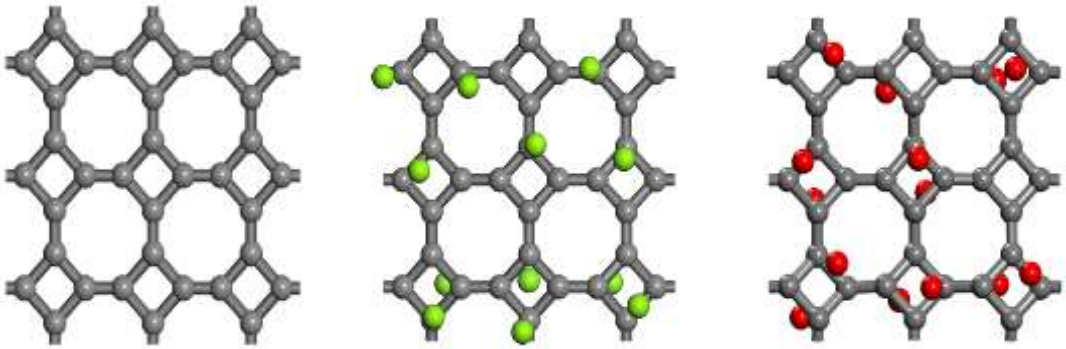
Due to the growing need for high-capacity ion storage batteries, researchers are looking into new categories of electrode materials with superior electrochemical properties. In this investigation, a tetragonal symmetry of carbon named as T Graphene (TG) has been taken into consideration as anode material for Mg and Ca-ion batteries **(**MIBs/CIBs**)** for their superior electrical characteristics. To comprehend the adsorption behaviour, charge transfer, anodic properties of TG, density functional theory (DFT) has been employed.Initially, the most favourable adsorption site for Mg/Ca insertion on the TG has been identified and found that C-C bridge site and octagonal hollow site show high adsorption behaviour for Mg and Ca atom with energy about -1.99 eV and -4.86 eV respectively. A significant amount ofHirshfeld charge about 0.24e and 0.79e transfer from Mg and Ca to TG respectively. When Mg/Ca is inserted, the DOS spectra show that the TG behaves metallically. A very high specific capacity is found about 1737.13 mAh/g and 1985.30 mAh/g for MIBs and CIBs respectively. Moreover, the average open-circuit voltages for Mg is 0.69 V and for Ca is 1.45 V. Therefore, TG may be used as high capacity anode material for MIB and CIB.



(a) TG (b) Mg adsorbed TG (c) Ca adsorbed TG

Fig 1. Before and after adsorption of Mg and Ca on TG
Keywords: T graphene, DFT, Mg ion battery, Ca ion battery, anode

NSP-3: Investigation of Structure with XRD Analysis, Impedance Spectroscopy, and Optical Property Analysis of Ni-Mg-Cu-Cd Dense Ceramic Obtain from Nanocrystalline Ferrites

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The physical and chemical characteristics of nano-crystalline ferrites are distinctive, such as a large surface area and enhanced reactivity, due to their small particle size. These properties make them suitable for various applications. These materials have the potential to greatly improve the performance of existing technologies and to enable new, innovative applications. Ferrites in bulk have been utilized extensively in a variety of applications due to their low cost, environmental friendly, and stability. This current investigation reports on the structural, electrical, and optical properties of Ni-Mg-Cu-Cd bulk ferrites. The sample's single-phase structural features with an increasing amount of Mg^{2+} are shown by XRD analysis. Crystalline size have measured using

Scherer's equation and Williamson Hall relation. Electrical and dielectric properties such as dielectric constant, dielectric loss tangent, and ac conductivity have studied using an impedance analyzer within the frequency range of 20 Hz to 120 MHz. By the substitution of Mg^{2+} content, changes in grain boundaries and grain resistance have been observed as well as in ac conductivity. According to optical measurements, the sample displays a band gap that is similar to that of semiconductors. The significance of the study lies in the improved properties observed in the ferrite in its bulk form, which have potential applications in various fields.

Keywords: Ni-Mg-Cu-Cd bulk ferrites, XRD analysis, Dielectric loss tangent, Ac conductivity, Band gap.

NSP-4: High-Temperature Stable Transition Aluminas Nanoparticles Recovered from Sol–Gel Processed Chitosan-Alox Organic–Inorganic Hybrid Films for Improvement of Flash Point of Petroleum Oil

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Alumina nanoparticles (NPs) have been the subject of researchers because of their temperature dependence unique properties (e.g., variety of metastable structure including am-γ-, δ-, θ-alumina and stable α-alumina). Chitosan, poly vinyl chloride and aramid polymers were subjected to synthesis alumina nanoparticles using sol gel process and aluminum ethoxide as precursor. Hybrid films were thermally degraded by heating at different temperature (500º-1100 ºC). The solid residues were assessed by TG, XRD and electron microscopy to consist dominantly of uniformly agglomerated spherical, cubic, tetragonal, monoclinic and rhombohedral mesoporous Al_2O_3 nanoparticles, irrespective of the alumina in the film. The recovered alumina particles morphology and surface microstructure were scanned by field emission scanning and high resolution transmission electron microscopy, respectively. Whereas the particle surface chemistry and texture were delved into, respectively, by means of X-ray photoelectron spectroscopy (XPS) and N_2 sorptiometry. The recovered alumina's were found, irrespective of the film content of alumina, to enjoy not only a high temperature (up to 1100 ºC) stable nanoscopic with γ-, δ-, θ-, α-alumina structure but also a high temperature stables chemical composition (lattice Al^{3+} and O^{2-} and absorbed OH). Amorphous; δ alumina; α- alumina faceted microstructure and highly accessible (127- 6 m^2/g) with average pore diameter in the range 4-6nm. Different polymorphs are important for improvement of flash point of petroleum oil with successful application.

NSP-5: Structural, Morphological and Magnetic Properties of Lanthanum Doped Cobalt Nanoferrite

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The samples of $CoLa_xFe2\text{-}xO4$ (x=0, 0.01, 0.025, 0.05) ferrites were synthesized by the sol-gel method. The structural, morphological and magnetic properties of the products were determined and characterized in detail by X-Ray Diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), Transmission Scanning Electron Microscopy (TEM), Energy Dispersive X-ray spectroscopy (EDX) and Vibrating Sample magnetometry (VSM). The XRD patterns confirmed that all the samples are in the cubic spinal structure which is further validated by Rietveld refinement in the space group Fd3m. The two absorption bands υ1 and υ2 are observed in Fourier transform infrared spectroscopy (FTIR) spectra corresponding to the tetrahedral and octahedral sites, which also show the signature of spinel structure of the samples. The TEM results are in agreement with the XRD results. The EDX analysis was in good agreement with the nominal composition. From the hysteresis loop, a significant decrease in coercivity and increase in saturation magnetization was observed with increase in Lanthanum content.

NSP-6: Bio-Degradable Microelectric Fiber from Moringa Oleifera Fruit Fiber Reinforced with Safely Functionalized Carbon Nanotubes

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A biodegradable microelectric fibers have been produced incorporating functionalized carbon nanotubes (f - CNTs) onto Moringa oleifera fruit fibers (MOF) by simple dipping-drying technique. A facile and non-destructive radio frequency oxygen plasma processing method has been employed to modify CNTs with hydrophilic oxygen-containing groups. The fibers were treated with alkaline solution coupled with plasma treatment to enhance the interaction between the fibers and matrices. Surface morphology, chemical, thermal, structural, mechanical and electrical properties of the uncoated and f - CNTs coated fibers were measured to evaluate their performance. FE-SEM micrographs showed that CNTs are uniformly integrated on the surface of the treated MOF. It is indicated that interaction between treated MOF and f - CNTs, thermal stability and flame retardancy were significantly improved with the incorporation of f - CNTs. Crystallinity and mechanical strength of the fibers also increased significantly because of the coating. The resistance of the f - CNT/T. MOF fiber sharply decreases from 1.5 MΩ to 0.01 k Ω with the addition of f - CNTs. Current density of the sample increases about 1000 times and conductivity increases up to 87 S m^{-1} under the applied voltage of 50 V, which also increases with temperature. Therefore, these fibers can be used in various electrical and electronic devices as well as conductive fillers in composite industries.
Keywords: Microelectric fiber, biodegradable, carbon nanotubes, flame retardancy, electrical conductivity

NSP-7: Nanocrystalline Nickel Copper Zinc Ferrites: Sol-Gel Synthesis, Rietveld Analysis, Cation Distribution, Maximum Entropy Method, Optical Band Gap and Impedance Spectroscopy Study

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In this investigation, ferrite nanoparticles with the chemical formula $Ni_{0.9-x}Cu_{0.1}Zn_xFe_2O_4$ (labeled as NCZF) ($0.53 \leq x \leq 0.73$, with step 0.05) are synthesized by the sol-gel auto-combustion method to investigate their structural, ferroelectric hysteresis, electric, dielectric, impedance, modulus spectroscopy, and optical properties etc. The X-ray diffraction (XRD) method is use to characterize the structure. The sample's structural investigation revealed that it crystallized as a cubic spinel form (Fd-3m space group). Surface morphology of the samples show spherical crystalline particles of narrow size distribution with a small variation in particle sizes (~91-128 nm). Using impedance spectroscopy, the electrical and dielectric characteristics of synthesized materials are investigated. It is found that the dielectric constant and tangent loss decrease with increasing Zn content. The $Z^{//}(f)$ curve confirms the appearance of a relaxation phenomenon in the sample which exhibits semiconductor behavior. An electrical circuit consisting of a link of grain and grain boundary elements is used to analyze the Nyquist plots. The band gap for all NCZF nanoferrites was calculated using Tauc's plots. Electrical and optical properties show higher electrical resistivity and considerable visible light absorption which is used light in the visible spectrum and optoelectronic devices.
Keywords: NiCuZn nanoferrites, FESEM, Optical band gap and Impedance spectroscopy.

NSP-8: Preparation of NiO–SnO_2 Nanoparticles using Azadirachta Indica Leaf and Myristica Fragrans Fruit Extract for Biological Applications

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This study reports a green approach to synthesize nickel oxide–tin oxide nanoparticles ($NiO–SnO_2$ NPs) by hydrothermal process. For green synthesis, Azadirachta indica leaf and Myristica fragrans Fruit Extract were used for the preparation of $NiO–SnO_2$ NPs. The preparation of the $NiO–SnO_2$ NPs was required three steps. In the first step, Ni-source precursor ($NiSO_4·6H_2O$) and Sn-source precursor ($SnCl_2·2H_2O$) with molar ratio 1:1 were dissolved in 30 mL of distilled water, and then 12 mL of the prepared Azadirachta indica leaf extract was added into the mixture. The reaction mixture was then stirred overnight and sodium hydroxide solution was added to adjust the pH (9–10) for the formation of Ni $(OH)_2$ and $Sn(OH)_2$ gels. In the second step, the final solution was poured into an autoclave, sealed and heated up to 80 °C for 24 hours. Then, the reaction container was cooled down by water immediately and the synthesized NP was washed several times with distilled water and dried at 115 °C for 5 hours. In the third step, to obtain the final product, the NPs was treated in a muffle furnace at 410 °C for 2 hours to remove the residual organic components [1]. The same procedure was performed by using Myristica fragrans Fruit Extract. Optical, compositional, surface, structural properties of $NiO–SnO_2$ NPs were further studied by ultraviolet (UV), Fourier transform infrared (FTIR), scanning electron microscopy (SEM), and X-diffraction (XRD). The formation of $NiO–SnO_2$ NPs were confirmed by the prominent peak observed at 300–350 nm in the UV spectrum [2]. The functional groups of NPs were further confirmed by FTIR. The morphological changes were observed for prepared NPs from Azadirachta indica leaf and Myristica fragrans Fruit Extract. Comparatively smaller particle size was observed by using Myristica fragrans Fruit Extract. XRD spectra revealed the formation of face-centered cubic NiO and tetragonal SnO_2 structure [3]. The prepared NPs material might be used for antibacterial applications.

Keywords: Green synthesis, Azadirachta indica leaf, Myristica fragrans fruit, $NiO–SnO_2$, nanoparticles, hydrothermal process, antibacterial activity

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Session-IVA: Theoretical and Computational Physics-II

TCP-9: Non-Monotonic Potential Description of A+^{12}C Elastic Scattering

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The present work reports the analyses of the experimental angular distributions of α+^{12}C elastic scattering in terms of the complex non-monotonic (NM) potential within the framework of the optical model (OM). The empirically adjusted imaginary potentials are used in conjunction with the real part of the NM potential to reproduce the experimental □+^{12}C elastic scattering data in the energy range $E_\alpha = 13.0 - 172.5$ MeV. The whole set of experimental data are analysed using two sets of real potential with unshifted Gaussian repulsive core (Set-1) and with shifted Gaussian repulsive core (Set-2). The volume integrals per nucleon pair for the real part have been found to be $J_R/(4A) = -15.78$ to -280.71 MeV.fm^3 for Set-1 potentials and $J_R/(4A) = -79.57$ to -113.89 MeV.fm^3 for Set-2 potentials. The $J_R/(4A)$-values for the real Set-1 potential have been found to be inconsistent. The use of Set-2 potentials successfully removed this inconsistency in volume integral. The consistent better fits using Set-2 potential with shifted Gaussian repulsive core implies that the scattering of α-particles from ^{12}C target is dominated by the potential in the central region of the target nucleus.

Keywords: Optical model, non-monotonic potential, ^{12}C nucleus, elastic scattering, volume integrals.

TCP-10: Density Functional Theory Based Insights into the Physical Properties of XC (X = Nb, Ta, Ti) Metallic Binary Carbides

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Binary metallic carbides belong to technologically prominent class of materials. We have explored the structural, mechanical, electronic, optical, and some thermophysical properties of XC (X = Nb, Ta, Ti) binary metallic carbides in details employing density functional theory based first-principles method. Some of the results are novel. Other results are in good agreement with available experimental and theoretical studies, where available. This ensures the reliability of the present first-principles calculations. Study of elastic constants and moduli shows that XC (X = Nb. Ta, Ti) compounds possess low level of elastic anisotropy, reasonably good machinability, mixed bonding characteristics with ionic and covalent contributions, brittle nature and high Vickers hardness with high Debye temperature. The mechanical stability conditions are fulfilled. The bulk modulus and Young's modulus of TiC are lower than those of NbC and TaC. XC (X = Nb, Ta, Ti) compounds are hard compounds suitable for heavy duty engineering applications. The electronic band structures with high electronic energy density of states at the Fermi level reveal metallic character of XC (X = Nb, Ta, Ti) compounds. Presence of both covalent and ionic bondings are evident from the charge density distribution maps of XC (X = Nb, Ta, Ti) compounds. The vibrational properties such as phonon dispersion curves and phonon density of states for XC (X = Nb, Ta, Ti) compounds are also calculated. Positive phonon frequencies at the Γ-point suggest that the solids under investigation are dynamically stable and capable of efficient thermal transport. The optical parameters are found to be almost isotropic. The optical absorption, reflectivity spectra, and the static index of refractive of XC (X = Nb, Ta, Ti) show that the compounds hold promise to be used in optoelectronic device sectors. Debye temperature, melting temperature, lattice thermal conductivity, and minimum phonon thermal conductivity of the compounds under study are high and show excellent correspondence with the elastic and bonding characteristics. Extremely high melting temperature of TaC indicates that TaC is a good candidate material for high-temperature applications.

TCP-11: A Comparative Study of the Structural, Elastic, Thermophysical, and Optoelectronic Properties of $CaZn_2X_2$ (X = N, P, As) Semiconductors via Ab-Initio Approach

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We present herein a detailed first principles density functional theory (DFT) calculations to study the structural, elastic, lattice dynamical, optoelectronic and thermophysical properties of Zn based ternary semiconductors $CaZn_2X_2$ (X = N, P, As). The unit cells of all the compounds are optimized using the Perdew Burke Ernzerhoff (PBE) generalized gradient approximation (GGA). The obtained lattice parameters are in excellent agreement with the experimental data and other theoretical findings. With the optimized unit cell geometries of $CaZn_2X_2$ (X = N, P, As), the elastic constants are calculated. From the computations we obtain six independent elastic constants, i.e., C_{11}, C_{12}, C_{13}, C_{14}, C_{33} and C_{44}. These elastic constants satisfied the mechanical stability criteria. The comprehensive studies of elastic constants and moduli show that $CaZn_2X_2$ compounds possess reasonably good machinability, relatively high Vickers hardness, relatively low Debye temperature and high minimum thermal conductivity. The phonon dispersion curves and phonon density of states are investigated for the first time for the materials $CaZn_2P_2$ and $CaZn_2As_2$. It is observed from the phonon dispersion curves that the bulk $CaZn_2X_2$ compounds are dynamically stable at zero pressure. Electronic properties have been studied through the band structures, density of states and charge distribution analyses. HSE06 (hybrid) functional is used to estimate the band gaps accurately. The electronic band structures show that $CaZn_2N_2$ and $CaZn_2As_2$ possess direct band gaps while the compound $CaZn_2P_2$ show indirect band gap. It is observed that the band gap decreases by changing the anion X from N to As. Energy dependent optoelectronic parameters exhibit good correspondence with the electronic energy density of states features. We have thoroughly discussed the reflectivity, absorption coefficient, refractive index, dielectric function, optical conductivity and loss function of these semiconductors. The optical absorption, reflectivity spectra and the refractive index of $CaZn_2X_2$ show that the compounds hold promise to be used in optoelectronic devices.
Keywords: Zn based ternary semiconductors; Density functional theory; Elastic properties; Thermophysical properties; Optoelectronic properties

TCP-12: Zn-Induced Magnetism in $La_{2-X}Sr_xCu_{1-Y}Zn_yO_4$: Relevance to the Suppression of Superconducting Critical Temperature

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Substitution of isovalent non-magnetic defects, such as Zn, in CuO_2 plane strongly influences the magnetic properties of hole doped copper-oxide superconductors. The physics behind the enhanced uniform magnetic susceptibility, χ, in Zn substituted cuprates can be understood in two different ways. Defect induced magnetic behavior can be due to independent localized moments appearing in the vicinity of Zn arising because of the strong electronic/magnetic correlations present in the host compound. Another way of looking at the enhancement is due to transfer of quasiparticle spectral weight, and creation of weakly localized low energy electronic states associated with each Zn atom in place of an in-plane Cu. If the second scenario is correct, one should expect a direct correspondence between Zn induced suppression of superconducting transition temperature, T_c, and the extent of the enhanced magnetic susceptibility at low temperature. In this case, the low-T enhancement of χ would be due to weakly localized quasiparticle states at low energy, and these electronic states will not be contributing to Cooper pairing. This possibility is explored here by analyzing the χ(T) data for $La_{2-x}Sr_xCu_{1-y}Zn_yO_4$ with different hole contents, p (= x), and Zn concentrations (y). Results of the analysis support this scenario.

Keywords: High-T_c cuprates; effect of disorder; magnetic susceptibility

TCP-13: Influence of Compressive Strain and Tensile Strain on Cubic $FAPbI_3$ Perovskites: A First-Principles Study

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Due to their unique structural, electronic, and optical properties, organic-inorganic perovskite materials have been widely employed in photovoltaic technologies. This work thoroughly investigated the effects of the biaxial compressive and tensile strains on the structural, electronic, and optical properties of formamidinium lead iodide perovskites ($FAPbI_3$) using the first-principles density-functional theory calculations. The electronic band structures have revealed that $FAPbI_3$ is a semiconductor material with a direct bandgap of 1.2163 eV at the R-point. The electronic bandgap decreased when compressive strain was applied and increased due to the subsequent enhance of tensile strains. When the spin-orbital coupling (SOC) effect was introduced, the electronic bandgap of $FAPbI_3$ significantly decreased. Optical studies measured the real and imaginary part of the dielectric constant, electron energy loss spectrum, and the absorption coefficient. It has been seen that the peaks of the dielectric constants of $FAPbI_3$ perovskites shifted to lower photon energy (redshift) with increasing compressive strain; conversely, they showed higher photon energy shifting nature (blueshift) owing to increased tensile strains. It was also observed that absorption becomes high in the visible region for higher strain; in contrast, it is low for lower strain. Moreover, electron energy loss was higher for low strain (visible region) and vice versa. The electronic and optical properties indicated that $FAPbI_3$ perovskites could be very suitable candidate in optoelectronic devices, such as light-emitting diodes (LEDs), liquid crystal displays (LCDs), backlights, solar cells, lasers, and photodetectors.

TCP-14: Electronic, Optical, Phonon, and Spin-Orbit Coupling Properties of Janus Wsse using a First-Principles Study

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Two-dimensional Janus WSSe has unique properties. Considering these, in this work, we investigate the effect of biaxial compressive and tensile strain ranging from - 6% to +6% on the structural, electronic, phonon, and optical properties of two-dimensional WSSe using first-principles density functional theory (DFT). The electronic band structure exhibited that WSSe is semiconducting in nature with a direct bandgap at the K-point. The electronic bandgap of semiconducting WSSe reveals a decreasing trend when the tensile strain is applied,

and it shows the opposite on increasing compressing strain. When considering the spin-orbital coupling (SOC) relativistic effect, the electronic bandgap of WSSe is significantly reduced. Equation of state and bulk modulus have been analyzed for compressive and tensile strains in that range. The strain-dependent phonon band confirmed the stability of the crystal structure. For optoelectronic applications, controllable optical properties are very crucial. Biaxial strain in WSSe can significantly increase their absorbance from UV, visible to the near-infrared area. We found that the peaks of dielectric constant of WSSe shift to lower photon energy (redshift) when increasing tensile strain; in contrast, they show higher photon energy shifting nature (blueshift) when the compressive strain was increased. Finally, our research suggests that the strain-tuned electronic and optical properties of the WSSe may open up an essential path for exploring next-generation optoelectronic applications.

TCP-15: Potential Applications of ScS_2 Monolayer as K-ion Storage Batteries: A First-principles Analysis

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The performance of monolayer ScS_2 as the cathode material for K-ion batteries was studied using a first-principles computation based on density functional theory (DFT) approach. Our study indicated that monolayer ScS_2 has an open circuit voltage of 2.13 V and a capacitance of 491.38 mAh/g, which are promising for energy storage device applications. Following ion adsorption, the cathode becomes conductive, necessary for high-rate performance, according to the band structure and density of states (DOS) study. Before ion adsorption, the monolayer ScS2 structure's bandgap energy was 0.073 eV; after ion adsorption, it changed to 0.143 eV, with a slight increase in bandgap and nearly no variation in conductivity. Ion storage batteries are electrochemical storage systems that depend on the intercalation and de-intercalation of ions between the electrodes. The high theoretical capacitance of this electrode makes it suitable for use in portable electronic devices and electric vehicles. Moreover, a relatively lower battery voltage makes it a safe and stable option for various other settings. Further research is being focused on improving the energy density and life cycles of ion storage batteries to make them more practical and efficient for a diverse range of applications.

TCP-16: The Stability of a De Sitter MTZ Thin Shell Wormhole Using Two Variable Equations of Different States

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Using the standard cut-and-paste approach of Visser, we constructed a spherically symmetric de Sitter conformally coupled MTZ thin-shell wormhole. The total quantity of exotic matter inside the shell is determined. We have inserted two identical copies of this MTZ black hole spacetime together in order to investigate the linearized stability analysis of the thin-shell wormhole solution. The wormhole throat radius and the actual quantity of exotic matter are related to each other as well as to the black hole mass. Different types of variable equations of state (EoS), including $p = \omega\sigma$ and$p = \frac{A}{a^n}\sigma$, are used to examine the stability of the wormhole. In all cases, stable regions have been found when$\omega > -1/3$, $\omega < -1/3$ and $\omega < -1$ represent the quintessence, dark energy, and phantom energy EoS, respectively. The EoS stability of chaplygin gas is being investigated.
Keywords: Wormhole, Stability, Exotic Matter, Phantomlike, Chaplygin gas.

Session-IVB: Condensed Matter Physics-II

CMP-9: Investigations on the Growth, Thermal, Structural and Optical Behaviour of Pure and L-Asparagine Monohydrate Added Magnesium Sulphate Heptahydrate Crystals

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Magnesium sulphate heptahydrate ($MgSO_4.7H_2O$) crystals were grown by slow evaporation process at room temperature in pure form and by doping L asparagine monohydrate ($C_4H_8N_2O_3.H_2O$). The thermodynamic and kinetic parameters, like change in enthalpy ΔH, change in Gibb's free energy ΔG, change in entropy ΔS, activation energy E_a, half-life $T_{1/2}$ and rate constant k were calculated by thermogravimetric and differential scanning calorimetry analysis. In order to conduct structural studies, powder X-ray diffraction was used to explore crystallographic characteristics such as strain, dislocation density and crystallite size. From FT-IR spectroscopy, functional groups, force constants and bond lengths were assessed. The elemental compositions of the crystals were examined by EDX spectrum. Using UV-vis spectroscopy, the optical behavior of the crystals, such as, electric susceptibility, optical and electrical conductivities, optical band gap and different optical constants like absorbance, reflectance and extinction coefficient, were calculated from the UV-vis transmittance spectra. The refractive index dispersion characteristics were also investigated, including static refractive index, oscillator energy, oscillator strength, dispersion energy and static dielectric constant.

CMP-10: Study of New MAX Phase Materials: Sc_2AX (A= Bi, Br), (X=C, N, B) Via Ab-Initio Method

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To investigate the structural and mechanical properties of Sc-based ternary, MAX phases Sc_2AX (A = Bi, Br; X = C, N, & B), the ab–initio method has been applied for the first time. The structural and dynamical stability of the proposed compounds has been confirmed by studying the formation energy and phonon dispersion curves. The calculated stiffness constants and elastic moduli are in good agreement with the reported values, indicating the accuracy of the calculations. Analysis of the energy dispersion in several directions has revealed the anisotropy in electronic conductivity. Mulliken population analysis is used to explain the combination of covalent and ionic bonding inside these ternary MAX phases and also, according to compute band structure and DOS confirmed the metallic nature of these selected compounds. Sc-d orbitals were found to be the conductivity's main source of contribution via DOS analysis. Among the six combinations, Sc_2BrN shows the best hardness and high melting temperature compared with others studied herein.

CMP-11: Mineralogical and Elemental Analysis of Colored Rocks Collected From the Northern Part of Sylhet District

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There are plenty of rocks near the Bangladesh-India (Meghalaya state) border of the northern part of Sylhet district. This work is dedicated to discover existing minerals in the rocks in that region and propose their

applications. Three colored (black, red, and white) rock samples have been collected from different locations. Then, these samples are converted into powder form using a stainless-steel hammer for their X-ray diffraction (XRD) and Energy Dispersive X-ray Spectroscopy (EDS) measurements. Intensity versus scattering angle patterns of XRD were analyzed by Rigaku Smartlab Studio-II software incorporated with Rietveld refinement. Various minerals were identified in the rocks. Identified minerals in black rocks are coesite HP (SiO_2), Ferro-holmquistite [$\{Li_2\}$ $\{Fe^{2+}{}_3Al_2\}$ (Si_8O_{22}) $(OH)_2$], Quartz low HP, Potassium Titanium oxide, Albite low HP (sodium tecto-alumotrisilicate), albite intermediate, etc. White rocks contain quartz low high HP, Glagolevite ($NaMg_6$ $(AlSi_3O_{10})$ $(OH,O)_8$), quartz low HP, etc. Minerals detected in the red rocks are silicon dioxide, quartz low high HP, Albite ($NaAlSi_3O_8$), Rutile HP (TiO_2), Microcline (K $(AlSi_3O_8)$), etc. Nearly appropriate peak matching was also achieved by the calibration and simulation of experimental XRD data with the standard data of expected minerals using X'Pert Highscore software. Most of the vivid and sharp peaks of diffraction patterns are highly matched with useful and/or toxic (like UO_2) compounds. Detected elements by EDS measurements are Na, O, Mg, Al, Si, Ca, K and Fe, but not all together exist in the same rock sample. The common ingredients of the different colored rocks were found to be silicon and oxygen, and they exist together as SiO_2 with varieties of phase. It was found that the elements detected by EDS measurements did not perfectly match those in the compounds predicted by the XRD. More careful analyses are in progress.
Keywords: Energy Dispersive X-ray Spectroscopy, Rietveld refinement, Coesite, Albite

CMP-12: Josephson Junction Model: Parallelism between Classical Optics and Quantum Phenomena in Superconductor

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Most superconducting devices are based on the characteristic properties of Josephson junction effect in superconductor. Josephson Effect is nothing but the quantum effect (due to the wave nature of Cooper pair waves) in electrical circuit. Adding two or more Josephson junctions, so-called multi junction, gives quantum phenomena analogous to classical optical phenomena. Analogous quantum interference and diffraction phenomena associated in multi junction are reviewed and analyzed. The associated quantum phenomena in multi Josephson junction provide technological advantages for constructing quantum interferometers (i.e., SQUIDs, SQIGs, and SQIFs etc.), qubit for quantum computation, quantum sensing and imaging, and so on. I have explained few of them with the help of multi-Josephson model in superconductor.

CMP-13: A DFT Investigation of the Predicted MAX Phase Y_2AX (A = S, Br; X = C, N) Compound

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Based on the ab initio density functional theory (DFT), we investigated the structural, electrical, and elastic properties of predicted ternary Y_2AX (A = S, Br; X = C, N) MAX phases. The predicted compounds are mechanically stable and brittle in nature, which is confirmed through the calculated elastic constants. The studied compounds are also dynamically stable, which is confirmed by the phonon dispersion curves. The band structure of all the listed samples have been studied. Among the four combinations, only Y_2SC has shown a band gap (0.158eV), which indicates the semiconductor in nature. Whereas other samples are the metallic in nature. This is a quantitative theoretical prediction, and it still awaits experimental confirmation.

CMP-14: Study on Threshold Displacement Energy Tin using Ab-Initio Molecular Dynamics (AIMD)

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Oxides, carbides and nitride ceramics are known to be radiation resistant, and, therefore, those compounds, such as zirconia, titanium nitride, titanium carbides, zirconium nitride, ceria, magnesium aluminate spinel, are expected to be advanced nuclear fuel, transmutation target to convert long life fission products and minor actinides. Base on the properties of these ceramic and oxide materials the innovative ideal of Inert Matrix Fuel (IMF) come into play in nuclear technology since mid of the twentieth century. To calculate the threshold displacement energy in TiN using AIMD simulations. AIMD simulations will performed using the SIESTA code in the framework of density functional theory (DFT). The norm-conserving Trullier-Martines pseudo potentials were factorized in the Kleinman-Bylander from, which was described as interactions between atoms and electrons. We have calculated the threshold displacement energies in TiN along main crystallographic directions [100], [110] and [111]. The value of threshold displacement energy (E_d) of Ti PKA along [100] and [111] is 40eV, and along [110] is 21eV. On the other hand E_d value for N PKA along those directions are 50eV, 18 eV and 54 eV respectively. Anti-site defects are found for N atom along [111] and [100] direction where Ti atom contains no anti-site defect. However, the threshold displacement energy strongly dependent on the crystallographic directions and crystal structure. It may be noted that threshold displacement energy is the vital parameter for radiation damage properties for nuclear fuel material.

CMP-14: A DFT Insight of Electronic, Optical and Thermoelectric Properties of Trigonal Nasbte$_2$chalcogenide

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Recently, ternary chalcogenides have gained remarkable interest in the scientific community because of their photovoltaic and thermoelectric applications. The present study complied with structural, electronic, optical and thermal properties of trigonal NaSbTe2 using first principles calculations. The electronic band structure confirmed that NaSbTe2 is a low band gap (0.705 eV) indirect semiconductor material. According to the density of states study, s-p hybridization between Sb and Te atoms mostly leads to the formation of the upper valance and lower conduction bands. The optical parameters such absorption coefficient, reflectivity, dielectric constant, refractive index, optical conductivity, loss function, transmittance and optical band gap has also been studied. These findings demonstrated that the current compound will be an emerging solar absorber for photovoltaic systems. Thermal properties including Seebeck coefficient, figure of merit, power factor, charge carrier density, electrical conductivity, and thermal conductivity has been extensively investigated and the obtained results indicated that NaSbTe2 will be suitable for thermoelectric device applications.
Keywords: Ternary chalcogenides, DFT, Electronic properties, Optical properties, Thermal Properties.

CMP-16: Electronic and Optical Properties of the Mono-Doped and Co-Doped Zirconium Disulfide Monolayer: A DFT Investigation

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Using the first-principles method, the electrical and optical characteristics of the Y-doped and Y, Chalcogen atoms (O, Se, or Te) co-doped zirconium disulfide monolayer are studied. An indirect band gap feature is observed in the band structures of the mono- and co-doped monolayers calculated using the generalized gradient approximation. Y-mono-doped and (Y+(O, Se, or Te)) co-doped ZrS2 monolayers are measured to have significantly different band gaps, measuring 1.18 eV, 1.23 eV, 1.16 eV, and 1.04 eV, respectively. According to the formation energy, the (Y+O)-doped ZrS_2 monolayer is more stable compared to the (Y+Se)-doped and (Y+Te)-doped ZrS_2 monolayers. The optical properties are very similar for both the single doped and double doped ZrS_2 monolayers. The absorption coefficient and optical conductivity are highest in the ultraviolet energy region. The designed materials are potentially suitable for UV photodetection and UV filtering applications.

Session-VA: Biomedical Physics

BMP-1: Evaluation of the Production Routes of the Ragnostics ^{157,165}Dy from the Stable Isotopes of Gadolinium and Dysprosium by Projecting Light Particles.

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Nuclear medicine uses ^{157}Dy and ^{165}Dy extensively for both diagnostic and therapeutic purposes. It is necessary to evaluate existing and promising alternative production routes for these two radioisotopes from different elements. In this study, TALYS 1.96 is used to theoretically estimate the production cross-sections and yields of ^{157,165}Dy from potential reactions with energies ranging from 0.001 to 200 MeV. The most suitable and cost-effective techniques for producing ^{157}Dy from gadolinium and dysprosium isotopes are alpha-induced ^{156}Gd and neutron-induced ^{161}Dy. Neutron-induced ^{164}Dy is the most potential route to produce ^{165}Dy from dysprosium isotopes. For the prospective reactions, these calculations are compared with EMPIRE 3.2.3 and TENDL-2019 data to understand the consistency of the computation.
Keywords: Dysposium, Terbium, Radiotheragnostics, Yield estimation, Nuclear medicine, Light beam reaction.

BMP-2: Anionic Magnetite Nanoparticles Induced Membrane Permeation in Lipid Vesicles under Various Membrane Potentials

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The emission of nanoparticles (NPs) into the environment from different sources is one of the main reasons for deaths and extent of illness in cardiorespiratory diseases. Magnetite NPs can be generated from various sources (e.g., iron industry, printer toners). Such magnetite NPs can be entered into the human body and interact with the biomembranes of cells. All types of cells maintain a range of membrane potential across the lipid bilayer. How the membrane potential influences the NPs induced vesicle deformation and lipid membrane poration of cell-mimetic giant unilamellar vesicles (GUVs) is not investigated yet, which is the key objective of this research. The GUVs are made with negatively charged lipid DOPG, neutral lipid DOPC, and the channel-forming protein Gramicidin A. Based on the concentration gradient of potassium ions between the interior and the exterior of GUVs, membrane potentials of 0, -30, -60, and -90 mV are generated across the lipid membranes. At 0 mV, both deformation and poration are observed, but at higher potentials, only membrane poration is observed. A slow leakage of encapsulating calcein is found in the presence of membrane potential, indicating the poration of vesicles. The probability of poration and the kinetics of poration increase as the negative membrane potential increases. At 0 mV, a single exponential decay of calcein is observed. However, for -30, -60 and -90 mV the leakage follows a two exponential decay model. The ratio of fast and slow leakage is 1, 2.89, 5.10, 11.74 for 0, -30, -60 and -90 mV membrane potential. On the other hand, the average time of poration decreases with negative potential. Thus, membrane potential affects the poration of cell-sized lipid vesicles. This study may help to reveal the mechanism of adsorption of NPs with biomembranes that can be applied in several areas of biophysical and biochemical processes.
Keywords: Magnetite nanoparticles, Membrane potential, Giant unilamellar vesicles, Deformation, Poration, Average time of poration.

BMP-3: Determining the Structural Properties of Small Sn Cluster (Sn_8) with Transition Metals (Ag, Au) Doping: A DFT Study

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The study of nanoclusters ranging from 10 ~ 10^6 is significant for understanding the advancement of the semiconductors industries and nanodevices [1]. In this regard, transition metal (TM) doping helps to improve the stability of nanoclusters by increasing surface area and favoring adsorption [1]. The structural properties of small Tin (Sn_8) clusters after doping with both homogenous and heterogenous transition metals (TM)- Silver (Ag) and Gold (Au) in two distinct locations have been studied using density functional theory and Becke's three-parameter exchange functional and Lee, Yang, and Parr's correlation functional (B3LYP) hybrid functional with the LanL2DZ basis set on Gaussian 09 Program for the associated validity [2]. Among all the doped nanoclusters, Sn_6-Au_S-Ag_M had the shortest average bond length of 3.16 Å and the lowest average binding energy of -2.765 eV compared to the pristine one which indicates higher stability as well as greater reactivity of the corresponding doped cluster [3]. Hence, Sn_6-Au_S-Ag_M may be a good candidate for further research and could potentially be used in sensor devices due to its favorable structural stability and suitable reactivity [1].

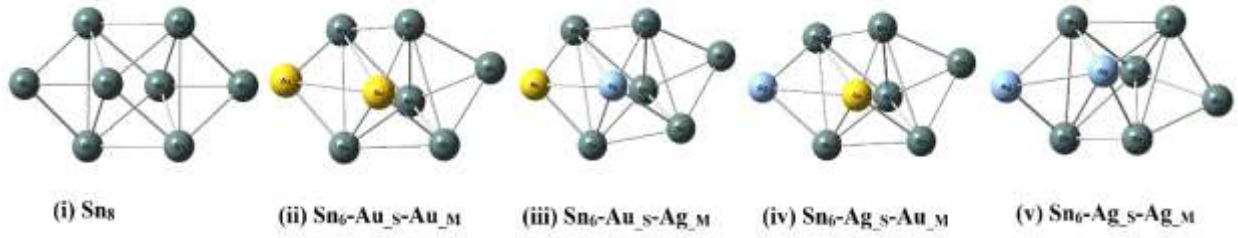

Fig.1: Geometric stable form of pristine and TM (Ag, Au) doped small Sn clusters.

Keywords: Nanoclusters, DFT, Transition metal.

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BMP-4: Design and Development of an Iot Based Robotic Arm System for Safe Handling of Radioactive

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The current research project focuses on developing a low-cost and reliable robotic arm that can handle radioactive samples at a 3MW TRIGA Mark-II facility. The facility is used for neutron activation analysis of different samples, and after irradiation, the sample becomes radioactive and is stored inside a shielded area. The transfer of the radioactive sample from the storage area to the laboratory poses a significant risk to occupational workers as they are exposed to ionizing radiation. The risk increases if the radiation dose rate limit is exceeded, which is set at 20 mSv/yr. To address this issue, the present study aims to develop a prototype robotic arm that can be used for the remote handling of radioactive samples. The arm is built on a robotic car and is operated using NodeMCU esp8266, which makes it easy to operate. The arm is equipped with five degrees of freedom, which allow for quick and effective movement in handling radioactive samples. The design of the robotic arm prioritizes affordability, ease of operation, and reliability, ensuring that it is safe and efficient to use. In addition to handling radioactive samples, the system can also be modified for storing high-level radioactive waste, reducing the risk of unwanted radiation exposure. The system requires basic coding skills, which makes it easy to build according to the user's needs. This IoT-enabled system promotes safety and efficiency in the handling of radioactive materials and reduces the risk of ionizing radiation exposure to occupational workers.

BMP-5: Argument and Contention over the Use of Low-Dose Irradiation to COVID-19 Pneumonia: A Comprehensive Review

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A single-stranded RNA virus of the Coronaviridae family known as Covid-19 is highly contagious and can cause pneumonia by spreading to the lungs. This paper reviews the results of current clinical trials related to the concept of Low Dose Radiation Therapy (LDRT) as a novel approach to treat patients with COVID-19 pneumonia. Low doses of ionizing radiation show an anti-inflammatory effect against inflammation and may improve outcomes, but there are also some harmful aspects of radiation in the human body.
In COVID-19 maximum death was caused by severe pneumonia. Acute respiratory distress syndrome is known as pneumonia, preceded by massive cytokines release. Low-dose ionizing radiation has the nature to create an anti-inflammatory response to inflammation. It has a history to use in the treatment of several cases of pneumonia from 1930 to 1948. Following past concepts of treating pneumonia with low doses of ionizing radiation, some human clinical trials have already used a single low dose of radiation to the whole lung. Some recent publications have also raised concerns about the use of low-dose radiation in treating elderly dying patients with COVID-19 pneumonia since there are also some harmful aspects of radiation in the human body. The focus of this paper is to review the past use of low-dose radiation in treating several types of pneumonia and the current arguments for the benefit of low-dose radiation in the treatment of COVID-19. It also discusses and compares eight recent human clinical trials on low-dose radiation for treating elderly dying COVID-19 pneumonia patients. According to an analysis of the number of successful treatment trials of COVID-19 patients using low-dose radiation, the treatment outcome shows 80% recovery of anti-inflammatory response from lung inflammation.
Low dose radiation therapy (LDRT) has been proven effective against pneumonia of diverse etiology, and may be a cost-effective treatment for elderly dying patients with Covid-19. In this study all the case, we find highly effective approach using LDRT.
Keywords: COVID-19, Low-Dose Radiotherapy, Pneumonia, Anti-inflammatory.
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BMP-6: Irreversible Electroporation of Tissue for Effective Intramolecular Devilery of Biomacromolecules

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Electroporation is a microbiology technique in which temporary pores are generated in cell membrane using an electrical field in order to increase the permeability of the cell membrane, allowing chemicals, drugs, electrode arrays or DNA to be introduced into the cell (also called electrotransfer). In irreversible electroporation soft tissue is removed by using strong electrical fields to create permanent and hence lethal nanopores in the cell membrane to disrupt cellular homeostasis. Irreversible electroporation destroys cancerous tumors with short electrical pulses without thermal heat. Its main advantage is that we can handle it safely to tumors that are near critical parts of one's body without doing damage to healthy organs or tissue. Here, we have demonstrated effective delivery of macromolecules by nanopore electroporation. Numerical modeling of local electric field

distribution and the biomacromolecules delivery within electroporated cell has become an important tool in both clinical and experimental settings. Most of our emphasis is on transient aqueous pore models and mainly molecular transport from outside to inside. In this simulation, we have designed a tissue which contain five cells having single nanopore of same size in each cell and gold (Au_{79}) using computer aided design software and performed simulation to the kinetics of molecular transport, from outside to inside of five giant unilamellar vesicles through nanopore. Here we have designed same pore size, different suspension area with time variation to transport from outside to inside. The diffusion constant observed from our simulation agrees with previous experimental results.

Keywords: Intracellular transport, electroporation, COMSOL, nanopore, biomacromolecules

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BMP-7: Monitoring Pulse Rate and Detecting Atrial Fibrillation with a Non-Invasive MEMS Pressure Sensor

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Continuous monitoring of cardiovascular health requires instruments that are both accessible and affordable [1]. To achieve these challenges, a flexible and wearable wristband was built based on an array of MEMS pressure sensor components, allowing for robust sensor-to-skin contact while ensuring long-term optimum comfort. The mean and standard deviation of man and women's data are regarded as: age (8 - 40 years), height (5 -180 cm), weight (20 - 90 kg) and BMI (6 - 30 kg/m^2). The device is capable of tracking the abnormalities in the heart rhythm and measuring the monitoring accuracy of the pulse rate. Silicon gel in the shape of a hemisphere was included in this 1.4 mm × 1.4 mm MEMS sensor device to filter the pressure wave from the dilating artery to the sensor module. Passive capacitive sensor inputs have very low energy demands; hence this model used a basic capacitive loss model indicating that the power consumption is just 5.5 W when a 3.5 V power source and 100 kHz output frequency are being used. This model also demonstrates that monitoring can be done for longer periods of time with small battery capacities, as well as the system can be adapted to operate wirelessly using limited Bluetooth. For healthy persons, the heart rate monitoring study demonstrated almost ideal beat-to-beat accuracy (sensitivity = 99 %, precision = 100%). In addition, the detection of beat-to-beat in coronary artery disease patients was successfully restored (95.5 % CI). Every reading was taken with the custom-made wristband, thus it was completely non-invasive. Finally, the results indicated that the device could be effective in the monitoring system of cardiovascular conditions as well as individualized medication.

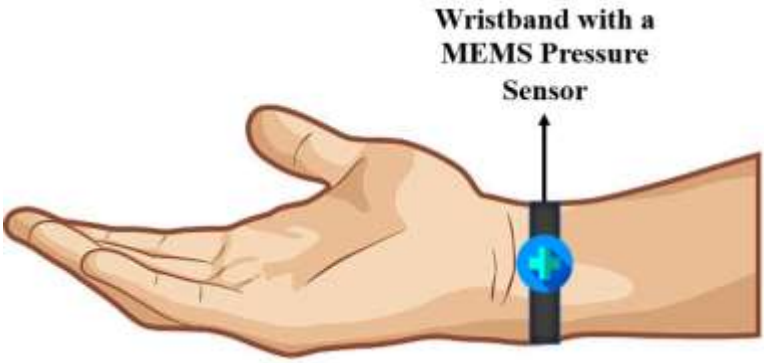

Fig.1: A Non-invasive and Wearable MEMS Pressure Sensor Device.

Keywords: Cardiovascular health, MEMS pressure sensor, wearable wristband, non-invasive.

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BMP-8: Preoperative Grading of Intracranial Glioma using Magnetic Resonance Imaging: A Cross Sectional Study

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Magnetic Resonance Imaging (MRI) is a medical imaging technique that produces three dimensional anatomic images by detecting the change in the direction of rotational axis of H^+ proton, available in living body using strong magnetic fields. According to WHO glioma is the most common CNS tumor that needs sufficient differentiation between high grade gliomaand low-grade glioma for appropriate surgical and treatment planning. Among different imaging modalities, MRI can characterize the tumor aggressiveness non-invasively, provide physiological information complementary to anatomy (1,2). This cross-sectional analytical study was conducted in the department of Radiology & Imaging of Sir Salimullah Medical College & Mitford Hospital, National Institute of neuroscience, Agargaon & BSMMU, Shahbag from Oct, 2019 to Sep, 2021. Total 52 patients of MRI diagnosed cases of intracranial glioma were included in this study. T1W, T2W, FLAIR, DWI and T1 post contrast sequences were acquired by 1.5T MRI scanner.MRI findings were correlated with histopathology diagnosis. Sensitivity, specificity, PPV, NPV and diagnostic accuracy of MRI in diagnosis of high-grade glioma were 97.1%, 83.3%, 91.9%,66.7% and 92.3%.Sensitivity, specificity, PPV, NPV & diagnostic accuracy of MRI in diagnosis of low-grade glioma were 80.0%, 97.1%, 92.3%,91.9% and 92.0%.Due to high diagnostic accuracy MRI is useful in predictingglioma grade.
Key words: MRI, glioma, histopathology.
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Session-VA: Electronics and ICT

EICT-1: An Iot-Based Weather Monitoring Patch Antenna

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The necessity to lower the frequency and enhance the bandwidth without boosting antenna size has grown as technology advances day by day. The developing Internet of Things (IoT) has significantly increased the demand for tiny antennas. In order to identify turbulence, pressure fluctuations, and the outside weather and respond immediately, real-time weather monitoring systems are utilized in IoT in aircraft. In this paper, compact microstrip patch antenna with an inset-fed using partial ground plane is designed for Internet of Things (IoT) applications at 2.45 GHz in the Industrial, Scientific, and Medical (ISM) band (2.4 - 2.4835 GHz). The inclusion of the inset-fed and partial ground surface lowers the resonance frequency, reduces the antenna size and improves the bandwidth of the antenna. The computer simulation technology (CST) microwave studio by CST student edition is used for design and simulation. A low-cost FR4 substrate with a dielectric constant of 4.3 and a thickness of 1.6 mm is used to make the design. The dimension of the antenna is $50 \times 40 \times 1.6$ mm^3. The simulation results show that the proposed antenna has a 0.1465 GHz i.e. 146.5 MHz bandwidth with a return loss of -27.17 dB, and attains a gain of 2.97 dBi and directivity of 4.7 dBi with an efficiency of -1.726 dB. The suggested antenna is light and tiny due to its low dielectric constant substrate, which makes it perfect for Internet of Things applications and also it can be utilized with many different wireless communication standards, such as Bluetooth (2.4 to 2.485 GHz), WiMAX (2.3 to 2.4 GHz), Microwave ovens (2.4 to 2.48

GHz), RFID (2.4 to 2.5 GHz), S-Band (2.3 to 2.4 GHz), Wireless Communication Services (WCS) 2.345 GHz to 2.360 GHz, and 4G LTE (2.3 to 2.315 GHz).
Keywords: IoT, Inset-fed, Patch antenna, CST, FR4

EICT-2: Development of Smart Healthcare System

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Technology in the medical sector significantly impacts the quality, efficiency, and delivery of healthcare services. In this situation, we built a smart medical ecosystem that is very important to the healthcare industry. The smart medical ecosystem is a comprehensive solution for the healthcare industry, connecting various stakeholders including labs, doctors, receptionists, and administration. The system aims to provide a seamless and efficient approach to managing all aspects of healthcare delivery. Electronic health records (EHRs) are a key component of the medical ecosystem. These records allow healthcare providers to securely access and manage patient information, including medical history, test results, and prescribed medications. This helps to improve the quality of care and reduce the risk of medical errors. Another important aspect of the system is the connection between labs and doctors. The quick and easy transfer of test results enables healthcare providers to make informed decisions about patient care and provide the best possible treatment. Doctors can issue online prescriptions. Additionally, patients can schedule appointments. Receptionists are linked to the administration, allowing for appointments, bookings, and patient information management. The administration, in turn, can manage the overall operation of the medical ecosystem, including billing and payment processes. To provide all these facilities, we made a web-based application that makes a common platform for all the hospitals and clinics to overcome these separated systems, and this single platform is better than others. Moreover, our smart healthcare system is able to monitor discharged patients regularly.
Keywords: Healthcare system, EHR, smart medical system.

EICT-3: Microcontroller-Based High-Speed and Secured Data Communication System for National Defense using LASER

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Modern civilization is based on electronic communication which needs a high-speed, secure and frequent data delivery system. Satellites, Radio waves, landlines, optical fiber systems etc [1] [2] [3]. have already been used for some past decades. But data transmission systems like the land line and optical fiber communication can be destroyed in a war situation. Again, wireless radio telecommunication is not fast enough and also can be hacked by tracking the radio frequency [4] [5] [6] [7]. In that situation, satellite communication also can be targeted. So developing a high-speed data communication system with high security is mandatory for defending our nation from any unexpected threat. This research offers a microcontroller-based data transmission and communication system using Arduino, laser and light-dependent resistance. The laser beam will be sent from a particular tower of a war zone and will be received from another one [8] [9] [10]. The pulse of the light will be controlled by a microcontroller which will carry a hidden byte. The receiver circuit will consist of a light-dependent resistance that will sense the pulse of the laser. Different numbers of pulses will carry a different alphabetic character and numerical value, only the receiver circuit will be able to decode the signal. As the intensity of the laser is very high so it can travel a long distance without any attenuation.
Keywords: Satellite, Radio waves, optical fiber, microcontroller, Arduino, laser
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EICT-4: Multimode Photonic Crystal Fiber Having Low Confinement Loss

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Photonic crystal fiber (PCF) plays a significant role in optical fiber communication. However, during propagation of light dispersion occurs. Multimode optical fiber shows higher dispersion. Therefore, dispersion should be reduced for effective transmission. In this paper, a multi-mode hexagonal photonic crystal fiber is proposed. The cladding of the proposed PCF have circular air-holes arranged in four hexagonal rings and four elliptical air holes in orthogonal whereas core is a single circular ring. This structure is designed and simulated using COMSOL Multiphysics. The material is pure silica. The performance parameters such as confinement loss, V-number, and effective area determined by wavelength interrogation method. The results show that V-number is greater than 2.50416 over wide range of spectrum which confirms the multimode operation of the fiber. The obtained value of performance parameters at 1.20μm wavelength are confinement loss of (2.11×10^{-9} dB km^{-1}), V-number (2.6059), and effective area ($2.23\times 10^{-10}\mu m^2$).

Keywords: photonic crystal fiber, effective area, confinement loss, multimode, COMSOL

EICT-5: Harmonic Behavior Analysis of a Step Index Mmi Device Realized with Polymer Material

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A multimode interferometer (MMI) is used to investigate the behavior of phase and amplitude of the light waves in the multiple modes following the multimode interference phenomena at the same time. In particular, in the MMI, light is distributed through multiple modes and exhibits multimode interference patterns with each other. These phenomena demonstrate complex interference patterns that can be used to extract information about the phase and amplitude of each mode, and they can be implemented in different ways depending on the specific applications. Meanwhile, it is established that an optical rotator is a device that can rotate the polarization of light by introducing a specific phase shift between the two orthogonal components of the polarized light, which results in a rotation of the polarization direction. Additionally, in the MMI, the interference pattern is created when the multiple modes of light are recombined and can exhibit a rotating behavior, depending on the specific configuration of the MMI and the properties of the light being used.
In this study, we have investigated the harmonic behavior of a step index MMI rotator realized with polymer material. We design an MMI rotator with a step-index profile realized with polymer materials using the RSoft CAD BeamPROP solver. We have used NP-005 (1.575) and NP-211 (1.567), respectively for core and cladding materials. Here, we have demonstrated a high level of mode selectivity, with the majority of the light being confined to the fundamental mode. Moreover, we have found the phase relationship between the different modes in such a way that the light can constructively interfere at the output port, which can contribute to the high level of transmission. In addition, we have also performed a detailed harmonic analysis of the device, which reveals that the MMI exhibits strong harmonic responses, which suggests that this device has potential applications in nonlinear optical systems. We aim to investigate the following properties of this device including a series of

optical measurements, including transmission, crosstalk, polarization rotation, and mode analysis. Our study demonstrates that an MMI realized with polymer material can exhibit a high level of transmission, low crosstalk, and strong harmonic response. The results suggest that this type of device could be used in a wide range of optical applications such as optical communications, sensing, and laser systems.
Keywords: Multimode interferometer, MMI rotator, phase relationship, step-index core, polymer optical waveguides

EICT-6: Gastrointestinal Diseases Detection by Analysing Wireless Capsule Endoscopy Images through Deep Learning

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Many individuals are experiencing anomalies in their gastrointestinal (GI) tract, which can sometimes be fatal. Worldwide, approximately 2 million people die from gastrointestinal diseases annually. Detecting these diseases at an early stage can decrease the mortality rate. In the field of medical imaging, wireless capsule endoscopy (WCE) is a recent technology that can be used to diagnose gastrointestinal diseases. WCE is capable of identifying anomalies in the GI tract early, before they develop into acute diseases, without the need for surgical procedures. Patients swallow a large pill-sized capsule that contains a camera, and a recorder is attached to their waist to capture the images produced by the capsule. Over an 8-hour period, the capsule observes the GI tract and generates more than 50,000 images. But to check up all these images, doctors need considerable time and this creates a challenge for manual diagnosis and has encouraged investigations into computer-aided techniques to diagnosis all the captured images in few minutes and with high accuracy. A deep learning method using pre-trained convolutional neural networks with a large dataset named kvasir containing about 80000 images of gastrointestinal tract captured by wireless capsule endoscopy has been used in this research. VGG-16, a 16-layer deep neural network has been used to detect the images and about 93% accuracy has been acquired which provides satisfactory result than other reported one. Hence, our pre-trained model has given adequate result in case of detecting gastrointestinal diseases at early stage.
Keywords: capsule endoscopy, gastrointestinal, medical imaging, computer-aided, deep learning, VGG-16

EICT-7: Contact Resistance Minimization for the Fabrication of High Efficiency Silicon Solar Cell

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During the fabrication process, various parameters influence the efficiency of a silicon solar cell [1]. The contact resistance plays an important role in limiting the efficiency of solar cells [2]. In this research, we have experimentally studied and analyzed the quenching effect (time and temperature) on the contact resistance of silicon solar cells. The quenching experiment was done with a modern Rapid Thermal Processing (RTP) system with varying temperature from 500 ^{0}C to 1000 ^{0}C. Following the experiment, contact resistance was measured using the Transmission Line Method (TLM). Measured resistances are plotted as a function of distance and linear regression analysis used to determine the ohmic contact resistance. The effect of quenching temperature on contact resistance was confirmed experimentally. Contact resistance between the metal-semiconductor regions of a silicon solar cell is significantly affected by the quenching temperature. Contact resistance was found to decrease with the increases of quenching temperature up to 850 ^{0}C, and then an increasing trend was observed. The relation of contact resistance on quenching temperature is shown in Fig.1.

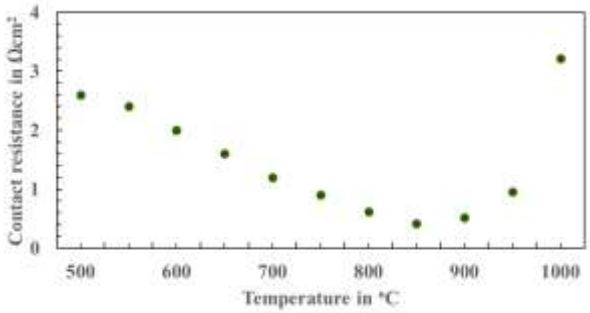

Fig.1. Impact of quenching temperature on contact resistance

At low quenching temperature, silver paste does not form a strong bonding with the semiconductor of a silicon solar cell. As a result, more contact resistance was discovered. As the quenching temperature increase, the bonding became stronger and the contact resistance gradually decreases and reaches its lowest values. Some micro cracks are formed on the busbars line at the higher temperature and the contact resistance again increases rapidly at the higher quenching temperature. An optimized quenching temperature (850 ^{0}C) was achieved to produce a minimal contact resistance (0.414 Ωcm^2) which will facilitate to fabrication of high-efficiency silicon solar cells.

Keywords: Quenching temperature, emitter region, metallic layer, ohmic contact

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EICT-8: Fueling the Future: Optimizing the Nuclear Fuel Cycle with Machine Learning

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We have implemented a machine learning algorithm to optimize the nuclear fuel cycle, which involves various stages, from mining uranium to disposing of spent fuel. The algorithm was trained on a large dataset of historical and real-time data from the different stages of the fuel cycle. It was designed to identify patterns, make predictions, and optimize the efficiency and sustainability of nuclear power. The algorithm was trained on a wide range of data sources, including environmental data, operational data, and economic data. The data was processed to identify trends and patterns, and the algorithm learned to make predictions about future outcomes based on the available data. The main goal of this research was to reduce the environmental impact of nuclear power by minimizing waste and resource consumption. By optimizing the fuel cycle, we were able to reduce the amount of waste generated and improve the overall efficiency of nuclear power generation. This has helped to enhance safety, reduce costs, and improve public perception of nuclear energy. The machine learning algorithm we developed has the potential to revolutionize the nuclear fuel cycle by enabling more sustainable and efficient production of nuclear power. By analyzing large datasets and making accurate predictions, the algorithm can help ensure the safe and responsible use of nuclear energy for generations to come.

11th March 2023 (Saturday)

Session-VIA: Materials Science -II

MS-9: Synthesis and Characterization of Nd Doped $CoFe_2O_4$ Nanocrystals for Biomedical Applications

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The Neodymium doped spinel cobalt ferrite nano crystals have been intensively studied because of their complex structural features and wide technological importance as magnetic memory devices, catalyst, drug delivery agents and hyperthermia devices. The crystalline Nd-doped cobalt ferrite nanoparticles might be widely used for manufacturing of clinical and memory devices due to extraordinary magnetic and physical properties. The electrical, magnetic and optical properties of the spinel ferrite depends on several factors such as synthesis technique, stoichiometry, composition, grain size, shape, sintering time, sintering temperature, etc. Spinel ferrite nano crystals have attracted much attention because of its remarkable chemical stability, high Curie temperature, large magneto crystalline anisotropy, mechanical hardness, saturation magnetization and coercivity. These properties make it suitable for variety of technological applications high density digital recording disks, magnetic resonance imaging (MRI), hyperthermia, magnetically guided drug delivery, biosensors etc. In this work, series of $C_{1-x}Nd_xFe_2O_4$ were prepared by solid state reaction technique. The nano crystals prepared by solid state reaction technique posses excellent chemical homoegenity and high quality. The presence of Nd ions cause's appreacible changes in the different properties of Nd doped $CoFe_2O_4$ nano crystals. The thermal, structural, morphological properties of the samples were charecterized by thermo gravimetric analysis (TGA) differential thermal analysis (DTA), Fourier transform infrared (FTIR) spectroscopy, X-ray diffraction (XRD), UV-Visible spectroscopy, and scanning electron microscopy (SEM). The XRD peaks confirmed the formation of face centered Cubic inverse spinel structure. FTIR analysis also confirmed the phase formation from various bonding in the crystals. The crystallites size varies from 68 nm to 74 nm depending on the doping level. The variation of micro strain, dislocation density, packing factor and Lorentz polarization factor with doping level were investigated. The synthesized nano crystals were suitable for use in the biomedical and clinical applications. The electrical properties measurement reveals that the samples were semiconductor. The optical properties measurement through UV-Visible absorption and transmission analysis reveals that the prepared nano crystals might be also useful as good absorber in the solar cell applications.

MS-10: Annealing Time Effect on the Complex Permeability and Magnetization Process of $Co_{72}Fe_8B_{10}Si_{10}$ Metallic Glass Ribbon

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The complex permeability of dynamic magnetic properties $Co_{72}Fe_8B_{10}Si_{10}$glass ribbon has investigated as a function of frequency in the range up to 120MHz using LCR Bridge with an applied minimum AC driving field.The aim of this study conducted as-cast specimen and also on specimens annealed at 200°C to 650°C as a constant two step annealing time. The Initial permeability, magnetic loss factor as well as relative quality factor were measured as a function of frequency and also the magnetic properties of thismagnetic glass were obtained by VSM.These studies high permeability is attributed to drastic decreases initial permeability is effective anisotropy due to minimum grain size effect and strong magnetic coupling for higher annealing time but short annealing time effect on permeability provide constant range up to frequency range information regarding thermal stability of this best choice in desired annealed temperature stable response of this metallic glass ribbon. Magnetic hysteresis parameter provides parameter inform about possibility metallic ribbon at elevate annealed sample for optimum operating point of view of this ribbon as soft magnetic material.
Keywords: MetallicGlass Ribbon; VSM; Permeability; Annealing.
Presenting mode: **poster**

MS-11: Realizing High Ferromagnetic Behavior of Lanthanum Doped Barium Titanate with Gadolinium Substitution

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Ferroelectric perovskite Barium Titanate ($BaTiO_3$) has attracted for the last few decades because of its promising applications in the electronics industries such as dielectric ceramics for multi-layer capacitors, piezoelectric material for microphones and other transducers and high-purity $BaTiO_3$ powder can be used as a key component of energy storage systems for electric vehicles. Various dopants in the A- and B-site of the $BaTiO_3$ have been used to enhance the transport properties for several applications. In comparison to undoped Barium Titanate, it has been observed that 0.3 mol% A-site lanthanum-doped Barium Titanate improved its ferroelectric and resistive characteristics [1, 2], whereas gadolinium-doped Barium Titanate had a larger dielectric constant [3, 4]. In this work, $Ba_{0.997}La_{0.003}Ti_{1-x}Gd_xO_3$ with x= 0, 1, 2, and 5 mol% ceramics were synthesized by using solid-state reaction technique, and the structural, morphological, electrical, and magnetic properties of the prepared samples were investigated. The XRD profile suggested a transition in phase from tetragonal to cubic after the addition of Gd. SEM analysis revealed that the increase in Gd contents lowers the grain size (D). The metal-oxygen bonds in the perovskite structure were confirmed from FTIR spectra. Gd occupied both A and B sites for Gd contents x= 1 and 2 mol%. Figure-1 shows the maximum saturated M-H loop for Gd contents x= 1 mol% which indicates the better ferromagnetic property of this sample. Maximum magnetization was found for Gd contents x= 1 mol% at room temperature. The maximum value of the dielectric constant was also observed for Gd contents x= 1 mol% maintaining high resistivity. Therefore, it can be said that perovskite material $Ba_{0.997}La_{0.003}Ti_{1-x}Gd_xO_3$ with Gd contents x = 1 mol% is a high resistive dielectric material maintaining better ferromagnetic behavior.

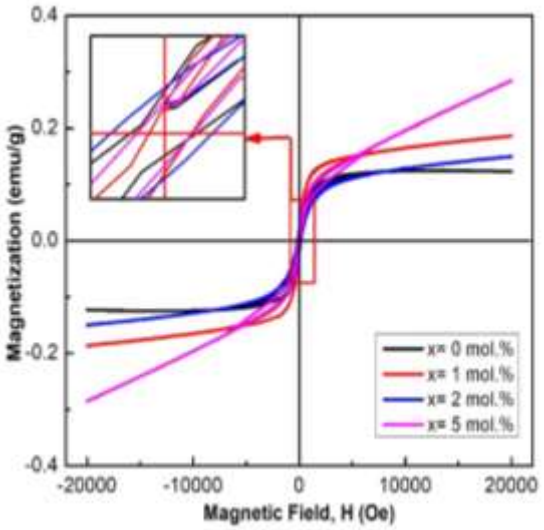

Figure-1: M-H hysteresis loop of $Ba_{0.997}La_{0.003}Ti_{1-x}Gd_xO_3$, with x= 0, 1, 2, and 5 mol%

Keywords: Barium titanate ($BaTiO_3$), Lanthanum (La), Gadolinium (Gd), phase transition, saturated M-H loop.

References:

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MS-12: Elastic, Optoelectronic and Photocatalytic Properties of Semiconducting Csnbo3: A First-Principles Insights

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The cubic phase of $CsNbO_3$ (CNO) perovskite has been hypothesized to investigate the elastic, electronic, photocatalytic, and optical properties for various technological applications using first-principles method. The pressure dependent structural stability has been confirmed from computed elastic constants. Relatively high value of elastic moduli, large hardness and toughness suggested that CNO would be applicable to design industrial machineries. The ductile to brittle transition is noticed at 20 GPa. The indirect and narrow bandgap of CNO proclaims its suitability for photovoltaic and IR photodetector applications. The partial density of states announces the dominant behavior of O-2p and Nb-4d to the upper valance band and lower conduction band, respectively. The pressure changes orbitals hybridization which can be substantiated by the change in the band gap. Strong covalency of the Nb-O bond and antibonding character of Cs-O have been anticipated by the Mulliken population analysis and by the contour maps of electron charge density. The low carrier effective mass and high mobility carriers predict the good electrical conductivity of the material. The calculated values of conduction and valance band edge potential illustrate the excellent water-splitting and environmental pollutants degradation properties of CNO.

MS-13: Synthesis and Characterizations of Co-Ni-Zn Ferrites

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Polycrystalline ferrite samples having a chemical formula $Co_{0.2}Ni_xZn_{0.8-x}Fe_2O_4$ (where x=0.0, 0.2, 0.4, 0.6 & 0.8) were prepared through the conventional ceramic method at 1350°C. The obtained ferrites were investigated for it's structural, morphological and magnetic properties by employing the techniques of powder X-ray diffraction (XRD), Fourier transform infrared (FTIR), scanning electron microscope (SEM) and vibrating sample magnetometer (VSM), respectively.The X-ray diffraction patterns of all the samples revealed the formation of cubic spinel structure.Lattice constants, oxygen position parameters, and overall temperature factors were determined from the Rietveld refinement of X-ray diffractiondata.The room temperature FTIR spectra showed two characteristic absorption bandsin the range of 600 to 360 cm^{-1}which are attributed to the vibrations of the metal ion-oxygen complexes in tetrahedral and octahedral sites in the spinel lattice. It was observed that the tetrahedral vibrational frequencies were shifted towards the higher frequencies with increase in Zn^{2+} ion concentration. The average grain size estimated from the SEM microstructures was found to 3-5 µm for the studied samples. Saturation Magnetization (M_s), Coercivity (H_c), and Remanence (M_r) were calculated from the M-H hysteresis loops recorded by VSM at room temperature. The value of the saturation magnetization was found to increase with decreasing Zn concentration.

MS-14: Synthesis and Characterizations of Titanium Doped Nickel-Zinc Ferrite Nanoparticles Prepared by Sol-Gel Method

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Titanium doped doped Ni-Zn ferrites $Ni_{0.5}Zn_{0.5}Ti_xFe_{2-x}O_4$(where x = 0.00, 0.02, 0.04, 0.06, 0.08 and 0.10) were synthesized via the sol-gel method and their structural, optical, electrical, dielectric, and magnetic properties were investigated. The prepared ferrite samples were found to have a single-phase spinel structure. X-ray lattice constantwerecompared with the theoretically estimated value. Bulk density, X-ray density, and porosity were also calculated. Functional groups of the prepared samples were determined by Ramanand Fourier transform infrared (FTIR) spectra. Thermogravimetric analysis (TGA) was used to determine the weight loss of samples at varying temperatures. Dynamic light scattering (DLS) and field emission scanning electron microscopy (FE-SEM) micrographs revealed a narrow particle size distribution. Elemental composition were confirmed by EDS coupled with FE-SEM. The frequency dependent dielectric constant (ε), dielectric loss tangent (tan δ), complex permeability constant (μ′) and relative quality factor (RQF) were also studied. The optical properties of the ferrites were investigated using UV−visible diffuse reflectance spectroscopy, which revealed a semiconducting nature of prepared ferrite samples due to a decrement in band gap energy values with an increase in Ti ion. A magnetic study was performed using a Physical property measurement system (PPMS), where the values of saturation magnetization (M_s), coercive field (H_c), remanent magnetization (M_r), and Bohr magneton (μ_B) were calculated. The variation of $M_s$was successfully explained by the A–B interaction due to Ti^{4+} doping, and the soft ferromagnetic nature was confirmed from the values of H_c. Based on the observed values of electrical resistivity and dielectric constant with proper magnetic properties, the study suggests the suitability of Ti^{4+}-doped Ni–Zn ferrites in microwave device applications.
Keywords: Spinel ferrites, Sol-Gel process, X-ray Diffraction, Zeta potential, Dielectric constant, microwave device.

MS-15: Nonradiative Recombination Centers in UV-B Algan MQW with Different Superlattice Periods under the N-Algan Layer Revealed by Photoluminescence Spectroscopy

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We have studied defect states acting as nonradiative recombination (NRR) centers in UV-B AlGaN MQW samples grown on c-plane sapphire substrate by MOCVD technique. The sample comprises a 4-μm-thick AlN buffer layer, AlN/$Al_{0.4}Ga_{0.6}N$ superlattice (SL) buffer layer with period lengths of 6.5 nm, a 1-μm-thick Si-doped AlGaN layer, followed by a 3-periods MQW consisting of 2.6-nm-thick wells and 9-nm-thick barrier layers, and a 10-nm-thick $Al_{0.4}Ga_{0.6}N$ cap layer. The compositions of well/barrier layer are $Al_{0.15}Ga_{0.85}N/Al_{0.4}Ga_{0.6}N$. Here, we have studied three samples with the same growth conditions except the number of SL periods (SLP). The number of SLP of samples A(SLP-50), B(SLP-100) and C(SLP-150) are 50, 100, and 150, respectively. Conventional photoluminescence (PL) measurements were done by an above-gap excitation (AGE) light ($h\nu_{AGE}>E_g$) of energy 4.66 eV and the samples exhibit three spectral peaks originating from SL, n-AlGaN and QW layers at 30 K (Figure 2). Some results of the same sample series focusing on the n-AlGaN has already been published [1]. By adding an intermittent below-gap excitation (BGE) light ($h\nu_{BGE} < E_g$) on the AGE light and observing the intensity change of QW peak PL spectra with and without the BGE light, $I_{AGE+BGE}$ and I_{AGE}, respectively, the normalized PL intensity (I_N) is calculated as $I_N = I_{AGE+BGE}/I_{AGE}$ in the two-wavelength excited photoluminescence (TWEPL). Its deviation from unity implies the presence of NRR centers in between the energy bandgap of the QW layer of the sample. The I_N values decreased with increasing the BGE photon number density at 30 K for BGE energies of 0.93 eV to 1.46 eV for all samples, which is explained by a two-level recombination model, showing the presence of a pair of NRR centers in the QW layer of the sample whose energy difference corresponds to that of the BGE energies. The most dominant quenching was observed by the 1.27 eV BGE energy at the same BGE photon number density (Figure 3). This result implies that the densities of NRR centers in the QW layer corresponding to the 1.27 eV BGE energy, at the same BGE photon number density, are higher for all samples. Comparing the decrement of I_N values for all samples (Figure 3), it is observed that the sample B(SLP-100) shows the lowest quenching of I_N values irrespective of all BGE energies, which implies that the sample with 100 SLP contains the lowest defect densities when compared to others. This result is consistent with our previous results for the n-AlGaN layer [1]. From these results along with [1], it is concluded that the formation of NRR centers in the QW layer has a significant correlation with the defect densities of n-AlGaN layer, lattice relaxation and number of SLP. The SLP affects the lattice relaxation of the n-AlGaN layer and this relaxation behaviour affects the formation of NRR centers. As the defect densities of the n-AlGaN layer is lower in sample B(SLP-100) compared to others, the defect densities of its QW layer is also lower and hence the emission efficiency of sample B(SLP-100) is higher. The present results interpreted by our proposed two-level model is significant and the TWEPL study of NRR centers directed us to optimize the growth condition further.

Reference

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MS-16: Effect of Organomodified Montmorillonite on Structural, Dielectric, Optical and Electrical Properties of $CuFe_2O_4$ Nanoparticles

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Tributylamineintercalated montmorillonite (TBA-MMT), an organomodified montmorillonite, supported $CuFe_2O_4$ (Cu ferrite) nanoparticles are synthesized by the addition of 2, 4, and 6 wt% of TBA-MMT in Cu ferrite by sol-gel auto combustion method. Structural and microstructural characterizations of the samples have been performed using X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR) techniques. Magnetic, dielectric and electrical properties of the samples have been measured. TBA-MMT supported and

naked Cu ferrite showed nine reflections from the planes of (111), (220), (311), (222), (400), (422), (511),(220) and (440) correspond to the cubic spinel phases. The lattice parameter obtained for naked Cu ferrite and 2 wt% supported TBA-MMT supported Cu ferrite is 8.3352 Åand 8.3216 Å respectively. The value of lattice parameter shows a decreasing trend with increase of TBA-MMT content from 2, 4, and 6 wt% in TBA-MMT supported Cu ferrite which indicates some sort of ionic migration between MMT layers of TBA-MMT and Cu ferrite nanoparticles. The value of crystallite size is found to be 18.84nm for naked Cu ferrite and it decreases with the increase of TBA-MMT content in Cu ferrite and found to be 18.03 nm for Cu ferrite supported with 6 wt% TBA-MMT. It appears that TBA-MMT content plays an important role in crystallization of Cu ferrite. The porosity increases with the increase in TBA-MMT content in Cu ferrite which indicates that TBA-MMT influences the agglomeration nature of Cu ferrite magnetic nanoparticles (MNPs). FTIR spectra of 2, 4, and 6 wt% TBA-MMT supported Cu ferrite clearly shows Cu ferrite is discovered to exhibit two bands in the range of 250-1250 cm^{-1}, one almost at 1600cm^{-1} and the other almost at 3700 cm^{-1}which are assigned to Fe-O and Cu-O stretching vibrations. In the present investigation A1g, F2g(1),Eg,F2g(2), and F2g(3) modes are found to be 79s, 1559M, 2335M, 1387W and 596L at 2 wt(%) TBA-MMT content in $CuFe_2O_4$. The same were observed at 80s,1554M, 2335M, 1378W and 597L at 4 wt(%) TBA-MMT content in $CuFe_2O_4$. Further, same modes were found at 80s, 1559M, 2335M, 1387W and 597L at 6 wt(%) TBA-MMT content in $CuFe_2O_4$ .Since this analysis has 5 Raman active modes so this type of ferrites is cubic copper ferrites.The value of band gap were estimated by the intercepts made on the X-axis or hν axis by extrapolated linear portion of the graph. The values of direct band gap energy as determined from the graph are 1.87, 1.84, 1.78, 1.75 eV for pure, 2 ,4 and 6 wt % TBA-MMT supported content respectively. A significant enhancement of dielectric constant (nearly 50% at 5 kHz) is observed for 2 wt% TBA-MMT supported Cu ferrite. The variation of dielectric constant with TBA-MMT content may be explained with Maxwell-Wagner series capacitor model. The ac conductivity increases with the increase of frequency both in naked and TBA-MMT supported compound and a remarkable increase in ac conductivity is found for the Cu ferrite supported with 2, 4 and 6 wt% TBA-MMT content. The present study indicates that dielectric and electrical properties of Cu ferrite nano material can be tailored with the addition of suitable amount of TBA-MMT as supporting material which finally will help to diversify the application of Cu ferrite.

Keywords: Organomodified montmorillonite, $CuFe_2O_4$, Sol-gel auto combustion, X-ray diffraction (XRD), Dielectric properties

MS-17: Synthesis and Characterize the Impact of Yttrium (Y) Doping on Multiferroic properties of Iron (Fe) Based $BaTiO_3$ for Device Application

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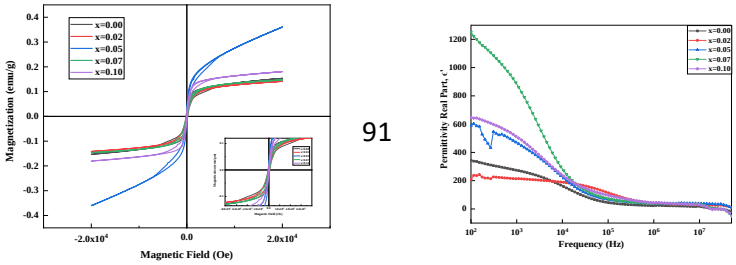
Yttrium (Y) doped iron (Fe) based polycrystalline perovskite ceramic of $Ba_{1-x}Y_xFe_{0.025}Ti_{0.975}O_3$ (where x = 0.00, 0.02, 0.05, 0.07, and 0.10) were synthesized by conventional solid state reaction technique. X-ray diffraction analysis (XRD) revealed the formation of cubic perovskite structures except for x=0.10, which identified the distorted phase shift from cubic to tetragonal structure also confirmed by Raman spectroscopy analysis. Bulk density was increased while the X-ray density was decreased with Y concentration and lowest porosity was observed at x = 0.05. Existence of O=C=O stretching and O-H bending functional groups were confirmed in all samples by Fourier Transform Infrared Spectroscopy (FTIR) analysis. At room temperature, Physical Properties Measurement System (PPMS) explored that saturation magnetization for x = 0.05 and 0.1 was higher than that of pure BFTO indicating stronger ferromagnetic behavior, more coercive and harder magnetic materials. For 7% Y, the highest dielectric constant was observed by demonstrating the highest conductivity and lowest resistivity. From UV-Vis spectroscopy analysis lowest band gap energy is found for 5% Y doping. By considering all the findings, 5% Y doping exhibits quite acceptable magnetic and optical properties that can be preferred to design electromechanical transducers and nonlinear optic devices while better electric and dielectric properties were observed for 7% Y doping which can be suitable for designing tunable capacitors, disc drivers, loudspeakers and microphone. **Fig.1:** (left) Magnetization vs. Magnetic field curve and (right) Variation of Permittivity as a function of frequency of $Ba_{1-x}Y_xFe_{0.025}Ti_{0.975}O_3$ ceramic samples.



Session-VIB: Environmental Science

ES-1: Emerging Water Contaminations in Our Daily Life and Their Impact on Human Health

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Surface and ground water have been using for different purposes (i.e. domestic, agriculture, recreation). However, due to anthropogenic activities and natural processes, the water sources are contaminated day by day. The use of synthetic chemicals has created numerous problems in the modern society. Even a Nobel Laureate Chemist, Robert Curl, called this 'chemical addiction' a technological disaster. Some 4,000 artificial chemicals are routinely used in our society in practically all sectors. Most of these chemicals originate from different types of industries and end up with the surface and ground water systems. Subsequently, agricultural land and food chains might have contaminated for using contaminated water along with other sources. On the other hand, it has been suspected that contaminated water might have impact on the increase of ecological risk and subsequently human health risk. Therefore, it is an important field of research areas to maintain and management of water quality.

Heavy metals/ metallic compounds are targeted in these days in order to remove and/or replace them from contaminated water using different types of natural additives. Because heavy metals are no-biodegradable and it remains in environment years after years. Some heavy metals are responsible for creating different types of problems in human body including cancer. For removing these toxic heavy metals from contaminated water, different types of water treatment processes have been used. Adsorption process is found to be one of the best techniques for removing heavy metals from contaminated water.

On the other hand, degradation of drinking water quality in water distribution systems is another big problem as well different types of metallic pipes were installed broadly in all over the world. Many of these metallic pipes are corroded and are continuous sources of different types of metal ions in drinking water distribution systems. Long time exposure of these toxic metals could be reason of cancer in human body. On the other hand, recent studies have reported that soluble or particulate metals decreases water quality in distribution systems. From our study, we have found that a lower content of metal suspension color, turbidity, and smaller particle size would appear to be obtained in presence of a phosphate based corrosion inhibitor at a pH value of 6.5 compared to a pH value of 8.5.

Disinfection by-products (DBPs), which is toxin and liable for creating cancer is another big problem in water distribution systems. To disinfect the microorganism in drinking water, several disinfecting agents are adding in water that reduces water born death. But unfortunately disinfecting agents react with natural organic matter in water and produces DBPs. Form our studies we found that different variables, i.e. iron nano particles, phosphate, pH and reaction time might have impact on DBPs formation in water. It should be mention that DBPs (THMs and HAAs) extraction from water and analysis are time consuming and complex procedure. Therefore, we have developed mathematical models considering the significant ($\alpha = 0.05$, $p < 0.05$) variables for the prediction of DBPs formation in drinking water distribution systems. This study suggested that the models' performance were found to be excellent under a wide range of studied variables for controlling DBPs formation in drinking water distribution systems.

On the other hand, dissolved organic matter (DOM) has been identified as one of the important precursors for DBPs formation. Therefore, DOM removal study has been conducted using different materials; and from this study, we found that iron nano particles i.e. goethite and magnetite were significantly removed DBPs precursor (DOM), which reduced the formation of toxin BDPs in drinking water. Molecular weight (MW) distributions of DBPs precursor (DOM) revealed that the higher molecular weight fractions adsorbed preferentially onto goethite followed by magnetite surface. The change of MW distribution of DOM was found to be in reasonable agreement with the change of DBPs formation in iron-water systems.

Contaminants of Emerging Concern in the Environment
https://toxics.usgs.gov/investigations/cec/index.php
Emerging Contaminant 1, 4-Dioxane in Drinking Water
http://www.wright-pierce.com/emerging-contaminant-1-4-dioxane/

ES-2: The Efficacy of Rare-Earth Doped V_2O_5 Photo Catalyst for Removal of Pollutants from Industrial Waste Water

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The rare-earth (RE) elements [Holmium (Ho) and Ytterbium (Yb)] doped vanadium pentoxide (V_2O_5) with a series of doping concentrations (1 mol.%, 3 mol.%, and 5 mol.%) have been successfully synthesized using environment-friendly facile hydrothermal method. The effect of RE ions on the photocatalytic efficiency of doped V_2O_5 has also been analyzed. The stable orthorhombic crystal structure of doped V_2O_5 confirms by the X-ray diffraction with no secondary phase, and high-stressed conditions are generated for the 3 mol. %. The crystallite size, strain, and dislocation density are calculated to perceive the doping effect on the bare V_2O_5. The optical characteristics have been measured using UV-vis spectroscopy. The absorptions are found to be increased with increasing doping concentrations; however, the bandgap remains in the visible range. The photocatalytic properties are examined for the compounds with varying pH, and it is observed that higher efficiency is exhibited for the pH 7 and catalyst concentration 500 ppm. The highest degradation efficiency is found to be 93% and 95% for the 3 mol.% of Ho and Yb-doped V_2O_5 samples within 2 hours, respectively. It is elucidated that the RE ions significantly impact the catalytic behavior of V_2O_5, and the mechanism behind these extraordinary efficiencies has been explained thoroughly.
Keywords: V_2O_5; Hydrothermal; Photocatalysis; Rare-earth ions; Photodegradation.
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ES-3: Hydrogeochemical Investigation of Groundwater in Cumilla District and Appraisal for Agriculture Purposes

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The economy of Cumilla is mainly based on agriculture. The climate of Cumilla region subtropical biased and consists of eight agro-ecological zones. Water is an important factor for good cultivation as well as human health. In this study ion chromatography was used to measure the construction of major cations and anions.

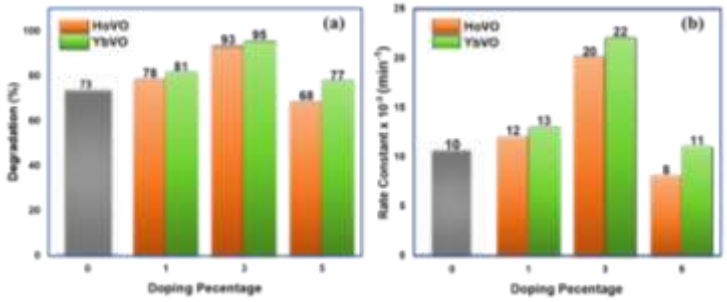

Fig. 1: (a) Degradation efficiency (b) degradation rate constant Comparison of pure, Ho and Yb doped V_2O_5.

The pH values of the assorted groundwater samples were varied from 6.8 to 7.4 with average value of 7.2 indicating that the waters are generally neutral to slightly alkaline in nature. The TDS values range from 39.5 to 614 mg/L with a mean value of 191.49 mg/L, which exhibit the similar picture of EC. This finding was in line within the permission values set by the water quality standards (domestic and agriculture) and fresh water class. Ion chromatography was used to measure the construction of major cations and anions. This study revealed that the concentrations of the water-soluble ions were found to be in the following order: Cl->Na+> Mg2+> Ca2+> K+>SO42-> NH4+> PO42-> NO3- >Br- >F-. This study showed that pH, EC, Salinity, TDS, Na+, K+, Ca2+ , Mg2+, Cl-, F-, NO2-, SO42-, PO42-and NO3- value in water samples are in tolerable limit according to Bangladesh (DoE) and international standards (WHO, FAO). From piper diagram it is found that the major water type is Ca2+-Mg2+-HCO3- in the study area. Gibbs plot suggesting that most of the samples fall within the rock-dominance zone. Silicate weathering-carbonate dissolution and silicate weathering-evaporation dissolution have been identified as the major processes that control the groundwater solute content respectively. Most commonly used as a basis to evaluate some water- quality related problems in irrigated that are salinity, water infiltration rate, toxicity and some other miscellaneous problems. From combined approaches of many irrigation water quality indicators, Percentage of sodium (Na %), sodium adsorption ratio (SAR), soluble sodium percentage (SSP), total hardness and Kelley's ratio (KR) were applied to assess the suitability of water for agricultural purpose. The important parameters such as Na%, SAR, RSBC, PI and KR values reveal as good quality of groundwater for irrigation purpose.

Keywords: Fresh water, ion chromatography, irrigation.

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ES-4: Metal Exposure and Risk Assessment of Point Source Wastewater on Fish and Human Health

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Metal contamination is ubiquitous in the riverine environments of Bangladesh and increasing progressively due to rapid urbanization and industrialization along the riverbank. As a consequent, aquatic ecosystems, including different fish species of the river, are contaminated by various trace and toxic metals, which ultimately affect human health. This study was performed to assess the quality of point-source industrial wastewater at varying percentage levels and their subsequent hazardous effect on fish (Anabas cobojius H.) and human health. Perceived value revealed that water quality parameters declined with the increase of wastewater concentration and trace metal evaluation index (TEI) ascertained a high level of water pollution on the basis of Cr, Mn, Fe, Co, Ni, Cu, Zn, As content for all percentages of wastewater. Concentration of wastewater and duration of culture treatment time largely impacted on fish mortality rate, body dis-pigmentation, mucus secretion rate, coagulation of mucus all over the body and accumulation of heavy metals by fish samples. However, estimated MPI indicated low contamination of fishes by the measured toxic elements. Zn and Hg contribute significantly to non-carcinogenic health implications for both the population group. Nevertheless, Hazard Index (HI) manifested very high to medium significant health effects regardless of ages. Carcinogen Pb showed insignificant risk but Cr and Ni showed extremely high to medium-high carcinogenic risk for both the population group and children were found more vulnerable receptors than adults. However, apportionment of the source of heavy metals in wastewater and fish samples stipulated anthropogenic.

Keywords: EDXRF spectrometry; pot culture; potential source apportionment; target hazard quotient; target cancer risk

ES-5: Appraisal of Heavy Metal Contamination in Roadside Perennial Plants, Soil and Dust of Dhaka South City Corporation, Bangladesh

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Pollution characteristics, bioaccumulation capabilities, possible source identification, ecological and human health risk of nine major elements were explored in the soil, roadside dust and plant leaves collected from ten different locations in Dhaka South City Corporation (DSCC), Bangladesh. Three different types of samples (i.e., soil, roadside dust, and plant leaves) were taken from ten distinct locations in the Dhaka South City Corporation (DSCC), Bangladesh. In this investigation, heavy metal (As, Cd, Cr, Pb, Fe, Ni, Zn, Cu, and Mn) was found in substantial amounts in roadside soil, plant leaves, and dust. Soil samples had the highest concentrations, followed by dust and plant leaves (soil > dust > leaf). According to the enrichment factor (EF), several of the metals were anthropogenic in origin. The contamination factor (CF) revealed that Fe and Cu contamination was extremely high in several areas. The bioaccumulation factor (BAF) revealed that the plant samples from a few areas showed moderate pollution levels for Cd, Cr, Pb, and Zn. Soil and dust samples were moderately contaminated by As, Zn, Pb, and Cu according to the geo-accumulation index. On the other hand, Cd was shown to be a substantial ecological problem in soil and dust samples. Health risk assessment demonstrated that all of the samples posed no harm to adults and children. A common pollution source can be the source of metals with strong positive correlations. Three primary components were extracted using principal component analysis (PCA) of parameters. Cluster analysis also revealed three distinct groups that showed a similar pattern with the PCA clustering on both a location and a metal basis. The study is designed to serve as a baseline for monitoring heavy metal pollution in the investigated area.

ES-6: Radiation-Induced Grafting of Acrylonitrile onto Non-Woven Polypropylene Fabric and Its Amidoximation for the Removal of Toxic Methyl Orange

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The present study gives emphasis on the removal of methyl orange (MO) from water using non-woven polypropylene fabric. The pre-irradiation method was applied for the grafting of 60% acrylonitrile (AN) and H_2SO_4 (2% of AN) as additive on the polypropylene (PP) fabric at 80 ^oC for 6 hours. At 30 kGy radiation dose, the graft yield was 150%. The treatment of grafted PP with hydroxyl amine hydrochloride ($NH_2OH.HCl$) produces AN-g-PP adsorbent. The amidoximated adsorbent, AN-g-PP and the pristine PP fabric were characterized by FTIR, SEM, DMA and TGA. The study also investigated the effect of different parameters on adsorption capacity such as contact time, MO concentration and pH. Langmuir and Freundlich adsorption isotherms were applied to explain the equilibrium adsorption data. The maximum adsorption capacity was 15.80 mg/g after 24 hours at pH 3.23 and concentration 50 ppm. To elucidate the kinetic data, different kinetic models were utilized and the data were better fitted to the pseudo first-order model with a good consensus between the experimental and the theoretical adsorption capacity. Moreover, desorption of adsorbed MO from the surface of the adsorbent gave satisfactory result. Thus, the amidoximated AN-g-PP fabric could be used as an adsorbent for the removal of MO from industrial wastewater.

ES-7: Comparative Study on Pollution Status of Seawater of Coastal and Continental Shelf Zones in the Northern Bay of Bengal

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Seawater of coastal areas including coastal and continental shelf zones of the northern Bay of Bengal (BoB) has become a major concern because of its value for socioeconomic development and human health. Due to contaminants from various sources with land-based pollutants, seawater of these areas is polluted every day.

Variation in physicochemical properties of seawater depending on all life processes make it desirable to consider as a vital component of marine environment and ecosystem. In fact, knowledge of seawater quality parameters through studies of physicochemical properties is crucial for a clearer understanding of the biological phenomenon. And chemistry of seawater reveals much about the metabolism of the ecosystem and explains general hydrobiological interrelationship. Here, a systematic study has been carried out to assess water quality parameters of seawater collected from 45 stations: 27 and 18 stations are from coastal zones (CZ) and continental shelf zones (CSZ) of the northern BoB during February 2019 and 2020, respectively using a water sampler and sampling locations were determined using a Global Positioning System. Different physicochemical properties: pH, temperature, conductivity, turbidity, salinity, total dissolved solids, density, viscosity, refractive index and dissolved oxygen were measured using different methods to monitor water quality parameters of seawater. Changes in various physicochemical properties of seawater of two different areas provide valuable and comparable information on the quality of these seawater, the source(s) of variations, and their impacts on the functions and biodiversity of seawater. Pollution category of collected surface seawater was confirmed by calculation of water quality index (WQI) on physicochemical properties, compared, and some important findings were noted. The obtained results highlight that there is a slight variation in most of the water quality parameters with variation in the geographical location of CSZ and CZ of the northern BoB and have good correlation with each other confirmed by correlation coefficients. Thus, the work is expected to accomplish the Sustainable Development Goal 14 based on preventing and reducing marine pollution and ocean acidification, protecting marine and coastal ecosystems, regulating fishing, and increase in scientific knowledge of the seas by 2025.
Keywords: Seawater quality parameters, water quality index, coastal and continental shelf zones, the northern Bay of Bengal, and correlation coefficient

ES-8: Depth-Wise Elemental Contamination Status in Sediments of the Kaptai Lake, Bangladesh

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In this study, two sediment cores from two different locations of the Kaptai Lake, Bangladesh were collected to assess depth-wise elemental concentration variations, levels of contamination and identify the pollutant sources. The total concentrations of 16 elements (Na, Al, K, Ca, Ti, V, Cr, Mn, Fe, Co, Zn, As, Sb, Hf, Th and U) were determined by neutron activation analysis (NAA) technique. The quality of the analyses was evaluated by analyzing certified reference materials IAEA-SL-1 (lake sediment) and IAEA-Soil-7. For quantification of the elements by NAA, samples along with the certified reference materials were irradiated in the rabbit irradiation facility of 3 MW TRIGA MARK-II research reactor at Atomic Energy Research Establishment (AERE), Savar and gamma-ray spectrometry of the irradiated samples was performed using high-resolution HPGe detector system. Different pollution indices (EF, I_{geo}, PLI, etc.) were used to assess the contamination status of the elements in the Kaptai lake sediments. In this study, depth-wise elemental concentration variation was studied for the two sediment cores. Pearson correlation analysis of the elemental concentrations in sediment cores was applied to find out the origin of the elemental sources. Therefore, the results of this study could be used to find out the contamination trend of the studied elements from the past to the present to take necessary actions to preserve the lake from future elemental pollution.
Keywords: Elemental contamination, Neutron activation analysis, Pollution indicators, Kaptai Lake

ES-9: Radiation Distribution at Workplace: A Case Study

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Natural background radiation from primordial radionuclides such as ^{226}Ra, ^{232}Th, and ^{40}K in sediment, soil, water, and rock accounts for around 80% of the total radiation dosage a person receives in a year. Occupational workers in different laboratories who deal with various natural and artificial radioactive sources receive

additional radiation dose at their workplaces. Institute of Nuclear Minerals (INM) of Atomic Energy Research Establishment (AERE) under Bangladesh Atomic Energy Commission (BAEC) deals with naturally occurring radioactive minerals (NORMS) and exploration of mineral resources using artificial radiation sources. The present study is aimed to investigate the additional doses any person of INM could receive during their stay at working hours. Environmental radioactivity as well as corresponding dose rate was measured using portable gamma-ray spectrometer along with a Geiger counter and environmental radiation detector at different rooms, laboratories and surroundings of INM as a part of routine radiation monitoring at the workplace. A total 34 measurements were collected from approximately middle of each 22 rooms and other 12 values from equal distance from the institute building. The measured radiation of ^{238}U, ^{232}Th, and ^{40}K were in the range of 4.25-13.79 ppm, 8.88-17.95 ppm and 0.93-2.23%, respectively. Correspondingly, the observed dose rates from individual dosimeter were found to be in the range of 0.09-0.18 µSv/h. The distribution of radioactivity showed that the laboratories and/or rooms which have various geological samples poses higher radionuclide presence and corresponding dose ranges. It can be mentioned that laboratories of INM regularly analyze different geological samples which may contain radioactive materials. Before processing those samples, they are usually kept in the sample store around radioactivity was found higher than average. In addition, higher dose rates can also be observed from the uncovered building materials, e.g., old mosaic materials at floors of the building. Combining these, increased dose rates are evident at the northern side of the building. Therefore, a systematic study of determination of the levels of radioactivity and their associated health risks for human beings can act as a vital part in radiation protection at workplace. Working in the higher radiation dose range areas may require safety measures for the employees of the institute. Considering 8 hours a day and 22 days a month, an employee engaged with radioactive mineral processing might be exposed to additional doses which can be significantly above the dose limit for an occupational worker in a year (20mSv). Although, the dose rates are within the allowable limit as regularly monitored by Thermoluminescence Dosimeter (TLD) for the employees of INM.
Keywords: Radiation distribution, background radiation, radionuclides, gamma spectrometer, geiger counter, personal dosimeter.

Session-VIIA: Nuclear Physics

NP-1: Externally Coupled Neutronics and Thermo-Hydraulics Analysis with MATCOM: Preliminary Results

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This work presents the preliminary results of a coupling scheme for neutronics and thermo-hydraulics in nuclear systems. The impact of thermal power production on fuel and coolant temperature distribution is significant, inter alia, for safety reasons, and the coupling of these two phenomena is crucial for accurate calculations in computational design modeling. The authors present the use of MATCOM, an open-source code for externally coupled iterative calculations, as an interface. MATCOM is designed with a modular approach, allowing for different relaxation and convergence regimes, and it demonstrates its effectiveness through a simulation of a standard VVER-1000 pin cell. The simulated case solves the coupled steady state Monte Carlo neutron transport and subchannel codes and showcases the capabilities of MATCOM.

NP-2: Calculation of Individual Fuel Element Burnup for Identification of Hottest Fuel Element of BAEC TRIGA Research Reactor Using TRIGLAV Code

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BAEC TRIGA Research Reactor (BTRR) is the only nuclear research reactor operated for the last 37 years. After achieving the initial criticality in 1986, BTRR has been operated around 815 MWd for various purposes like nuclear research, higher education, hands-on training, and radioactive isotope production. Till today, BTRR has been running without any sort of reshuffling or reloading. This study has been performed to calculate the

individual fuel element burn-up; hence, the hottest fuel element of each ring has been identified using the TRIGLAV computer code. Fuel housed in C-08, D-08, E-01, F-21, and G-20 has been detected as the hottest fuel element of the corresponding fuel ring. At the same time, fuel housed in C-02, D-04, E-20, F-24, and G-28 has been identified as the least burned fuel element respectively. A study has been conducted on different burn-up conditions starting from zero to 1400 MWd burnup. This study may help to develop a reshuffle strategy of the current BTRR core after 1300 MWd burn up when the core excess reactivity falls below 5 $. Nowadays, TRIGA fuel becomes very expensive as well as some regulatory constraints in the international market. This sort of reshuffling may increase the core lifetime.

Keywords: TRIGLAV, BTRR, Burnup, Nuclear Reactor, Excess reactivity

NP-3: Fuel Composition Optimization of Molten Salt Reactor (MSR) Using Openmc Monte Carlo Code

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One approach to the issue of energy shortages is the construction of nuclear power plants (NPPs). This facility uses fission reactions in the world's abundant supply of fissile material. With the fourth generation of nuclear power plants, technology has been developed that is superior to the previous generation in terms of security, energy production, burn-up, and economics. Molten salt reactor (MSR) is one of the six-generation IV nuclear reactors that are currently at a peak point of interest. The conventional design approach of MSR is on the consideration of Th-U fuel cycle & $LiF - BeF_2$ fuel salt which raises some regulatory issues including beryllium toxicity, tritium production, higher cost & proliferation concerns due to the higher enrichment of Uranium-235. The goal of the study is to justify the neutronics behavior of the MSR based on fuel salt compositions that are proposed by considering the lower enrichment of uranium-235 (LEU) and setting some benchmark data for the development of future studies. In this study, a parameter study has been carried out on MSR using eight types of fuel compositions using the OpenMC monte carlo code. The OpenMC code is developed by members of the computational physics reactor (CRPG) group at the Massachusetts Institute of Technology (MIT) since 2011. This program simulates neutron characteristics in reactors based on the Monte Carlo approach using a continuous cross-section energy library. This paper represents some neutronics behavior associated with these compositions like optimum criticality, temperature-reactivity feedback, conversion ratio, the figure of merit, atom density at critical enrichment for each of the fuel salt compositions, and burnup for the best-suited fuel salt composition which are produced by regenerating the ORNL MSR project model by using OpenMC code where JEFF3.3 & ENDF/B VIII data libraries. Thus, the purpose of this research is to obtain optimum results in neutronic analysis, which is even, to select a suitable low-enriched uranium composition for MSR.

Keywords: Molten salt reactor, OpenMC, Neutronics, Computational physics reactor, Fuel salt

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NP-4: Neutronics Modeling of SPERT III E-Core Critical Experiments with STREAM

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The Special Power Excursion Reactor (SPERT) III is a pressurized light water experimental research reactor that performed reactivity-initiated accident (RIA) to study nuclear reactors' kinetic and safety behavior. STREAM, a deterministic 3D transport code, is used to develop the neutronics modeling of the SPERT III E-core, including flux suppressors, cruciform transient rods, fuel assemblies, and control rods. A detailed steady-state neutronics model was developed for cold zero power (CZP) and hot zero power (HZP) conditions to calculate the eigenvalue and rod worth of the core. Moreover, RIA tests were performed for the core's CZP,

HZP, and normal operating conditions. The eigenvalue, control rod worth, and the magnitude of the transient power pulse were compared with the experimentally measured data. Numerical results achieved an excellent agreement with measured data, and it demonstrates the accuracy of the transport code STREAM.

Keywords: SPERT III, RIA, STREAM, Neutronics modeling.

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NP-5: Shielding Calculation and Verification for 15MV Medical Linear Accelerator Treatment Facilities

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Introduction: Linear accelerators are now the most common treatment units in radiotherapy departments in cancer centers. They produce high energy x-ray (4MV to 25 MV) beams and electron (4MeV to25MeV) beams.The purpose of radiation shielding is to reduce the effective equivalent dose from a linear accelerator to a point outside the room to a sufficiently low level. This level is determined by individual states but is generally 0.02 mSv per week for a public or uncontrolled area. Frequently, a higher level is chosen for areas restricted from public access (i.e., "controlled" areas) and occupied only by workers; this limit is 0.1 mSv per week.

Materials and Methods: This study will provides essential guidelines to proper facility planning, Room design feature and shielding design, Radiation protection and work practice.The shielding calculation were carried out assuming concrete as shielding design. We proposed a shielding calculation model that decouples the concepts of occupancy factor, workload, and use factor and target dose when determining primary and secondary barrier thickness. All the equation for shielding calculation is calculated according to NCRP-151 & Safety series 47.

Result & Discussion: The patient numbers and occupancy factors are consider as taken variable in this calculation IMRT & 3DCRT shielding calculation. Maximally 15MV linear accelerator is considered for the photon beam here. We get the values of the calculations: Calculation value for primary barrier and secondary barrier thickness is 3000mm and 2100mm which meets protocol.

Conclusion: This shielding calculation is found that the occupational workers and public dose limit is acceptable according to protocol. The bunker is to absorb the radiation produced by the LINAC, such that the people outside the bunker do not affect with the ionizing radiation.

Keyword(s): Linac, Bunker, Shielding, Controlled areas.

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NP-6: Uranium Removal from Aqueous Solution Using a Novel Starch-Acrylic Acid-Acrylamide Hydrogel Prepared by Radiation Technique

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Due to their harmful impacts on both aquatic and marine habitats as well as human health, the presence of heavy metal ions in the environment poses a potential concern. One of the heavy metals that is known to be exceedingly toxic and unnecessary for both humans and aquatic life is uranium [U (VI)] [1, 2]. Gamma rays from a Co-60 source were used to prepare a novel starch-acrylic acid-acrylamide hydrogel at room temperature. The prepared starch-acrylic acid-acrylamide mixture were exposed to 10 kGy gamma radiation at a dose rate of 7.22 kGy/h. By using IR and SEM, the adsorbent was identified. Uranium (VI) was absorbed from an aqueous solution using the produced absorbent. Adsorption experiments were conducted with altered contact time, pH, temperature, and uranium (VI) solution concentration to examine the impact of adsorption circumstances on absorption capacity. The maximum amount of absorption that could be accomplished was 166.84 mg/g (Figure 1(a)).

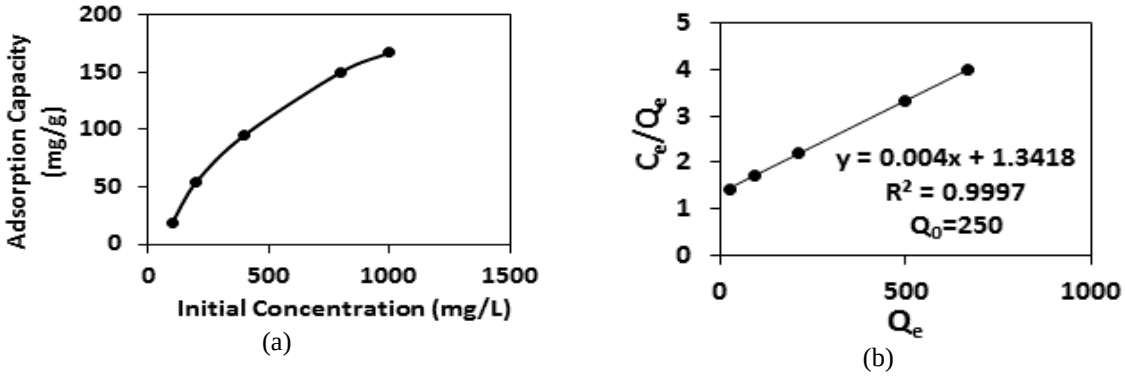

Figure 1: (a) Effect of concentration on the adsorption capacities of starch acrylic acid-acrylamide hydrogen (pH 3.57, contact time 5 h, room temperature) (b) Langmuir isotherm plot for U(VI) adsorption at room temperature

The interpretation of isotherm data using Langmuir isotherm revealed the monolayer adsorption of U(VI) ions onto the hydrogel (Figure 1(b)). The pseudo-second-order equation was found suitable to interpret U(VI) adsorption by the hydrogel. Findings of U(VI) ion desorption and reuse of the absorbent are encouraging. According to the study, uranium (VI) removal from contaminated water may be possible using the hydrogel absorbent made of starch, acrylic acid, and acrylamide.

Keywords: Gamma Radiation, U(VI) adsorbent, Adsorption capacity, Desorption.

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NP-7: Study of Radiation Shielding Behavior of Mono-Energetic Photon and N-Beam Using Some Locally Developed RBS, MI & IS Composites

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The present study focuses on the radiation shielding behavior of mono-energetic photon and thermal neutron beam (n-beam) using some locally developed composite materials, fabricated by indigenous ingredients like Cox's Bazar Raw Beach Sand (RBS), Magnetite-Ilmenite (MI), Inland Sand (IS) with Madhupur Clay (MC). The ionizing radiation attenuation features of the fabricated composites and ordinary concretes were measured using broad beam transmission geometry, Geiger–Müller counter, and quantified in terms of transmission factor (TF) in the energy range of 65keV to 164keV (X-ray) and 661.5keV to 1250keV (γ-ray). The thermal neutron shielding efficiencies were experimented and presented in terms of normalized gray value (NGV) using neutron irradiated images at TRIGA Mark-II research reactor in Bangladesh. The whole structural morphologies of the

prospective composites were also examined by neutron imaging method. It was observed that the incorporation of RBS and MI in clay material boosted up the shielding efficacies. The TFs of RBS-Clay, MI-Clay, IS-Clay and ordinary concrete were 0.04 to 0.729, 0.023 to 0.714, 0.306 to 0.799 and 0.191 to 0.739 respectively in the energy range of 65keV-1250keV. The Diminution of TFs reflects the improvement of attenuation characteristics. The RBS-Clay & MI-Clay were demonstrated outstanding shielding behaviors among the investigated composites. The NGVs of RBS-Clay, MI-Clay, IS-Clay and ordinary concrete were 0.553, 0.555, 0.902 and 0.494 respectively. The higher NGVs (RBS, MI & ordinary concrete) indicate a higher degree of brightness in the respective positions of the thermal neutron irradiated images that reflect a lower efficiency in thermal neutron shielding. The whole structural morphologies, studied using the images of the composites, divulge the fine and homogeneous structural distribution of the locally developed Madhupur-clay based composites in relation with ordinary concretes. Therefore, the locally developed shielding materials would be useful for X-ray, γ-ray and neutron radiation fields in the hospitals and nuclear facilities.

Keywords: Radiation, Shielding, Transmission, Gray-value, composite.

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NP-8: Potentiality of the Capacitor as Low-Cost Radiation Detector: A Brief Review

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Radiation detectors are based on changes in the structural and electrical properties resulting from the influences of radiation sources [1]. Again, ionization chambers are most effective and commonly used as radiation detectors i.e., for measuring the absorbed dose in radiation therapy, but they are expensive and cannot measure surface doses [2]. Recent studies have shown that some capacitors like vertical metal-oxide-semiconductor capacitors have 96% charge collection efficiency [3]. The goal of developing a capacitor-based detector is to develop a low-cost dosimeter that can be used for surface dose measurement. As capacitors have charge-storing property which gives an increase in voltage and radiation stimulates discharging of the capacitor by ejecting electrons from its plate when X-rays are irradiated from a medical linear accelerator (LINAC) and this principle is used to develop capacitor-based detector [4]. The whole procedure has been followed by calibrating the capacitor using an established ion chamber to convert the voltage into dose and an electrometer is essential to measure the charging and discharging voltages of the capacitor [2], [4]. In light of previous research, the discharging of the capacitor has an indication of the proportionality to the dose from LINAC, and the dose was consistent with the data from the ionization chamber which concludes that the capacitor can effectively observe the surface dose during therapy as well as it can be a potential medium of low-cost radiation detector [2].

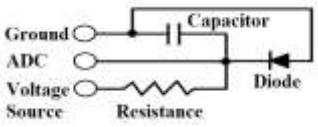

Fig-1. Circuit diagram for capacitor dosimeter

Keywords: Capacitor, Absorbed dose, Ionization chamber, Electrometer, Radiation detector.

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Session-VIIB: Atomspheric Physics

AP-1: Sensitivity of PBL Parameterization and Cumulus Physics Schemes in WRF-ARW Model on Intensity of Tropical Cyclones 'Amphan' and 'Bulbul' over the Bay of Bengal

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The sensitivity of PBL parameterization and cumulus physics (CP) schemes in the Weather Research and Forecasting (WRF) model has been studied for the Tropical Cyclone (TC) 'Amphan' and 'Bulbul' which crossed Sundarban Coast during 1000-1200 UTC of 20 May 2020 and 1500-1800 UTC of 9 November 2019 respectively. Nine PBL schemes and eight CP schemes in combination with WRF double moment 6 class (WDM6) Microphysics schemes have been investigated on the intensity of TCs and find out the best combination of CP and PBL physical schemes. For this study, National Centre for Environment Prediction (NCEP)'s Final Reanalysis (FNL) data ($1^0 \times 1^0$) have been used as lateral and initial conditions in the WRF-ARW model. The model has been configured in a single domain and runs for four different initial conditions (0000 UTC of 16, 17, 18, and 19 May 2020 to 0000 UTC of 21 May 2020) in simulating TC 'Amphan' and for three different initial conditions (0000 UTC of 6, 7 and 8 November 2019 to 0000 UTC of 10 November 2019) in simulating TC 'Bulbul'. The model simulated intensity of different PBL and CPs have been analyzed and compared with IMD estimated intensity. Root mean square error (RMSE) of pressure drop has been found below 12 hPa by the SHA scheme for TC Amphan and below 8 hPa for the MYNN3 scheme of TC Bulbul for all initial conditions. RMSE of MSWS has found below 8 ms^{-1} for the TKE scheme for TC Amphan and below 8 ms^{-1} for YSU and MYNN3 schemes for TC Bulbul for all initial conditions. For CPs, a Lower RMSE error of pressure drop below 15 hPa has been found for all initial conditions for KF for TC Amphan and below 8 hPa for KF and NSAS of TC Bulbul. Lower RMSE error of MSWS below 12 ms^{-1} has been found for KF and Tiedtke schemes for all initial conditions of TC Amphan and below 8 ms^{-1} has been found for the KF schemes for all initial conditions of TC Bulbul.
Keywords: MSWS; MSLP; WRF; PBL; Cumulus; Intensity.

AP-2: Study on Upper Air Wind for the Track and Movement of Pre-Monsoon Tropical Cyclone Using WRF Model and ERA Data

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Prediction of track and movement of tropical cyclones is very important to save lives and wealth from the devastation of it. So, high resolution Weather Research and Forecasting (WRF-ARW v4.22) model is used for the simulation of three pre-monsoon tropical cyclone (TC) Aila, Viyaru and Roanu which formed over the Bay of Bengal (BoB) during 23-25 May 2009, 10-16 May 2013 and 17-21 May 2016 respectively. National Centers for Environmental Prediction (NCEP) final reanalysis (FNL) data (1°×1°resolution) are used as initial and lateral boundary conditions (LBCs) which are updated at six hourly intervals. The model domain is set up with 9 km horizontal resolution with vertical level up to 100 hPa. The WRF model is run for 96 hrs using WSM6-class microphysics (MP) schemes, YSU PBL schemes and Kain-Fritsch (KF) cumulus schemes. ERA data of ECMWF was obtained for 60 vertical levels from 1000 to 1 hPa. The model simulated SLP and wind at different pressure levels are studied for track and movement of the TCs respectively. Again, wind at different pressure levels obtained from ERA data are also studied for movement of the TCs. Track and landfall (position and time) of TCs obtained from model and ERA data are compared with those observed data obtained from IMD. It is revealed from the model output and ERA data that the upper air wind controls the track and movement of the TCs.

Keywords: Track, movement, landfall, WRF model, ERA data

AP-3: Development of Human Comfort Index of a Heat Wave Event of 2016 over Bangladesh Using NWP Models

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High resolution Weather Research and Forecasting (WRF-ARW v4.12) model is used for the simulation of a heat wave event which occurred during 6-13 April 2016. So, an attempt has been made for simulating the extreme temperature conditions over Bangladesh using the WRF model and then an effort has been made to construct the Human Comfort Index (CI) by the Rayman model. National Centers for Environmental Prediction (NCAR) final reanalysis (FNL) data (1°×1°resolution) are used as initial and lateral boundary conditions (LBCs) which are updated at six hourly intervals. A single domain is used which is set up with 9 km horizontal resolution with a vertical level up to 100 hPa. The WRF model runs for 168, 144, 120, 96, 72, 48 and 24 hrs using Yonsei University Scheme (YUS) for Planetary Boundary Layer (PBL) parametrization, Kessler Scheme (KF) for microphysics, Kain-Fritsch (KF) scheme for cumulus parameterization, RRTM for long wave radiation, and Dudhia Scheme (DS) for short wave radiation. Physiological Equivalent Temperature (PET), human thermal comfort condition, which is investigated at the extreme weather condition. To simulate Physiological Equivalent Temperature (PET), the primary meteorological parameters T2 (2-m air temperature), RH2 (2-m relative humidity), WS10 (wind speed at 10 m), SLP (sea level pressure) and FNL data are used for 34 stations of Bangladesh. WRF model performance is very good to predict T2, RH2, SLP and WS10 values and Rayman model is good enough to compute Human CI.
Keywords: Heat waves, Human Comfort index, NWP models

AP-4: A Study on Extreme Temperature Conditions over Bangladesh During 1990 To 2019

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Extreme Temperature is a weather phenomenon that is distinguished by marked cooling or heating of the air, or with the invasion of very cold or hot air, over a large area. When the temperature plunges 10°C or less and continues for three or more days, it is considered a cold wave. In the winter season, the Sun shifts southwards and the Indian sub- continent gets incline solar insulation. Wind enters into the country through the Himalayan foot hills and drops the day-night temperature and makes the cold feel. On the other hand, when the temperature exceeds 36 degrees and lasts for a minimum of three or more days it can be considered a heat wave. In the pre-monsoon, south/ south westerly wind carries a high amount of moisture over Bangladesh. The heat capacity of moisture is higher than that of dry air. Solar insulation, Temperature advection and moisture incursion these three phenomena are responsible for Extreme temperature (HW) conditions. Veering and Backing is also responsible for especially severe and very severe CW and HW conditions. In the present study, all categories of Cold Wave (CW) and Heat Wave (HW) days (Duration) and frequencies (How many times did swipe over) have been studied for the winter (December to February) and Pre-monsoon (March to May) over most of the stations (34) of Bangladesh for the period 1990-2019. The highest numbers of cold wave and Heat wave days are found at Srimangal (803 days) and Jashore (927 days) for all types of events while Frequency are found at Srimangal (114) for CW and Rajshahi (127) for HW during winter and Pre-monsoon season respectively. January is the highest cold month and April is the highest warm month in Bangladesh. Cold days in Bangladesh have decreased in all divisions except Barishal. The highest 5 coldest places are Srimangal, Ishurdi, Rajshahi, Chuadanga and Dinajpur while the highest hottest places are Jashore, Chuadanga, Rajshahi, Ishurdi and Satkhira on the basis of duration. Kutubdia and Teknaf had no CW or HW; Cox's Bazar had no CW at all. Among 30 years, 1995 is the highest coldest year while 2009 is the lowest cold day recorded, again 2014 is the highest hottest year while 2018 is the lowest hot day recorded. Using Mann-Kendall test, the HW trend of Sylhet station has given only significant and decreasing value whereas Satkhira station has no trend value for CW. From

spatial distribution, coldest areas are shown at Srimangal and Northwestern part of Bangladesh while hottest areas are shown at western and middle-western part of Bangladesh.
Keywords: Extreme, Temperature, Cold Wave, Heat Wave, Condition.

AP-5: Variation of Different Meteorological Parameters of TC Aila -A Case Study

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Forecasting of upcoming tropical cyclones with their landfall and track are very important and it is also a challenge for the forecaster. So, an attempt is taking to understand the variation of different meteorological parameters of tropical cyclone (TC) Aila which formed over the Bay of Bengal (BoB) during 23-25 May 2009. ERA data of ECMWF was obtained for 60 vertical levels from 1000 to 1 hPa. Winds at different pressure levels obtained from ERA data are studied for movement of the TCs. Track of TC Aila is obtained using best track data. Variation of different meteorological parameters of tropical cyclone (TC) Aila such as Geopotential, temperature, Specific Humidity, Vertical velocity, Relative humidity and Ozone mass ratio are observed before the formation of cyclone to after the decay of cyclone for the different stations around and far away from the track of the cyclone. Value of the meteorological parameters shows a significant change. So, forecasting of cyclones as well as track of the cyclone may be identified from the value of meteorological parameters at different stations.
Keywords: Track, movement, meteorological parameters, ERA data

AP-6: Impact of Sea Surface Temperature on Simulating the Track and Intensity of Tropical Cyclone Kyant

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Sea Surface Temperature (SST) is the most important parameter for the genesis, intensification and track of Tropical Cyclones (TCs). In the present study, an attempt has been made to examine the impact of SST update on track and intensity of TC Kyant formed over the Bay of Bengal (BoB) using the Advanced Weather Research and Forecasting (WRF) model. TC Kyant that was unable to make landfall (ie, weakened over the ocean) is simulated with default SST and an updated SST from Real Time Global (RTG) SST with horizontal resolution of (0.083° × 0.083°). Two two-way interactive nested domains are considered for the simulation with the horizontal resolution of 27 km and 9 km respectively. The simulated track and intensity in terms of Minimum Sea Level Pressure (MSLP) and Maximum Wind Speed (MWS) are compared with Regional Specialized Meteorological Center (RSMC), New Delhi best track data. It is found that an updated SST has tremendous impact to improve the prediction of TC track and intensity.

AP-7: Thunderstorm Characterizes over Bangladesh on 06-07 May 2020 Using WRF-ARF Model-A Case Study

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In this study, an attempt has been made to simulate a thunderstorm event occurred over Bangladesh on 06-07 May 2020 by using the WRF-ARW model. The model is configured with 259 grid point in East-west and North-south direction and WSM 3-Class Simple Ice Scheme microphysics option, Yonsei University Scheme as PBL parameterization, Revised MM5 Scheme for the surface layer, Unified Noah Land Surface Model as a land surface model, Rapid Radiation Transfer Model Scheme for both short wave radiation and longwave radiation and Kain-Fritsch (new Eta) Scheme as cumulus physics option. Then the model is compiled for 48 hours using the 1°×1° six-hourly GFS data on a single domain of 9 Km horizontal resolution and 38 vertical layers. Half

hourly model is output is visualized by GrADS. The model performance was done by analyzing different meteorological parameters, for instance, MSLP, wind pattern at various pressure levels, vertical wind shear, two-meter height temperature and RH as well as their vertical cross-section, CAPE, and CIN, etc. For the validation of model-simulated different weather, parameters have also been compared with the three-hourly observed value of BMD, for example, MSLP, Temperature and RH at 2-m height, and rainfall. It is found that the model simulated result is good enough to predict thunderstorm events over Bangladesh and its adjoining areas. In conclusion, the result of the current research will help to detect thunderstorms precisely to forecast the weather timely to minimize the destruction of the environment and death of human beings.
Keywords: WRF-ARW, Thunderstorms, MSLP, CAPE and CIN

AP-8: Simulation of Cyclone Sitrang and Its Characteristics over the Bay of Bengal Using Weather Research and Forecasting Model

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An attempt has been made to simulate cyclone Sitrang over the Bay of Bengal on 20-24 October 2022 using Weather Research and Forecasting Model. The model was run on a single domain of 10 km horizontal resolution using Morrison 2-moment microphysics with Kain-Fritsch cumulus parameterization scheme and Yonsei University planetary (YSU) boundary layer scheme, MM5 surface layer physics scheme, Rapid Radiative Transfer Model (RRTM) for long-wave and Dudhia scheme for short-wave scheme are used in version 4.2.1 for the simulations. The NCEP high resolution FNL 6-hourly data is used for initial and lateral boundary conditions. GrADS is used to visualize the different graphics. The model predicting capability is evaluated by analyzing Mean Sea Level Pressure (MSLP), wind pattern, vorticity, vertical wind shear, reflectivity, temperature and rainfall distribution. The model has successfully captured the system, its initial condition, propagation, landfall time and location reasonably well. The model has simulated rainfall, wind and rh sensibly well compared with the observed data by BMD and Tropical Rainfall Measuring Mission (TRMM). It can be concluded that the WRF model with the accurate arrangement of the domain, horizontal resolution and the appropriate parameterization schemes is proficient to simulate and forecast the cyclone Sitrang over the Bay of Bengal and its associated rainfall over Bangladesh.
Keywords: Morrison 2-mom, Kain-Fritch, YSU scheme, Vorticity, TRMM, NCEP.

Session-VIIIA: Thin Film

TF-1: The Effect of Temperature, Incident Angle, and Active Layer Thickness on the Performance of $CH_3NH_3PbI_3$ Perovskite Solar Cell

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Perovskite solar cells (PSCs) have become very popular for producing clean and renewable energy owing to their rapidly developing power conversion efficiency. Nevertheless, their commercialization faces many challenges due to their burn-in degradation in the presence of sunlight and air [1]. In this study, a numerical simulation: SETFOS software was used to investigate the performance of a perovskite solar cell with $CH_3NH_3PbI_3$ as its active layer. SETFOS (semiconducting thin film optics simulation) was developed by FLUXiM, which utilizes many distinct models pre-installed into the software. It can successfully reproduce the optical as well as the electrical behavior of various devices. A study of the J-V measurements changes with parameters: active layer thickness, incident angle, and temperature are being conducted. An increase in incident angle especially over 45 degree decreases the perovskite solar cell performance and reduces its efficiency from 9% to 7%. The investigation with simulation reveals that at normal incident angle reflection of light is lowest which later increases with increasing angle. The effect of device temperature as well as active layer thickness is also being studied.
Keywords: Perovskite solar cells, SETFOS, J-V measurements, fill factor, power conversion efficiency
Reference:
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TF-2: Numerical Investigations to Evaluate the Device Performance of Lead Free $CH_3NH_3SnBr_3$/CIGS Tandem Cell Comparing With the Single-Layer Solar Cell Using SCAPS ID

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Due to the toxicity and the complex fabrication process lead-based perovskite solar cells are unable to fabricate commercially though the lead halide perovskite solar cells' power conversion efficiency has reached 25.2%. In this work, with the help of SCAPS 1D, a lead free single-layer perovskite ($CH_3NH_3SnBr_3$) solar cell along with a tandem solar cell ($CH_3NH_3SnBr_3$/CIGS) have been investigated to compare the photovoltaic performance by using PCBM ([6,6]-phenyl-C_{61}-butyric acid methyl ester) and SnTe as an ETL and HTL respectively. Thickness, defect density, doping concentration and series-shunt resistance of the tandem device have been optimized and get the best performance of the device. In the case of a single absorber layer, power conversion efficiency (PCE), open circuit voltage (V_{oc}), fill factor (FF) and the short circuit current density (J_{sc}) are achieved 20.58%, 0.931 V, 64.95% and 34.03 $mA.cm^{-2}$ respectively. Moreover, it is observed that the tandem structure (FTO/PCBM/$CH_3NH_3SnBr_3$/CIGS/ZnTe/SnTe/Au) obtains 22.68% of PCE, 0.916 V of V_{oc}, 71.46% of FF and 34.66$mA.cm^{-2}$ of J_{sc}. After analyzing the above two structures, it is found that the tandem structure has 2.10% higher PCE than the single structure.
Keyword: Tin based perovskite, tandem solar cell, ETL, HTL, SCAPS 1D.

TF-3: Influence of Deposition Techniques on Quality and Properties of Cuo Thin Films

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Copper oxide is an attractive material for whole transportation for perovskite solar cells. In this study, copper oxide (CuO) thin films were prepared by solution-processed method from isopropanol [$(CH_3)_2CHOH$], copper acetate monohydrate [Cu $(CH_3COO)_2$], and monoethanolamine (MEA) [HO $(CH_2)_2NH_2$]. Thin films were deposited onto ultrasonically cleaned glass substrate by spin coating, chemical bath deposition technique at room temperature and were annealed at 500 °C for 1 hour, and in spray pyrolysis technique the film was deposited at 500°C for 1 minute using ultrasonic spray pyrolysis machine. The surface morphological, compositional, structural, and optical properties were characterized by using scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDX), X-ray diffraction (XRD), and UV-Vis-NIR spectrophotometer, respectively. XRD confirms the polycrystalline monoclinic crystal structure of the films as shown in Fig-1.

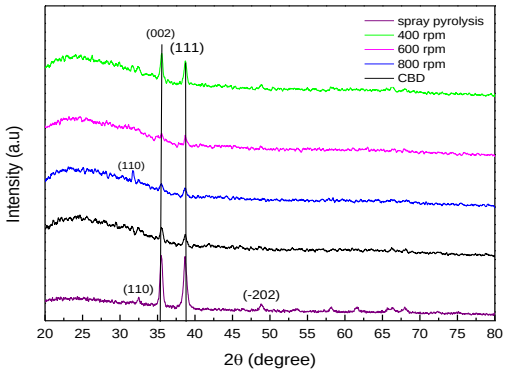

Fig-1: XRD pattern for CuO thin films for different techniques

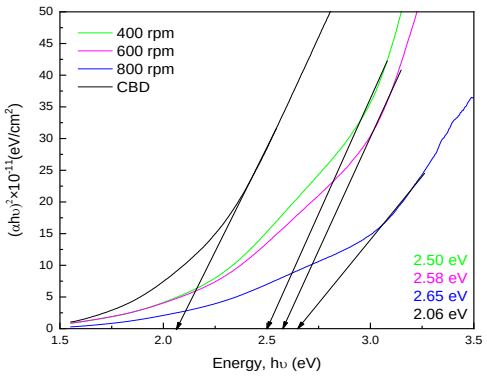

Fig-2: Band gap of CuO thin films deposited in various techniques

Microstructural parameters such as crystallite size, microstrain, and dislocation density were calculated for each technique. SEM images reveal the homogeneity of the films and good surface morphology with a large number of grains deposited by every technique. EDX results denote the presence of Cu and O elements inside the deposited samples. The direct band gap of CuO thin films has been observed to increase from 2.06 eV to 2.65 eV for different techniques as shown in Fig-2. Fourier transform infrared spectroscopy (FTIR) studies also confirm the presence of CuO films in the molecular structure.
Keywords: CuO thin film, spin coating, chemical bath deposition, spray pyrolysis, grain size, band width.

TF-4: Structural and Optical Properties of Aluminium Doped Zinc Selenide Thin Films Synthesized by Thermal Evaporation Technique

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Aluminium doped Zinc Selenide (Al: ZnSe) thin films have been grown onto glass substrate using thermal evaporation technique under a high vacuum (5×10^{-6} mbar). Al doping amounts varied between 0.5% and 2.5%. The thickness of the films was 500 nm and monitored by a frequency shift of the quartz crystal oscillator. Each film was annealed for one hour at 300 °C in the deposition chamber. Energy-dispersive X-ray spectroscopy and Fourier-transform infrared spectroscopy (FTIR) were utilized for the phase analysis. The X-ray diffraction investigation revealed that the structure of the films is FCC zinc blend and cubic. The preferred orientation was in the direction (111). UV-Visible spectrophotometry was used to analyze the transmittance, reflectance, absorbance, absorption coefficient, energy band gap, Urbach energy, refractive index, extinction coefficient, dielectric constants, and optical conductivity of all the films. The optical band gap was observed to be between 2.73 eV to 2.82 eV for undoped and doped films. The band gap increased with increasing doping concentration. The films had a high absorbance and broad band gap, making them potentially useful in optoelectronic and photovoltaic devices.
Keywords: X-ray diffraction, UV-Vis spectroscopy, Absorbance, Refractive index, Optical conductivity

TF-5: Study of Cadmium Telluride (CdTe) Thin Film Materials for Detector Application in Radioactivity Measurement

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Detectors play a critical role in the safe transport of radioactive materials. In Bangladesh the detection system of radioactive material is mostly based on NaI(TI) and HpGe detectors. However they have some limitations such as low energy resolution, low intrinsic spatial resolution etc.. Over the past few decades development in semiconductor detector technology provided an appropriate substitution for scintillation detectors (NaI(TI), HpGe) in terms of high sensitivity, better energy resolution. One of the considered detectors is Cadmium Telluride (CdTe) detector due to its wide energy band gap and high atomic absorption co-efficient. For the development of CdTe detector technology the present objective is to deposit CdTe thin film and characterize its radiation effect on its optical properties. CdTe thin films of 50 nm (30 nm at 300°C S_T and 20 nm at 200°C 0C S_T), 100nm (60 nm at 300°C S_T and 40 nm at 200°C S_T) and 200 nm (120 nm at 300°C S_T and 40 nm at 80°C S_T) have been deposited on the glass substrate at fixed annealing temperature 100°C for 60 min by thermal evaporation method and the gamma radiation effect on their optical properties has been investigated. Transmittance and reflectance have been measured in the region from 400 nm to 1300 nm and were used to evaluate the optical parameters (Transmittance, reflectance, absorption coefficient, extinction coefficient, refractive index) and the band gap energy for CdTe thin films before and after gamma radiation (50 kGy and 100 KGy of Cobalt 60 Source). It was found that the transmittances of the films were decreasing with increasing the film thickness and reflectance was decreasing with increasing the film thickness in the infrared region. Maximum transmittance was found about 83% in the visible wavelength for the film of thickness 100 nm and maximum reflectance was found about 49% in the ultraviolet region for the film of thickness 50 nm. The band gaps of all the films were found to decreases with the increase of the radiation dose.

TF-6: Structural, Morphological, Optical, and Electrical Analysis of Mn-Doped Nio Thin Films

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Nickel oxide (NiO) is a semiconductor with face-centered cubic (FCC) crystal structure. Because of the wide band gap, high transparency, and porous surface morphology of NiO, it shows high-performance in various electronic and optoelectronic devices. For this reason, recently metal doped NiO thin films has drawn the attention of the researchers. In this work, NiO and manganese (Mn) doped NiO thin films have been deposited onto glass substrates at 723 K temperature using a simple and low-cost spray pyrolysis technique. The amount of Mn doping is varied from 0 to 4 at% at the step of 1 at% in NiO films. Structure, morphology, chemical composition as well as the optical and electrical properties of the deposited films are studied. X-ray diffraction analysis shows that NiO and Mn-doped NiO films has FCC structure with the predominance of (111) peak. Crystallite size decreases from 31 to 22 nm with Mn doping. Surface morphology was investigated by a scanning electron microscope (SEM). In SEM images all the samples show uniform distribution of particles with porous structure. Chemical composition and stoichiometry the deposited thin films have been confirmed by Energy dispersive X-ray spectroscopy. The optical transmittance is measured in the wavelength range 200 - 1100 nm using an UV-Visible spectrophotometer. Highest transparency around 90% and band gap of 4.03 eV is obtained for 2 at% Mn-doped NiO thin film. Extinction coefficient and dielectric loss tangent in the visible-NIR region of light reduce with Mn doping. 1 at% Mn doped NiO film shows the highest optical conductivity and refractive index in the visible light. The room temperature resistivity increases with Mn-doping up to 2 at%. Investigation of the temperature dependent electrical conductivity reveals that almost all the films show three regions of conduction except the 2 at% Mn-doped film. Two regions of conductivity are found for 2 at% Mn-doped NiO thin film. The activation energies are calculated in the temperature range of 300 - 373 K. All the samples show low activation energy at the higher temperature regions. Formation of transparent and crystalline NiO thin films with porous surface morphology, wide band gap, high resistivity and low activation energy via Mn-doping indicated the suitability of this material in fabrication of sensors and high-power devices.

TF-7: Structural, Morphological, Optical and Electrical Properties of Co Doped Cuo Thin Films

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Copper (II) oxide (CuO) is a semiconductor with p-type conductivity and monoclinic structure. Availability in nature, environment friendly behavior, band gap in the visible region of light and ability to form porous microstructure has made CuO an interesting material to the researchers. In recent years, transition metal-doped CuO thin films have been prepared using several deposition techniques and the properties of the films have been studied by the scientific community for device applications. In this work, cobalt (Co)-doped CuO thin films have been synthesized using a simple and low-cost spray pyrolysis technique. CuO films have been prepared with the Co concentrations 0, 2, 4, 6 and 8 at%. Field emission scanning electron microscopic images of Co-doped CuO thin films, show the aggregations of nanoparticles on the film surfaces. For 6 at% Co doping, the surface morphology of CuO turns into porous and sponge-like nanostructures. In X-ray diffraction analysis, CuO film shows monoclinic structure with the preferential orientation along ($\bar{1}11$) direction. No other peak corresponding to Co impurity or any other crystalline phase of copper oxide are found up to 4 at% of Co doping. The ($\bar{1}11$) peak loses its predominance with the appearance of the (311) peak corresponding to Co_3O_4 and (200) peak related to Cu_2O upon 6 and 8 at% Co doping. The crystallite size decreases from 11 to 5 nm with Co doping. In UV-visible spectroscopy, the optical transmittance of Co-doped CuO films increases with wavelength and saturates in the near-infrared light region. The highest transmittance of about 96% is found for the 6 at% Co- doped CuO film. The optical band gap of the films increases from 2.14 to 2.91 eV with Co doping. Refractive index, dielectric constants, and electron effective mass reduces with Co doping. Electrical resistivity of the films decreases with Co doping. The films shows p-type conductivity up to 2 at% Co doping, then for further doping the conductivity changes into n-type with the reduction of Hall coefficient and carrier mobility.

Remarkable changes occur in the structural, morphological, optical and electrical properties of CuO thin films because of Co doping. It may be said that Co-doped CuO thin films can be used for optoelectronic applications.

TF-8: The Chemistry of Cobalt Oxide Thin Films Studied with High-Pressure Core Level Spectroscopy and Scanning Tunneling Microscope

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Cobalt oxide nanomaterials have attracted attention because of their application potential in the fields of heterogeneous catalysis [1]. On the metastable Ir (100)-(1×1) surface a large number of thin Co oxide structures have been grown and characterized in detail [2]. This wealth of Co oxide structures gives a unique tool to vary the stoichiometry, surface termination, defect concentration, and study how this affects the surface chemistry.

Here we use high resolution core level spectroscopy (HRCLS) to give a detailed picture of the adsorption of CO, CO_2, and H_2O probe molecules onto thin films of Co_3O_4(111) and CoO(111) grown on the Ir(100)-(1×1) surface [3]. We find that the CoO(111) film without Co surface atoms is almost fully inert with respect to CO/CO_2 adsorption and water dissociation at 90 K, while adsorbed CO/CO_2, and water dissociation are identified on the pristine Co_3O_4(111) having Co surface atoms.

Based on the above findings we conclude that surface Co atoms are essential for CO/CO_2 adsorption and water dissociation and most likely also for the high catalytic activity of the Co_3O_4 (111) film.

In the last part of the talk we will discuss the catalytic properties of the Ag (100) supported Co oxide films based on recent high pressure CLS measurements. Under O_2:CO mixtures in the mbar regime at 500 K, a CO_2 gas phase component observed in the C 1s spectrum at a position of 292.4 eV (Fig. 1b). The production of CO2 in the gas phase is also visible in the QMS signal (Fig. 1c) recorded simultaneously both at this temperature and lower temperature, which suggests that the Co_3O_4(100) phase is catalytically active. Another key finding from these experiments is that transformation back and forth between CoO and Co_3O_4 films is observed in O2:CO mixtures in the mbar regime. In pure CO the CoO film is observed while the Co_3O_4 film always is observed when there is oxygen in the gas supply. Figure 1: (a) Co 2p spectra. (b) Corresponding C 1s spectra. (c) CO and CO2 signals in the quadrupole mass spectrometry.

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Session-VIIB: Composite Materials

CM-1: Study of Complex Permeability of Chromium -Substituted Ni-Cu-Zn Ferrites Synthesized by Solid State Reaction Method

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Ferrites, in particular, are ferrimagnetic materials with the intriguing dual features of being both electric insulators and magnetic conductors and these exceptional qualities have made them suitable for a variety of applications, including transformer cores, antenna rods, magnetic data storage, etc. Among the ferrites family,

the mixed Ni-Cu-Zn ferrites are well-recognized magnetic materials for the application of multilayer chip inductor (MLCI), because of the low sintering temperature, high permeability in the radio frequency region and high electrical resistivity. By using a substitutional approach, numerous efforts have been made to enhance the electrical resistivity, magnetic, and dielectric properties of Ni-Cu-Zn ferrites. The impact of Cr substitution on the magnetic and electrical characteristics of Ni-Zn ferrites has been carefully studied by a few researchers. However, the effect of Cr^{3+} ion replacement on Ni-rich Ni-Cu-Zn ferrites has not been documented yet in the literature. In this research the Cr^{3+} ion substituted $Ni_{0.65}Cu_{0.15}Zn_{0.20}Fe_{2-x}Cr_xO_4$ (where x=0.00, 0.02, 0.04, 0.06, 0.08, 0.10) ferrites have been synthesized via conventional solid-state process and their structural and magnetic properties in particular, complex permeability have been studied. The X-ray diffraction (XRD) spectra showed that every sample has a single-phase cubic spinel structure. The energy dispersive x-ray spectroscopy (EDX) patterns verified the presence of each element with the desired percentage of the ferrite composition. The complex permeability measurements were performed with the help of an Impedance Analyzer at room temperature. The real part of initial permeability (μ') of the samples was found roughly steady up to a high frequency ~10^6 Hz and it began to decline after that frequency. The real part of initial permeability(μ') was obtained maximum for Cr-undoped sample and with increasing Cr substitution the value gradually decreases. However, the Cr-substituted sample, x=0.04, exhibits the highest quality value. Overall experimental results suggested that the developed Chromium-doped Ni-Cu-Zn ferrites might be used in a variety of devices for high frequency applications.

CM-2: Synthesis and Characterization of Structural, Magneto-Electric and Optical Properties of $Ca_{0.90}Sr_{0.10}Mn_{1-X}mo_xo_3$ Ceramics

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The polycrystalline $Ca_{0.9}Sr_{0.1}Mn_{1-x}Mo_xO_3$ ceramics (where x = 0.00, 0.02, 0.04, 0.06 and 0.08) were synthesized by the standard solid-state reaction method. All the samples were pre-sintered and sintered at 1300℃ for 4 hours. It is a fascinating material because replacing the Ca and Mn ions in CaMnO3 can be used in wide applications in catalysis, fuel cells, electrochemical sensing, solar energy, photovoltaic, Li-ion batteries, supercapacitor materials, magnetic storage devices etc. Structural and compositional analysis were characterized by X-ray diffraction (XRD). The XRD pattern confirmed a phase transformation from orthorhombic to tetragonal symmetry (for x > 0.04). The effect of Mo doping on the density, porosity, magnetic and electric properties was investigated clearly. Porosity and crystallite size of $Ca_{0.9}Sr_{0.1}Mn_{1-x}Mo_x$ ceramics decreased with increasing dopant concentrations of Mo. Crystallite sizes were found at a range of 34 nm to 31 nm. It was noticed that the values of tolerance factor vary from 0.829 to 0.828, and it deceased with the addition of Mo, which leads to distortion of the perovskite structure. Frequency dependent complex initial permeability was carried out at room temperature in the frequency range 80Hz to 130MHz. It was observed that the permeability value first decreased for x=0.1 and then increased. The maximum value of complex initial permeability was observed at low frequency, 2400 Hz, for x = 0.06 sample. The M−H hysteresis curves revealed the paramagnetic with weak ferromagnetic behavior of the compound at room (300k) temperature, whereas antiferromagnetic behavior with weak ferromagnetic behavior was seen at low temperature (5k). This kind of behavior influences on CMR properties. The sample x = 0.08 showed better dielectric properties than others. This type of behavior can be used as microwave absorbing material. The presence of vibration of M-O and M-O-M bonds around 661, 583 and 402 cm^{-1} were observed from FTIR spectroscopy, indicating the formation of $CaMnO_3$ phase. In addition, an optical band gap of 1.85 to 4.06 eV was obtained from UV-vis spectroscopy, which is promising for visible light absorption. The compound may be used in photovoltaic, supercapacitor, and UV detector.

CM-3: Polymer Electrolytes Enhance Dye-Sensitized Solar Cells Conversion Efficiency and Stability: A Short Review

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Dye-sensitized solar cells (DSSCs) have recently received much surveillance as sustainable energy sources. DSSCs are categorized as third-generation solar cells. Its affordability, flexibility, environmental friendliness, simplicity of production, and high power conversion efficiencies (PCE) under indoor/outdoor light make it a promising next-generation sustainable energy technology. The photovoltaic efficiency of DSSCs depends on electrolyte materials. Generally, liquid electrolytes are used in DSSCs. Despite having high liquid electrolyte ionic conductivities, it performs poorly because of instability. Liquid electrolytes are not compatible with DSSCs because of leakage and volatilization. Polymer electrolytes are promising alternatives in DSSCs. The main advantages of polymer electrolytes are their outstanding heat stability and superior ionic conductivity. This study investigates the effect of polymer electrolyte on the PCE and robustness of the DSSCs. This article also includes a comparison table listing the properties of several polymer electrolytes along with their advantages and drawbacks. In the evaluation process, it is predicted that polymer-based solid electrolytes will dominate in DSSCs application.

Keywords: Dye-Sensitized Solar Cell, Polymer Electrolytes, Conversion Efficiency, Stability, $BaTiO_3$; Solid-state reaction; Structural properties; Electrical properties; Optical properties

CM-4: Synthesis and Characterization of Multiferroic Composite (1-X) Ba0.6Sr0.4Cr0.6Ti0.4O3+(X) $Cofe_{1.8}La_{0.2}O_4$ via Double Sintering Ceramic Technique

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The multiferroic composite (1-x) $Ba_{0.6}Sr_{0.4}Cr_{0.6}Ti_{0.4}O_3$+(x) $CoFe_{1.8}La_{0.2}O_4$ with different concentrations, x = 0.0, 0.2, 0.4, 0.6, 0.8, 1.0 were synthesized by combining a ferroelectric material (1-x) $Ba_{0.6}Sr_{0.4}Cr_{0.6}Ti_{0.4}O_3$ and ferrite material (x) $CoFe_{1.8}La_{0.2}O_4$ using the traditional double sintering ceramic process. The tetragonal perovskite structure BaSrCrTiO (BSCTO) phase and the spinel cubic structure of the ferrite CoFeLaO (CFLO) phase were confirmed by X-ray diffraction (XRD). The increase in Fe doping amount leads to increased average grain size. FTIR analysis confirms the presence of M-O and M-O-M metal oxide bonds. The saturation magnetization (M_s) and remnant magnetization (M_r) of the composites were enhanced when $CoFe_2O_4$ were integrated into them. At x = 0.4, the highest coercivity (H_c) value is observed. According to electrical analysis, the composite with x=0.4 has the highest coercivity field (E_c), remnant polarization (P_r), and polarization (P) value among all other concentrations. The results of the UV-Visible spectroscopy analysis show that all of the samples are wide-band gap semiconductor materials, allowing devices to operate at far higher voltages, frequencies, and temperatures than typical semiconductor materials.
Keywords: Multiferroics; Saturation magnetization; Polarization; Band-Gap.

CM-5: A First-Principles Study of Elastic, Electronic and Optical Properties of $Mcuo_3$ (M = La and Y) Under Hydrostatic Pressure

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From theoretical perspective, perovskite materials display a variety of fascinating and unusual characteristics when subjected to hydrostatic pressure. The elastic, electronic, and optical properties of newly hypothesized perovskite $MCuO_3$ (M = La, Y) are calculated under the hydrostatic pressure up to 100 GPa by the first

principles calculations based on density functional theory (DFT). The mechanical stabilities are confirmed by the calculated values of elastic constants. The values of Pugh's ratio indicate the ductile nature of $YCuO_3$ and $LaCuO_3$ at all pressures. Since both substances have anisotropic elastic properties, the elastic constants can be thought of as a monotonic function of pressure. Under pressure, calculations are also performed for the Debye temperature, melting temperature, and minimum thermal conductivity. $YCuO_3$ and $LaCuO_3$ show metallic behavior where a few valence bands cross the Fermi level. The density of states near the Fermi level shows the predominant overlapping of Cu-3d and O-2p orbitals. The Mulliken population analysis and charge density profile provide evidence for the presence of covalent bonds. With the variation of pressure, optical properties including conductivity, reflectivity, and loss function are also examined.

CM-6: Structural, Electrical, Magnetic, and Magnetoelectric Properties of Multiferroic Composites Used As Novel Multifunctional Devices

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In this study, the stoichiometric and non-stoichiometric (1-y) $[Ba_{0.9}Ca_{0.1}Zr_{0.1}Ti_{0.9}O_3]$+ (y) $[Ni_{0.25}Cu_{0.13}Zn_{0.62}Fe_{2-x}O_{4-3x/2}]$ (where x = 0.00 to 012; y = 0.2 and 0.5) composites are synthesized using a solid-state reaction technique. Samples prepared from these composites were sintered at 1200℃. Their structural, electrical, magnetic, and magnetoelectric characteristics have been investigated. XRD and FTIR analyses approve the presence of individual phases without any traceable secondary phase formation. FTIR analyses revealed the different band modes. SEM investigation confirmed the formation of grains possessing polyhedral or irregular shapesand sizes with little agglomeration with Iron-deficiencyand the presence of the required elements as per the stoichiometric ratio was ascertained by EDX.The low-frequency dispersion in the dielectric constant resulted from Koop's and Maxwell-Wagner's two-layer models.The non-monotonic variation was observed in lattice parameter, crystallite size, and volume of unit cell with iron-deficiency.The ac electrical conductivity incorporated the universal law of Jonscher with large dispersion at higher frequencies.The impedance spectra revealed that the conduction mechanism could be corroborated with the collective accomplishment of remarkably conducting grain and unremarkably conducting grain boundary responses. The permeability decreased with Iron-deficiencyfor y = 0.2 while increased for x = 0.04, after which it decreased with iron deficiencyfor y = 0.5. The highest value of magnetoelectric coefficient was realized for x = 0.0; y = 0.5 composites (171 mV/cm-Oe) due to the elastic interaction mediated by the strain between the two phases. The above results of these studied composites are suitable for novelmultifunctional device applications.
Keywords: Stoichiometricand non-Stoichiometric, multiferroic composites, crystallite size, magnetoelectric coefficient.

CM-7: Enhanced Dielectric, Magnetic and Optical Properties of Ba-Sr-Ca Titanate Ceramic Materials with Mn- Substitution for Spintronic Devices Application

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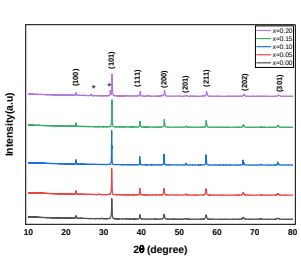
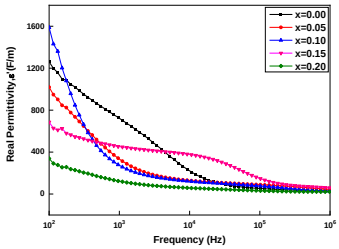
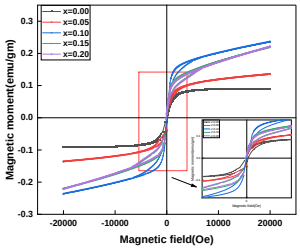
Polycrystalline $Ba_{0.6}Sr_{0.3}Ca_{0.1}Mn_xTi_{1-x}O_3$ were prepared by solid-state reaction method with different percentages of manganese (0%, 5%, 10%, 15%, and 20%) sintered at 1250°c for 4 hours. The structural, magnetic, optical, dielectric and transport properties of Mn-doped Ba-Sr-Ca titanate ceramic materials were investigated on all samples. The final sample (x=0.20) showed a phase change from cubic to tetragonal in the X-ray diffraction analysis (XRD) spectra. The Mn^{2+} substitution resulted in a drop in the lattice parameter and an increase in crystal size of up to x=0.10. Bulk density was relatively high and porosity

was low for x = 0.10. In agreement with the XRD analysis, the Raman spectra investigation also demonstrated the cubic to tetragonal phase transition at x=0.20. Absorption bands for the composition identified the presence of C–H and C–OH bending frequencies by FTIR (Fourier-transform infrared spectroscopy). According to the Physical Properties Measurement System (PPMS), coercivity increased substantially for x = 0.00 to 0.05 before declining for x = 0.10 to 0.15. With the highest coercivity for x=0.05 and x=0.20, the anisotropy constant was raised which is hard to demagnetize. According to UV-Vis spectroscopy, the optical band gap for the size shift went from 1.566 eV to 1.302 eV. For the frequency range of 100 Hz to 100 MHz, the impedance analyzer determined the dielectric properties in all of the ceramic samples. For x=0.10, it was determined that the dielectric constant had a higher value. Due to their frequency response property, ceramics are a viable candidate for spintronic devices such as tunable capacitors, disc drivers, loudspeakers, and microphones. Among all the dopant, x=0.10 shows high dielectric constant, high saturation magnetization, structure, high RQF and low bandgap which suggested as multiferroic spintronics memory devices.







CM-8: Lead-Free All-Inorganic $Cs_3Sb_2I_9$ Perovskite Materials Synthesized By Chemical Vapor Deposition and Their Photodetector Application

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Lead-based organic or all-inorganic halide perovskites (ABX_3, A = organic or inorganic cation, B = lead cation, and X = Cl, Br, I) are well-known for their fascinating properties which make them suitable for many optoelectronic devices. However, the stability of organic hybrid compounds as well as the toxicity of lead (Pb) inhibit the development and commercialization of these devices. Consequently, Pb-free, all-inorganic halide perovskites are now the subject of the latest research interest. In this work, we successfully synthesized Pb-free all-inorganic $Cs_3Sb_2I_9$ perovskite microplates and thin films by a two-step chemical vapor deposition (CVD) approach. XRD analysis of the microplates and thin films show the pure phase crystalline nature of the $Cs_3Sb_2I_9$ perovskite structure. As compared with other typical lead-free perovskite materials, the $Cs_3Sb_2I_9$ materials demonstrate excellent optoelectronic properties, including the large Stokes shift andhigh exciton binding energy. Simple photoconductive devices fabricated using these microplates and thin films exhibit a respectable performance with responsivity up to 40 and 54.5 mA/W and high detectivity reaching 1.2×10^{11} and 4.3×10^{10} Jones for microplates and thin films, respectively. Moreover, a stable photo switching property with fast rise and decay times of 96 μs and 58 μs for microplates and 50 ms and 30 ms for thin films. The efficient response is benefited from the excellent crystal quality of the microplates. All these results clearly suggest the technological potential of all-inorganic lead-free $Cs_3Sb_2I_9$ perovskite materials are promising candidate for futurehigh-performance photodetectors and other optoelectronic devices.
Keywords: XRD, CVD, perovskite structure, photodetector

CM-9: Investigation of Structural, Optical, Magnetic and Electrical Properties of Ni doped $Ba_{0.95}Ca_{0.05}TiO_3$ Ceramics

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The solid state reaction method was followed to prepare the polycrystalline $Ba_{0.95}Ca_{0.05}Ti_{1-x}Ni_xO_3$ (x = 0, 0.05, 0.10, 0.15, and 0.20) ceramics. The structural, optical, magnetic, and electrical properties of the solid solution were investigated. Perovskite structure with tetragonal symmetry was observed from XRD pattern, and it was also observed that the Ni (nickel) behaves as both A- and B-site dopants simultaneously. The X-ray density firstly decreased and then increased with Ni contents whereas the bulk density increased and the porosity was found to be decreased. Crystallite size was calculated at a range of 16 to 21 nm using the Scherrer formulae. The optical energy band-gap and metal-oxygen bonds in the perovskite structure are investigated by analyzing the data obtained from ultraviolet-visible spectroscopy and Fourier transforms infrared spectroscopy (FTIR), respectively. The physical properties measurement system (PPMS) was employed to investigate M-H hysteresis loops at room temperature, and found the weak ferromagnetic behavior of Ca and Ni doped $BaTiO_3$ ceramics. It was also observed that saturation magnetization decreased with increased Ni contents due to lattice strain. Frequency-dependent permeability was measured at room temperature in the frequency range 100Hz to 100MHz. The maximum value of permeability is observed for x = 0.10 which means that good magnetic property can be obtained for 10% Nickel doped sample. The increasing trend of relative quality factor and decreasing trend of loss factor with frequency support the high-quality magnetic characteristics of the compositions. Dielectric properties of the compound were determined using an Impedance Analyzer at room temperature. The sample x=0.05 carry the maximum value of dielectric constant (ε), and minimum dielectric loss ($\tan\delta_E$). High values of AC resistivity (ρ) and impedance (Z) at lower frequencies indicated higher polarization. AC conductivity (σ_{AC}) improved linearly with an increased frequency indicating small polaron hopping is present in the conduction mechanism.

Session-IX: Physics Education

PE-1: Effects of Nonlinear Gravitational Waves on the Electrical Voltage of Bryophyllum Pinnatum at Various Altitudes

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Ion propulsion is an antigravity technique that is connected to a high voltage power source**.** Here, we're attempting to quantify how gravity affects the PKL cell's low voltage power supply at various heights. We created a PKL cell and tested it with three different weights of copper and zinc, where copper served as the cathode and zinc as the anode.For each electrode, we recorded how many zinc plates were submerged in PKL extract.For measuring, we used a reference height (Jagannath University) taken from the ground. Our standard height is 8.7757 meters.As a result, the open circuit voltage and load voltage in the CD800A multimeter have different magnitudes.
Our heights were 8.7757 meters, 9.26592 meters, 9.3091 meters, and 9.4996 meters, respectively.
Our working period for type 1 lasted for around 5000 minutes.Our working period for type-2 lasted for roughly 73 minutes.The length of our working session for type 3 was roughly 86 minutes.The amount of PKL extract we utilized was approximately 100gm, and the load resistance was 4.7k ohms for each type of electrode.

Time duration(minutes)	Weight of the Copper Plate(gm)	Weight of the Zinc Plate(gm)	Weight of the Zinc Plate+ Copper plate+ Electrolyte (gm)	Height from the ground (m)	Open circuit voltage V_{oC} (v)	Load Voltage V_L(v)
15	121.46	29.69	251.15	8.78	0.994667	0.934
31				9.27	0.99717	0.92917

58				9.50	0.9935	0.9155
90				9.31	0.99117	0.928167

Table 1: Data collection for weights and voltages (Type 3)

Table-1 summarizes our results for type 3 for us.Changes for various heights are also visible here. The value of

open circuit voltages is increasing-decreasing periodically with altitude, similar to type 1, type 2, and outcomes, as can be seen if we pay close attention to the open circuit voltage side.Similar shifts are also being seen in load voltage.We can infer that there may be a connection between the voltage sources and gravity because the phenomena happened in the same type of weather, environment, and environment.

Keywords: BPL electrochemical cell, Plasma physics, Ion propulsion, Antigravity, Height, voltage.

Acknowledgement: The Ministry of Posts, Telecommunications, and Information Technology of Bangladesh provided funding for this project through the ICT Innovation Fund mechanism.The study was conducted at Jagannath University's Physics Department in Dhaka, Bangladesh.

(a) (b)

Fig.2 Experimental set-up of the study (a) & BPL juice making(b)

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PE-2: Understanding the Necessity of Updated Syllabus of Physics for Undergraduate Students - Establishing Academy and Industry Collaboration in Bangladesh

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Physics is one of the most fundamental subjects that is taught when a student is enrolled in "Science" group in Bangladesh. Prior to that, several topics of Physical Science are learned by the students in Secondary and Primary Schools. However, at undergraduate level, when a student is enrolled in any field of Engineering such as Electrical & Electronic Engineering (EEE), Mechanical Engineering (ME) or Industrial and Production Engineering (IPE) and Architecture etc., they also study Physics for a significant amount of time, where focus is mainly given on the theoretical part of the subject with some laboratory experiments in current context.

However, these are the applied fields which have direct link to the fundamental subjects such as Physics and Mathematics. These subjects play very crucial role for their future career paths [1]. Though not much attention has been given in developing updated syllabus and linking it to the industry of Bangladesh so far. Therefore, student who study Physics courses as minor, will not be able to connect it to the real world due to non-existent nature of such links. Studies shows that understanding of Physics topics depends upon socio and demographic context also [2]. In this current research work efforts are made on how we can establish such links through updating syllabus and accommodating real world case studies associated with different Engineering and Architectural problem of Bangladesh. Nonetheless, it is an important act in the direction of achieving SDG's (SDG: 4, SDG: 9, SDG: 17) as Bangladesh plans to achieve SDG's by 2030, declared by UN.

Keywords: Physics Education, Undergraduate Studies, SDG, Quality Education in Bangladesh, Academy-Industry Collaboration.

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CONTRIBUTTORY ABSTRACTS FOR POSTER PRESENTATION

Venue:
Department of Physics
Jahangirnagar University

Bangladesh Physical Society

Poster Presentation

Session: Theoretical and Computational Physics

PP-1: A First-principles study of pressure induced opto-electronic and thermoelectric properties of $FrCaX_3$ (X = Cl, Br, I) perovskites

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The effects of hydrostatic pressure on the opto-electronic and thermoelectric properties of lead-free cubic halide perovskites $FrCaX_3$ (X = Cl, Br, I) are explored using Predew-Burke-Ernzerhof generalized gradient approximation (PBE-GGA) in the framework of density functional theory. The calculations are carried out using WIEN2k simulation package and BoltzTraP2 code. Under uniform pressure, atoms interact more strongly due to a considerable drop in bond length and lattice parameters in the examined systems. The band gap becomes lower with pressure increment, resulting in better conductivity. The optical capabilities of the materials also suggest that a number of optoelectronic devices that operate in the visible and infrared spectra might employ the researched materials. Due to their low thermal conductivity and high electronic conductivity, these compounds have good potential in commercial thermoelectric devices.

PP-2: A Density Functional Theory Studies of Mechanical, Electronic, and Optical Properties of Cubic $CeAlO_3$ Structure

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Several studies have previously been conducted on the different phases (cubic and tetragonal) of the $CeAlO_3$ structure. Utilizing the GGA-PBE functional, these studies primarily focused on structural, electronic, and optical properties. We employed first-principles calculations based on density functional theory using CASTEP code. Using the GGA-PBEsol approach, our research focuses on the mechanical properties of the cubic structure. Electronic and optical properties are studied using the GGA+U approach. The Goldschmidt tolerance factor indicates that this structure is stable. Mechanical stability criteria for a cubic structure are also fulfilled. In addition, the value of the Poisson ratio is positive, which is 0.2. The results indicate that the structure is mechanically stable. Both the GGA + U and HSE06 functionals, which were used to study the structure's electronic properties, point to the structure's half-metallicity. The band gap obtained using GGA + U is 3.57 eV, corresponding to previously observed values (3.5 eV). We also investigated using the HSE06 functional, as it is a better functional for measuring band gap value, and the value obtained in the down spin state was 3.9 eV. In addition, the broad absorption peak and optical conductivity of bot structure occur in the ultraviolet region, and they diminish as energy increases. We assert that these structures are highly probable for use in spintronics and optoelectronics.
Keywords: CASTEP; DFT; Perovskite; Half-Metallic; GGA+U.

PP-3: A First-principles Calculations to Examine the Impact of Variation in the X+ Cation on Structural, Mechanical, Electronic, and Optical Properties of $XCdCl_3$ Chloroperovskites

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The CASTEP algorithm has been used to explore the structural, elastic, mechanical, and optoelectronic characteristics of $XCdCl_3$ (X=Na, K, Rb, and Cs) chloroperovskites using the Density Functional Theory (DFT) framework. Exploration of $XCdCl_3$ chloroperovskites (X=Na, K, Rb, and Cs) has been conducted using the GGA, GGA-U, and LDA functionals. Our study is credible since all the computational results for structural parameters agree well with the existing experimental data. The constants of elastic stiffness C_{ij} employ the necessary conditions to demonstrate the mechanical stability of the $XCdCl_3$ perovskite structures. The elastic modulus and other trustworthy characteristics show that the $XCdCl_3$ chloroperovskites are soft and ductile mechanically. Every material has an indirect bandgap, and when the X-site cation changes from Na to Cs, so does the energy of the bandgap. The optical conductivity and absorption of visible and ultraviolet light suggest that photovoltaic technologies will use these materials extensively.
Keywords: Chloroperovskite; Semiconductor; Photovoltaics; CASTEP; DFT.

PP-4: An Average Model of Volume Dependence Grüneisen Parameter of Solids

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The Grüneisen parameter (γ) is dimensionless quantity. The elastic bulk modulus, Debye temperature, and melting temperature are determined using the parameter. There are several established methods to investigate Anderson, Thomson, Al'tshuler, and Jeanloz parameters. [1]. Among them Jeanloz defined a model to investigate these properties with volume dependence. Srivatia et al. and other researcher modify the model by introducing the limiting value of γ_∞ **→1/2 as V→** 0. Some of the other researcher is considered that the limiting value of γ_∞ **→2/3 as V→** 0, and investigated on the several solids as par examples in ε-Fe, NaCl, K, Li, and Na [1-2]. Most recently, we aappliedthe two limiting value in case of MgO, and obtained the volume dependence of second and third order Grüneisen parameters [3]. In this work we proposed a limiting value of γ_∞ as the average value of the two limiting values. We perform the calculation in the average limiting value of $\gamma_\infty \rightarrow 7/12$ in case Cu and MgO. We found the average limiting value of γ_∞ can explain the experimental data of the two solids. The initial parameter of γ values also agree with the experimental values in the model.

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PP-5: Effect of S Substitution on the Physical Properties of $RbTaO_3$

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This study investigated the effect of Sulfur substitution on the mechanical, thermal, electronic, and optical properties of $RbTaO_3$ using the modified Becke-Johnson potential (mBJ) in the framework of density functional theory (DFT). The results showed that substituting S for O in $RbTaO_3$ effectively decreased the band gap. The cubic phase of $RbTaO_3$ has been changed to tetragonal for $RbTaO_2S_1$ and $RbTaO_1S_2$, which is again transformed to cubic phase for $RbTaS_3$. The band gap has been significantly changed from 2.717 eV to 1.438

eV, 0.286 eV, and 0.103 eV for $RbTaO_2S_1$, $RbTaO_1S_2$, and $RbTaS_3$, respectively. Consequently, the optical properties have also been modified. Substituting S for O in $RbTaO_3$ also considerably affects the elastic and thermal properties.
Keywords: Perovskite, Mechanical properties; Electronic properties; Thermal properties; optical properties.

PP-6: Comprehensive Device Modeling and Performance Analysis of Double Perovskite Solar Cells with Diverse ETM and HTM

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The highest power conversion efficiency (PCE) for lead-based organic-inorganic perovskite solar cells was 25% in 2019. Lead-based hybrid perovskite materials are used in several photovoltaics applications, but there is a significant impediment due to the toxicity and volatility of organic cations. On the other hand, hybrid lead-free double perovskite can be a possibility in commercializing high-performance perovskite solar cells. In this research study, we propose a lead-free perovskite solar cell with the configuration of FTO/ETL/$(FA)_2BiCuI_6$/HTL/Au using a solar cell capacitance simulator (SCAPS). Meanwhile, different HTM and ETL candidates were selected, such as Spiro-OMeTAD, CuI, NiO, Cu_2O, MoO_3, CuSCN, and TiO_2, SnO_2, ZnO, and CdS, respectively. The discussion about the function of candidates on solar cells performance demonstrated that ZnO and Cu_2O both have relatively high PCE due to their high conductivity and better chemical interaction with perovskite absorber. Analyzing factors like the thickness of the absorber layer, doping densities, the defect density in the absorber, interface defect densities, and working temperature point, we predict that the $(FA)_2BiCuI_6$ solar cell with the FTO/ZnO/ $(FA)_2BiCuI_6$ /Cu_2O/Au structure can attain a power conversion efficiency of ~24% at 300 K. Our analysis indicates that $(FA)_2BiCuI_6$ have great potential as an absorbing layer towards highly efficient lead-free all-inorganic perovskite solar cells.

PP-7: Strain-Induced Electronic and Optical Properties of Formamidinium Tin Tri-iodide $CH(NH_2)_2SnI_3$ Perovskite

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The organic-inorganic hybrid perovskite materials have gained widespread research interest in photovoltaics. The fascinating optical and electronic properties of halide perovskites are prevalent in photovoltaic applications. This work focuses on the strain-driven optical and electronic properties of formamidinium tin tri-iodide perovskite, $CH(NH_2)_2SnI_3$ (hereafter $FASnI_3$) via a first-principles density functional theory (DFT). The electronic band structure demonstrated that $FASnI_3$ is a semiconductor material. A direct bandgap of 0.7145 eV has been found at the R-point for unstrained planar $FASnI_3$ structure. Due to the application of compressive strain, the bandgap was reduced, while the bandgap attained a higher value due to a gradual increase in tensile strain. Moreover, the optical properties such as absorption coefficient, dielectric function, and electron loss function showed that $FASnI_3$ structures have good photo-absorption ability. While increasing compressive strain, the peaks of the dielectric constant were red-shifted. However, a blue shift nature of the dielectric peaks was prevalent under the influence of tensile strains. While undertaking the spin-orbit coupling (SOC) relativistic effect, the bandgap of $FASnI_3$ was reduced from 0.7145 eV to 0.4435 eV. Overall, the strain effect on $FASnI_3$ is a crucial factor to consider for optimizing the performance of optoelectronic devices.

PP-8: Studies of the possibility of a theory of energy emission from black holes without losing quantum information

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In general relativity, black holes are objects with space-time singularity at the center, whose gravitational attraction is so strong that nothing can escape if it crosses its event horizon. By using the basic ideas of general relativity and quantum mechanics, and works of others, Stephen Hawking theorized that black holes could emit energy where quantum information is lost. It is possible that both of these views are flawed. The possibility of an alternative theory of energy emission from black holes without losing quantum information has been studied using quantum entanglement and quantum tunneling primarily as guiding principles to preserve the basic idea of unitarity to avoid the theorized space-time singularity and quantum information loss, and found to be probable.
Key words: space-time singularity, quantum information, quantum entanglement, quantum tunneling, unitarity.

Session: Plasma and Astrophysics

PP-9: MACS and Neutron Capture Cross Sections of Branching Point Isotope ^{63}Ni In The S-Process Energy Region

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In the stellar nucleosynthesis, there is a stage after the formation of iron, called slow neutron capture process or s-process. In this process, heavier elements than iron are formed by capturing neutrons. However, there are some isotopes in the s-process path, where competition between beta decay and neutron capture becomes significant. These isotopes are known as branching point isotopes and these isotopes affect the abundance of certain elements in their region. Therefore, in order to understand the formation of elements by s-process it is necessary to study the neutron capture cross sections of these branching point isotopes. Such a branching point isotope is ^{63}Ni, which affect the abundance of other isotopes in the Ni-Cu-Zn region. By reviewing various literatures, we found that the neutron capture cross sections and Maxwellian averaged cross sections of this isotope shows different values in different literatures. Therefore, we wanted to reduce this discrepancy. For this reason, we evaluated the neutron capture cross sections and Maxwellian averaged cross sections using a nuclear reaction code with various level density models and photon strength function models and compared the results with the existing values. From the result we found that, when Back-shifted Fermi gas model used as the level density model along with Kopecky-Uhl Lorentzian model, Brink-Axel model, Goriely's hybrid model and Gogny-Hartree-Fock-Bogoliubov model as the photon strength function models are in good agreement within 10-20% uncertainty of experimental values. Furthermore, to find the best fit we adjusted the values of gamma normalization factors (G_{norm}) for different models, which can be used for future experiments.
Keywords: Level density models, photon strength function models, gamma normalization factors, branching point isotopes, s-process, MACS

PP-10: Nonlinear dust-acoustic waves in nonthermal complex plasmas with warm positive dust

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Using a Sagdeev pseudopotential approach where the nonlinear structures are stationary in a comoving frame, the arbitrary or large amplitude dust-acoustic solitary waves have been studied in dusty plasmas containing warm positively charged dust and nonthermal distributed electrons and ions. Depending on the values of the critical Mach number, which varies with the plasma parameter, positive supersonic and subsonic dust-acoustic solitary waves are found. It is found that our plasma system under consideration only supports the positive dust-acoustic solitary waves. The increasing effect of nonthermal parameters enhances the phase speed of dust-acoustic waves, but the latter decreases with the ratio of ion number density to the positive dust number density

(μ). It is observed that the amplitude (width) of the dust-acoustic solitary waves decreases (increases) as we decrease the value of μ. On the other hand, the amplitude (width) of dust-acoustic solitary waves decreases (increases) with increasing the values of the nonthermal parameter. The applications of our present work in space environments (viz. Earth's mesosphere, cometary tails, Jupiter's magnetosphere, etc.) and laboratory devices, where nonthermal ion and electron species along with PCD species have been observed, are briefly discussed.

Keywords: Dust-acoustic waves; sub- and supersonic solitary waves; nonthermal plasma medium; pseudopotenial approach;

PP-11: Studies On Some Models of Gamma-Ray Bursts, Recent progress, and Future Perspectives

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As the universe's most powerful and ephemeral sources of gamma-ray flashes, GRBs(Gamma-Ray Bursts) are the pinnacle of cosmic pyrotechnics. These energetic, fleeting, and unexpected phenomena were unintentionally discovered by American vela satellites 56 years ago, and have remained a puzzle since that. Gamma rays aren't inhibited by Earth's atmosphere, so when they are identified by satellites, ground-based telescopes are quickly prompted to conduct follow-up investigations at longer wave-lengths. There are at least two separate subtypes of GRBs(long and short duration), which are thought to occur in far-off galaxies. They are thought to be the outcome of stars collapsing or neutron stars merging, although the underlying physical mechanisms are still poorly understood. Through the implementation of numerous observational and theoretical models, the study of GRBs has achieved significant strides in recent years. These models have been used to describe the diversity of GRBs and to anticipate their characteristics. GRBs are also progressively being used as cosmological probes, both for analyzing galaxy evolution going back to the age of reionization and for inspecting the physics of gravitational wave sources. However, there are still a lot of unsolved concerns and work that has to be done. This study evaluates some of the most significant GRB models, including the fireball, magnetar, and binary neutron star merging theories, as well as internal and external shock models. In order to properly comprehend these fascinating occurrences, the study also emphasizes the significance of multi-wavelength observations and the necessity for additional theoretical and computational work. Overall, this study provides a comprehensive overview of the current state of GRB research and a glimpse into the future of this field.

Keywords: Ephemeral sources, Gamma-Ray flashes, Cosmic pyrotechnics, GRB models, sources, Gravitational wave, Significant, Satellites.

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Session: Materials Science

PP-12: Molecular Orientation Resolved (e, 2e) Cross Sections For CF_4 at 67 eV Impact Energy

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In thisstudy, the fully differential cross sections (FDCS) for low energy (E_0= 67 eV) electron impact ionization for a particular alignment and orientationof molecule about its axis aremeasured. In the full perpendicular plane,

the fully differential cross sections for electron impact ionization of CF_4 are determined experimentally by using a reaction microscope for several kinematics such as two ejected electron energy of 5 eV and 8 eV, and scattering angle of -25°, and -30°, and two molecular axis alignment of ϕ_{Mol} = 0°, and 45° and its relative orientation respectively. The momentum vectors of the two outgoing electrons (energies E_{e1}, E_{e2}) and one fragment ion are detected in triple coincidence (e, 2e + ion) [1]. For dissociation of the final CF_3^+ ion and neutral F in its electronic ground state, the momentum vector of CF_3^+ allows to conclude on the molecular alignment and orientation during the collision [2-4]. Finally, it is observed that the electrons are very sensitive due to the molecular orientation and alignment at low energy and low scattering angle.

Keywords: Electron impact ionization, reaction microscope, fully differential cross sections, (FDCS), molecular orientation and alignment.

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PP-13: Efficiency Analysis: Can Solar Energy Fill the Needs of Energy in Bangladesh?

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The energy crisis in Bangladesh is a burning issue nowadays, as this country is greatly dependent on fossil fuels. The government and the scientific communities are looking for alternatives that are sustainable methods to combat the current energy deficiency. This country receives average daily sunshine duration of around 12 hours and the energy out of it is ranging from 4.5 to 4.8 kWh/m^2 which can be proved very significant for a sustainable power sector. Adaptation of solar energy is already a promising long-lasting approach, and numerous solar panels have already been installed in both urban and rural areas. But the efficacy of this technique depending on the geographical location has not been assessed, especially in the different parts of the country with several distinct seasons. To assess this, data analysis using Python programming language has been utilized to interpret the efficiency of utilizing solar energy in Bangladesh. The solar energy and the intensity of sunlight reaching the surface of the country around the year have been taken into consideration to conduct the research. This study will present the feasibility of solar energy for all divisions of the country, show comparisons among them, and also the seasonal impacts on the utilization of solar energy. Also, the other possible and/or viable options will be recommended when necessary.

Keywords: renewable energy, python, solar radiation

PP-14: (1-x)$Ba_{0.6}Sr_{0.4}Cr_{0.6}Ti_{0.4}O_3$+(x)$CoFe_{1.8}La_{0.2}O_4$ Composites: Synthesis and Analysis of Multiferroic Properties via Double Sintering Ceramic Technique

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The multiferroic composite ((1-x)BSCTO+(x)CFLO) with different concentrations, x = 0.0, 0.2, 0.4, 0.6, 0.8, 1.0 was obtained by combining a ferroelectric material, (1-x)$Ba_{0.6}Sr_{0.4}Cr_{0.6}Ti_{0.4}O_3$ and ferrite material (x)$CoFe_{1.8}$ $La_{0.2}O_4$ using the traditional double sintering ceramic process. The tetragonal structure perovskite (BSCTO) phase and the spinel cubic structure of the ferrite (CFLO) phase are revealed by X-ray diffraction investigation. Morphological characterization evidence that the increase in Fe doping amount leads

to increased average grain size. FTIR analysis confirms the presence of metal oxide bonds (M-O & M-O-M). The saturation magnetization (M_s) and remanent magnetization (M_r) of the composites enhanced after $CoFe_2O_4$ was assimilated into them. At x = 0.4, the highest coercivity (H_c) value is observed. According to electrical analysis, the composite with x = 0.4 has the highest coercivity field (E_c), remanent polarization (P_r), and polarization (P) value among all other concentrations. The results of the U-V analysis show that all of the samples are wide-bandgap semiconductor materials, allowing devices to operate at far higher voltages, frequencies, and temperatures than typical semiconductor materials.
Keywords: Multiferroics; Saturation; FTIR; Polarization; Band-Gap.

PP-15: Synthesis and Characterization of Nickel-Doped Barium Titanium Iron Oxide ($Ba_{1-x}Ni_xTi_{0.8}Fe_{0.2}O_3$) Ceramics

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Conventional solid-state reaction method from barium carbonate ($BaCO_3$), nickel oxide (Ni_2O_3), titanium dioxide (TiO_2) and iron oxide (Fe_2O_3) raw materials prepared $Ba_{1-x}Ni_xTi_{0.8}Fe_{0.2}O_3$ solid solutions. Ni has been doped at the A- site of $Ba_{1-x}Ti_{0.8}Fe_{0.2}O_3$ compositions with x =0.0, 0.02, 0.04, 0.06, 0.08 and 0.10 have been investigated by structural magnetic and dielectric properties. All the samples have been pre-sintered at 800° C and sintered 1300 °C for four hours. Mechanochemical reaction leads to the gradual formation of $BaTiFeO_3$ phase. The structural analysis has been caried out by XRD, FTIR use the transmission and absorption of the sample, RAMAN provides the chemical structure and molecular interactions. Investigations of electrical and magnetic properties has been carried out from the measurements of dielectric constant, resistivity, permeability, loss factor, and M-H curves of the samples using spectrometer, impedance analyzer and VSM analysis and it was shown that the formation of $BaTiFeO_3$ phase. Ni doping in $BaTiO_3$ exhibit many interesting features, such as shift in transition temperature, increasing diffuse phase transition and decreasing dielectric constant Ni^{2+}(r_6^{2+} = 0.69Å) ions substituting Ba^{2+}(r_6^{2+} = 1.35Å) site due its small ionic radius. Our aim to demonstrate that the what's the change on structural, dielectric and magnetic properties when Ni doped on $Ba_{1-x}Ti_{0.8}Fe_{0.2}O_3$.

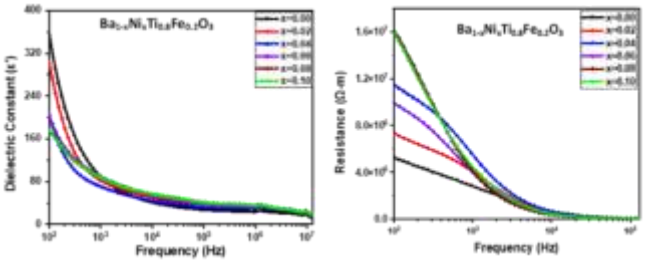

Fig.1: Shows the change dielectric constant and resistance varies with frequency.
Keywords: Ceramics, $BaTiFeO_3$ doping Ni, XRD, VSM, FTIR, RAMAN, Dielectric and Magnetic property.

PP-16: Annealing Time and Temperature Effects on Crystallization Kinetics and Activation Energy of $Co_{72}Fe_8B_{10}Si_{10}$ Amorphous Ribbon

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The soft magnetic amorphous ribbon materials represent the phase transformation occurring under the extreme situations that are widely used in various applications such as the power transformer and inductive devices. The step annealing time and temperature effects on kinetics of crystallization are different phases of $Co_{72}Fe_8B_{10}Si_{10}$ amorphous ribbon were taken in nitrogen atmosphere with continuous heating rate of 10 to 60°C/min in step of 10°C and heating rate up to 800°C has been studied by DTA. Two exothermic from DTA curve are evident attwo distinct crystallization temperatures. The first crystallization peak is α-FeCo(Si) phase and second

crystallization peak Fe_2B phase. The effect of annealed on crystallization peaks are corresponds structural relaxation due stress release formed by rapid solidification and difference are affected by different anneal temperature and time effect but increased as-quenched glassy state. The crystallization activation energy of the amorphous alloy was calculated using the Kissinger's equation. The activation energy of as-cast ribbon of α-FeCo(Si) phase increases with annealing temperature up to 300^{o}C whereas Fe_2B phase primly slightly increase after decreasing trend up to 450^{o}C. Boride phase is discontinuous activation energy relaxation effects utilize at annealed temperature increase to break single metastable crystalline phase with annealing time form metallic glass state ribbon.The α-FeCo(Si) phase an activation energy being linearly increases with increasing annealed ribbon related to the instantaneous magnitude and inculcation depend on step annealing time implies suitable size confirmed for soft magnetic nature for particular fundamental Si phase peaks [110] from XRD pattern. Kinetics anisotropy reorientation depends on the instantaneous state can be used as soft magnetic glass materials.

Keywords: Amorphous Ribbon; DTA; Annealing; Activation energy.

PP-17: Chalcopyrite Semiconductors of $HgXN_2$ (X=Si, Ge and Sn): A DFT Study for Photovoltaic and Thermo-mechanical Applications

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In recent times, the research community has paid much attention to chalcopyrite compounds due to its exceptional physical properties, which are very compatible with photovoltaic applications. The ground state physical properties of Hg-based chalcopyrite semiconductor compounds are investigated density functional theory (DFT), which is based on full potential linearized plane wave (FP-LAPW) method. The structural, electronic, optical, mechanical and thermal properties of the body-centred tetragonal (BTC) phase, $HgXN_2$ (X=Si, Ge and Sn), have been calculated using the modified Becke-Johnson exchange potential (TB-MBJ). The calculated lattice parameters and volume are well consistent with the prior report. The positive values of the elastic stiffness constants confirm the mechanical stability, and the phonon frequency ensures the dynamic stability of all title compounds. The electronic band structure demonstrated a direct band gap of 1.70 eV, 0.99 eV, and 0.94 eV for the $HgXN_2$ (X=Si, Ge and Sn) compounds, respectively. All these compounds have a lower optical reflectivity and high absorption coefficient in the visible light range. Due to the favorable band gap and high absorption coefficient, these compounds could be suitable for optoelectronic/ photovoltaic device applications. Moreover, the thermal expansion coefficient, thermal conductivity, melting point and fracture toughness behavior can be calculated, which also could show promise for thermal barrier coating (TBC) applications.

Keywords: Chalcopyrite compounds, Mechanical properties, Optical properties, Thermal properties, Density functional theory

PP-18: Influence of Bi_2O_3 addition on the magnetic properties of Li-Cu-Mg-Zn ferrites

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The magnetic properties of Bi_2O_3 added Li-Cu-Mg-Zn ferrites having the general formula $Li_{0.25}Cu_{0.10}Mg_{0.10}Zn_{0.3}Fe_{2.25}O_4$+ xBi_2O_3 (where x = 0.0, 0.2, 0.3, 0.4, 0.6 and 0.8 wt%) have been studied along with the microstructural feature. The samples are prepared by the conventional solid-state reaction technique. The samples have been sintered at 950 ^oC. From the X-ray diffraction technique, it is observed that all the prepared samples have shown a single phase cubic spinel structure. The microstructural study shows that the average grain size is strongly dependent on the amount of Bi_2O_3 addition. The saturation magnetizations (M_s) have been observed from the magnetic hysteresis loops. The Neel temperatures (T_N) have been measured from the magnetization (M) curve as a function of temperature at a constant magnetic field. It is clearly demonstrated that the value of M is constant up to an onset temperature and then it decreases rapidly with the increase of temperature following a sharp fall to zero value. This indicates to the paramagnetic (PM) transition from the ferromagnetic (FM) phase. The value of T_N is found to larger at x = 0.4 wt% Bi_2O_3 addition compared to the other samples.

Keywords: Bi_2O_3 addition; spinel ferrite; hysteresis; saturation magnetization, Neel temperature

PP-19: Effect of hydrostatic pressure on structural, elastic, and optoelectronic properties of $ScCuO_3$ via DFT approach

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A comprehensive investigation of the structural, elastic, electronic, and optical properties of $ScCuO_3$ perovskite has been performed using density functional theory (DFT). Under pressure, the structural and mechanical stabilities of this compound have been established. The values of Pugh's ratio (B/G) and Zener anisotropy factor indicated that $ScCuO_3$ exhibits ductile behavior and elastic anisotropy at different pressures. The metallic behavior of $ScCuO_3$ is confirmed by the electronic band structure where a few valence bands cross the Fermi level. The Cu-3d and O-2p orbitals overlap near the Fermi level which is found from the density of states diagram. Under the applied pressure, the strong hybridization between Cu-3d and O-2p states is observed. Different optical properties (dielectric function, conductivity, absorption coefficient, loss function, reflectivity and refractive index) are also analyzed. The highest reflectivity is found in the low-energy region which assures the application of this compound as a coating material to reduce solar heating. Both the absorption spectra and optical conductivity reflects the metallic nature which is supported by electronic band structure calculations. The present work opens up new possibilities for using $ScCuO_3$ in various optoelectronic device applications.

PP-20: Study on structural, optical, and magnetic properties of La^{3+} doped Cobalt-Zinc nano ferrites

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In this report, $CoLa_xZnFe_{2-x}O_4$ nano ferrites synthesized by the sol-gel auto combustion method have been studied. The XRD analysis confirmed the formation of the single-phase cubic spinel structure with minor impurity at x=0.10- 0.20. The mean crystallite size decreases with increasing La^{3+} concentration in the range of 41 nm to 26 nm. Two major functional groups were found from FTIR spectra confirmed the presence of metal oxide bond within the range 600 to 350 cm^{-1}. Microstructural analysis from FE-SEM revealed the irregular-shape grain morphology with size in the range of ~ 80 nm to 25 nm. The EDX spectra of the samples confirmed

the presence of Co, Zn, La, and Fe elements. The optical band gap (Eg) estimated from the UV-VIS-NIR diffuse reflection data of the powder samples was found to vary (~1.53 to 1.59 eV) and consistently increased with the increase of La^{3+} content. The magnetic properties of the sample's such as saturation magnetization (M_S), magnetic moment (μ_B), and coercivity (H_C) were obtained from the respective hysteresis loops and revealed that synthesized ferrites are soft ferrite nature and may be integrated for suitable device applications.

PP-21: Effect of Gd substitution on the electromagnetic properties of Mg-Cu-Zn ferrites

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In this study, the solid-state reaction technique was used to prepare Gd substituted Mg-Cu-Zn ferrites with the compositions of $Mg_{0.3}Cu_{0.2}Zn_{0.4}Gd_xFe_{2.1-x}O_4$ (where x = 0.0, 0.01, 0.02 and 0.04). X-ray diffraction was used to examine the structural characteristic, and it revealed a single-phase cubic spinel structure for x = 0.01. Nevertheless, for x > 0.01, a secondary phase of $GdFeO_3$ coexists with the cubic spinel structure. The average grain size for x = 0.01 was found to larger at x = 0.01 compared to other compositions. Vibrating sample magnetometer (VSM) measurement has been used to determine the magnetic parameters such as saturation magnetization, remanent magnetization, coercivity, squareness ratio and anisotropy. Frequency dependent dielectric constant has been measured for all the prepared samples. The dielectric constant decreases as the increased of frequency following the Maxwell-Wagner polarization model. AC electrical conductivity has also been observed. It indicates that AC conductivity shows a sharp increase at higher-frequency region, which could be attributed to the enhancement of electron hopping between the Fe^{2+} and Fe^{3+} ions in the ferrite matrix.

PP-22: Magnetocaloric effect of rare-earth-based perovskite manganite for magnetic refrigeration

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The magnetocaloriceffect of $La_{1-x}Sr_xMnO_3$ (x = 0.2, 0.3, 0.4) perovskite manganite have been studied.The crystal structure of the prepared samples has shown a rhombohedral structure,which is confirmed by X-ray diffraction technique. The lattice parameterand tolerance factor have been calculated from thisstudy. The magnetocaloric effect has been observed in terms of entropy change ($-\Delta S_m$) and relative cooling power (RCP). The value of the Curie temperature (T_c) for x = 0.3 is 312 K, which is near room temperature, while the values of $(-\Delta S_m)_{max}$ are 1.031 and 2.245 J/ (kg. K), and the values of RCP are 95 and 278 J/K for H = 2 and 5 T, respectively. Investigated samples possess a moderate amount of maximum entropy change $(-\Delta S_m)_{max}$and large relative cooling power (RCP), wide working temperature range and tunable T_c. But the $La_{0.7}Sr_{0.3}MnO_3$compound comparatively exhibits the largest value of RCP at T_c = 312 K which is very near to the room temperature. These properties along with T_c near room temperature make $La_{0.7}Sr_{0.3}MnO_3$ can be considered as the promising candidate for magnetic refrigeration application.

PP-23: Pressure and temperature dependent exploration elastic anisotropy, acoustic and thermodynamic properties of Cesium Niobate

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The effect of pressure and temperature on mechanical, acoustic, and thermodynamic properties of cubic $CsNbO_3$ has been illustrated with the help of a substitution based strategy utilizing first principles method. The high values of average sound velocity, acoustic impedance, and intensity of sound radiation exhibit the potential acoustic applications of the compound. The high Debye temperature and high melting temperature, high heat capacity, low thermal expansion coefficient, and minimum value of thermal conductivity substantiate the compounds to be used as thermal management material. The $CsNbO_3$ is elastically anisotropic and the elastic anisotropy factors, and Debye temperature can be seen as the monotonic function of pressure. The low value of the Gruneisen parameter and the high value of lattice thermal conductivity proclaim well lattice conductivity and low anharmoinicity of the material. The monotonic delaine of lattice thermal conductivity with temperature can be seen for $CsNbO_3$. The significant response of enthalpy, entropy, free energy, constant pressure heat capacity, and constant volume heat capacity with the change in pressure and temperature have also been analyzed, which may be supportive for future investigations of $CsNbO_3$ through experiments and theories.

PP-24: Characterization of Nano-Structured Magnesium-Aluminum Ferrites Synthesized by Citrate-Gel Auto Combustion Method

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An effort is taken to get the solution to the new challenges of modification advancements in ferrite technologies. The hypothetical variation in the structural, magnetic and electrical properties of cubic spinel magnesium aluminium ferrites introduced by the substitution of doping elements have been rationalized and proved. The outcome of aluminium substitution on the magnesium ferrites has been examined and investigated. Spinel ferrites having compositions of $MgAl_xFe_{2-x}O_4$ (x = 0.1, 0.2, 0.3, 0.4) were prepared by the sol-gel auto-combustion method. The prepared samples characterization such as Scanning electron microscopy (SEM), DC electrical resistivity, AC electrical resistivity, and dielectric properties measurements were tested using the respective instruments. The grain size and crystal size of all samples were measured from the micrographs of SEM and XRD Data. It is found that the average grain size is within the range of 300 nm - 550 nm for all different series which is formed keeping the samples at 1100°C sintering temperatures. Two-probe method experiment having the temperature from 30°C to 500°C gives the data of dc electrical resistivity. The Curie temperature is depending on the sintering temperature and it increases with increasing doping concentration. Also, doping has an effect on grain size and it is decreasing with increasing concentration. Analyzing the SEM micrographs, it is found the average grain size has to decrease tendency with the increasing of Al content. DC electrical resistivity exhibits excellent semiconducting behaviour. Frequency dependence dielectric constant and dielectric loss factors were measured keeping the frequency range of 75 Hz to 130 MHz at room temperature. The result shows that dielectric constant (ε) and dielectric loss tangent (tanδ) decrease with the increase in frequency and the ac resistivity and Q-factor increase. Comparing the electrical properties of four compositions can be said that the mixed ferrite, sample-4 (x=0.3), shows the highest Q-factor of all at 1100°C.
Keywords: Mg-Al ferrites, sol-gel, nanocrystalline, magnetic properties, electric properties, dc resistivity, dielectric, loss tangent.

Session: Nano Structure Physics

PP-25: Structural with Rietveld Refinement Analysis, Cation distribution, Magnetic, Electrical and Dielectric Properties of Al substituted Ni-Cd dense Ceramics Obtained From Nanocrystalline Powder.

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By employing a solution combustion technique, transition element Al substituted Ni-Cd magnetic nanoferrites have assembled as bulk ceramics from nanocrystalline powder, which has the general formula $Ni_{0.65}Cd_{0.35}Fe_{2-x}Al_xO_4$ (x = 0, 0.015, 0.030, 0.045, 0.060) and demonstrates how the amount of Al substitution tune their structural, magnetic and electrical features. Structural with Reitveld refinement analysis like goodness of fit, cation distribution, maximum entropy method etc. and optical characteristics are investigated using XRD data and UV-vis spectroscopy. The formation of a single phase spinel structure has confirmed by XRD investigation and Reitveld refinement. The substitution of Al shown to drop in the lattice constant indicates incorporation of Al in the crystal lattice. The crystalline size have determined 36-38 nm with the help of Scherer's formula, 36nm to 43 nm by modified Scherer's formula , 43-64 nm in W-H plot and 38-42 nm in strain size method. Initial permeability have found to increase with substitution of Al. The electrical conductivity has increased along with Al content and frequency. The real and imaginary components of the dielectric spectroscopy have investigated with frequency and found to decrease with the addition of Al. The loss tangent and eddy current loss both also have found to decrease with frequency. Complex impedance study showed that both the grain resistance and the grain boundary resistance increase with Al content.

Keywords: Nanocrystalline powder, XRD, Rietveld refinement, Cation distribution, Maximum Entropy Method.

PP-26: Hydrothermal Synthesis of Cadmium Oxide (CdO) Nanoparticles for Solar Cell Application

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Metal oxides have been receiving increasing attention over the couple decades because of their unique properties and very wide range of applications. In this research Cadmium oxide (CdO) nanoparticles had been synthesized by using an easy, cost effective, and green technique hydrothermal method. Effect of hydrothermal treatment time in their shape, size, and optical properties was investigated. X-ray diffraction analysis (XRD) spectra identified typical cubic monteponite structure of CdO with an average grain size of 43.12, 45.65 and 56.54 nm along with the treatment time of 6, 14 and 22 hours respectively. Overall results depicted that the shape and size of CdO nanoparticles were changed with the treatment time. UV-Vis spectroscopy identified the broad absorption bands centered at 320.64 nm, 320.18 nm, and 310.12 nm for treatment time 6, 14, and 22 hours respectively. This blue shift in the absorption band of CdO nanoparticles was exhibited due to the quantum size effect. Moreover, band gap energy was calculated by using Tauc plot. The band gaps were found to be 2.58, 2.46 and 2.42 eV for CdO nanoparticles treated for 6, 14 and 22 hours respectively. Fourier Transform Infrared (FTIR) Spectroscopy explored the absorption peaks near 424, 1431 and 3511 cm^{-1} that confirmed the presence of Cd-O, C-H and -OH group respectively. The broad absorption bands and wide band gap of CdO nanoparticles have made them potential candidates for the solar cell and many more optoelectronic applications.

PP-27: A Case Study on Toxicity Effects of Metal Oxide Nanoparticles Utilization

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Various metal oxide nanoparticles are now in concern of emerging science for its' feasibility in various applications. On the other hand these possess toxicity which becomes more concerning issue in the case of efficient utilization. ZnO nanoparticles are highly toxic to NIH/3T3 cells, inducing viability loss, and membrane leakage and morphology changes. Nano-sized metal oxides were more poisonous to Sprague Dawley rats than micro-sized metal oxides. When the NP size was reduced, cytotoxicity and ROS generation increased. 70 nm ZnO particles are more cytotoxic than 420 nm ZnO particles due to their smaller size and greater (SSA) specific surface area. Metal oxide NPs (100 nanometer) have been shown to be highly hazardous to human oral mucosa cells, with and without UVA-1 irradiation. UVA1 treatment for 15 minutes at a concentration of 0.2 g/ml NPs

led to tumor cell eradication [2]. Because of our investigation, the main information provides the data that we found regarding the toxicity of metal oxide nanoparticles with size.
Keywords: Cytotoxicity, Ecotoxicity, Phototoxicity, Genotoxicity, Metal Oxide Nanoparticles.
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PP-28: An overview on modification of Metal Organic Framework.

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The unusual combination of high surface area and variable pore size has made metal-organic frameworks (MOFs) a popular topic of study in recent years. MOFs have the potential to be used in many different areas due to the mix of metal ions and organic linkers. These areas include gas storage and separation, catalysis, and medication delivery. Post-synthesis modification, covalent modification, and surface functionalization are only some of the latest developments in MOF modification. Adding functional groups to the MOF surface after synthesis is called post-synthesis modification, while covalent modification entails the establishment of covalent bonds between the MOF and functional groups is called covalent modification. During surface functionalization, functional groups are adsorbed or covalently bonded to the MOF surface. Evidence suggests that MOFs' stability, selectivity, and reactivity can be improved by these modification methods, making them more desirable for use in the real world. Our research will reveal that MOF modification is a thriving research field that has seen significant progress in recent years.
Keywords: MOFs, covalent modification, surface functionalization, modification methods.
References:
[1] A. Name et al., Journal Name, **Volume No.** Page No. (Year).
[2] B. Name et al., Journal Name, **Volume No.** Page No. (Year).

PP-29: A Case Study on photocatalytic acivity of TiO_2 nanomaterials.

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Because of their photocatalytic activity, nanoparticles made of TiO_2 are becoming increasingly essential for use in environmental applications. The photocatalytic activity of the TiO_2 nanomaterials has been measured by measuring the degradation rate of a model pollutant for example, methylene blue, under the irradiation of ultraviolet light, and this method has been demonstrated to be practical in a number of studies. According to the findings, the crystalline phase, particle size, and surface area of the TiO_2 nanomaterials all played an important part in the photocatalytic activity of the materials. Because of the strong photocatalytic activity of the TiO_2 nanoparticles, it is possible that they might be employed for the treatment of waste water, as well as the removal of contaminants from water and air. The results of our research will provide a comparison of the efficiency of TiO_2 nanoparticles with their size.
Keywords: TiO_2 Nanoparticles, Photocatalysis, Dye-degradation, morphology.

PP-30: A Case Study on Energy storage applications of Zeolitic Imidazolate Framework

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Zeolitic Imidazolate Framework (ZIF) is a new class of microporous materials that has been gaining significant attention in the electronic industry due to its unique combination of high surface area, tunable pore size, and attractive chemical stability. One of the key applications of ZIF in electronics is as a dielectric material in capacitors, where its high surface area and tunable pore size make it an excellent candidate for energy storage. Additionally, ZIF's chemical stability and low dielectric loss make it a promising material for use in high-frequency electronic components such as filters and oscillators. ZIFs can also be used in lithium-ion batteries, sodium ion batteries, capacitor, supercapacitor, solar cell etc. In this study, we will show the efficiency of ZIFs in potential application in electronic industry with several ZIFs and their size.
Keywords: Lithium-Ion Batteries, Sodium Ion Batteries, Capacitor, Supercapacitor, Solar Cell, ZIFs.

PP-31: An overview on TiO_2 nanoparticles as cancer treatment therapy

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Titanium dioxide (TiO_2) nanoparticles have gained interest as a potential cancer treatment therapy due to their unique photophysical and photocatalytic properties. TiO_2 nanoparticles are able to generate reactive oxygen species (ROS) under light illumination, which can cause oxidative stress and induce apoptosis in cancer cells. Additionally, TiO_2 nanoparticles have shown the ability to enhance chemotherapy and radiotherapy efficacy, making them a promising adjuvant therapy. In vitro and in vivo studies have demonstrated the effectiveness of TiO_2 nanoparticles in treating various types of cancer, including breast, prostate, lung, and skin cancer. However, the biocompatibility and safety of TiO_2 nanoparticles still need to be thoroughly evaluated, as there are concerns about potential toxicity and inflammation caused by the generation of ROS. Nevertheless, the potential of TiO_2 nanoparticles as a cancer treatment therapy is promising and further research is needed to optimize their efficacy and safety for clinical application. Our study will review the applications of TiO_2 nanoparticles as cancer treatment therapy.
Keywords: Metal Oxide Nanoparticles, Antase, Rutile, Cancer.

PP-32: Structural, Magnetic and Optical Properties of Double Perovskite Y_2CoCrO_6 nanoparticles

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Y_2CoCrO_6 (YCCO) double perovskite nanoparticles have been successfully synthesized by adopting the facile sol-gel method. The Rietveld refinement of the XRD pattern of YCCO nanoparticles revealed a single-phase monoclinic structure with the $P2_1/n$ space group. Thermogravimetric analysis revealed the excellent thermal stability of the synthesized nanoparticles. The average particle size of YCCO nanoparticles is around 80 nm determined by both field emission scanning electron microscopy and transmission electron microscopy imaging. The selected area electron diffraction pattern revealed the good crystallinity of the material. The existence of mixed valence states of Fe and Cr ions in the YCCO compound was confirmed by X-ray photoelectron spectroscopy. The temperature dependent magnetization curve revealed the transition from paramagnetic to antiferromagnetic at around 143 °C. The unsaturated magnetic hysteresis loops exhibited the coexistence of weak ferromagnetic and antiferromagnetic domains in YCCO nanoparticles. The UV-visible spectroscopy ensured that YCCO nanoparticles have a direct band gap of ~2.30 eV, which was further confirmed by photoluminescence spectroscopy. Thermally stable YCCO material can be a new prospective material for applications in spintronics, optoelectronics, and photocatalysis due to its intriguing structural, magnetic, and optical properties.
Keywords: Double perovskite, Sol-gel method, Nanoparticles, Weak ferromagnetism, Band gap.

PP-33: A Novel Dynamic Method Utilizing Silver Nanoparticles for the Power Generation in Bryophyllum Pinnatum.

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The production of electricity and the demand for it have been significant tasks for the entire world, especially during wartime when conventional fuels are inaccessible.The Bryophyllum Pinnatum cell with silver nanoparticles (Ag NPs) can provide a relatively high power supply, which is more than the supply of its typical electrochemical cell, in order to resolve this problem by producing energy from biomass.

B.Pinnatum Leaves ⇨ Leaves Extract ⇨ $AgNO_3$ Solution=Ag NPs

For each module, we employed 2 ml of Ag NPs and 140 g of BPL extract.Moreover, we obtained average significant data with and without NPs.

Date	Local Time (hr)	Time Duration (min)	Open Circuit Voltage,V_oC (v)		Short Circuit Current,I_{sc} (mA)		P_{max} $=V_oC*I_{sc}$ (mW)		R_{in} $=V_oC/I_{sc}$ (mΩ)	
			With NPs	Without NPs	With NPs	With out NPs	With NPs	Without NPs	With NPs	With out NPs
1.9.2022	1.00 pm	1485	6.18	6.15	25	20.59	154.5	126.6285	0.2472	0.2987

We can observe from the data how much the use of Ag NPs enhanced both open circuit voltage and short circuit current.Moreover, the NPs module's supply power of the cell has grown by about 19.61%. (mW).Moreover, the NPs module's resistance has also been reduced.The dynamic potentiality of Ag NPs in the bio-electrochemical cell is a significant research project that may help to uncover a potential solution for the energy problem and the development of bio-electrochemical cells.

Fig. 1: Experimental setup for measuring LED power in both cells with and without nanoparticles.

Keywords: Bryophyllum pinnatum,BPL bio-Electrochemical cell, Green synthesis, Power generation, Silver nanoparticles.

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PP-34: Synthesis and Characterization of Hydroxyapatite and Nickel Ferrite Nano-Composites for Biomedical Application.

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Hydroxyapatite (Hap) is one of the most adaptable biomaterials used for implantation and grafting due to its close similarity to the material with which teeth and bone tissues are made [1]. Magnetic nanoparticles have potential use in the biomedical industry because of their unique mechanical, thermal, physical and chemical properties [2]. Due to the fascinating properties of magnetic nanoparticles, they have been utilized in magnetic resonance imaging (MRI), controlled drug delivery to cancer/tumour cells, tissue growth, cell separation, and gene delivery [3]. Magnetic nanoparticles have been the topic of strong research because of their possible applications in high-density magnetic recording, magnetic fluids [4]. Amongst the several ferrite materials for magnetic recording applications, nickel ferrite ($NiFe_2O_4$) has been widely considered because it retains excellent chemical stability and good mechanical hardness [5]. In this work nano composites of Hap and nickel ferrite was synthesized using wet chemical co-precipitation method. Nickel ferrite and Hap powder was mixed with the ratio of 4%,8%, then sintered at different temperatures to get the fine mixer powder. Enhancement of magnetic properties of nano Hap were observed after mixing with nickel ferrite. Characterization of Hap and nickel ferrite and their composites were done with XRD, FTIR, RAMAN, PPMS. The experimental results show that this nano-composites would be useful for biomedical applications such as repair of massive bone imperfection, bone tissue engineering, elimination of heavy metals and more importantly in drugs delivery.
Keywords: Hydroxyapatite, Nickel ferrite, XRD, RAMAN, Biomedical Applications, Nano-magnetic ceramics.

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PP-35: Structural, Optical, and Electromagnetic properties of Zinc Oxide (ZnO) and Iron-doped Zinc Oxide (Fe: ZnO) nanoparticles

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Due to their enhanced biocompatibility and multifunctional capabilities, smart nanoparticles for medical applications have drawn a lot of attention. These applications include advanced drug delivery systems, nanotheranostics, in vivo imaging, and electronic device manufacturing. It is possible to make use of the doping of ZnO NPs to improve the ZnO characteristics that currently exist and add whole new functions to the doped material. Zinc oxide (ZnO) and iron-doped zinc oxide (Fe: ZnO) nanoparticles were synthesized by the wet-chemical method to observe the influence of iron deficiency levels upon their morphological, structural, electronic, elastic, and optical properties. The techniques of dynamic light scattering (DLS), Fourier transform infrared (FTIR), X-ray diffraction (XRD), and scanning electron microscopy (SEM) are used to determine the lattice parameter, crystal structure, crystallite size, and particle size. The XRD and FTIR patterns demonstrate the formation of the "Wurtzite structure." The lattice parameter increased with the increasing iron content up to an optimum value of iron doping (10 wt%), following a decreasing trend. The lattice parameter increased from 0.4270676 nm until it reached 0.427124 nm, then it declined as the iron content rose. FTIR data was used to determine the functional group of Fe in ZnO samples at various peaks.- Zn-O at around 399 cm^{-1}, $-CH_2-NH_2$ (Aliphatic amine) at 1074.35-1085.92 cm^{-1}, -co at 1438.92-1440.83 cm^{-1}, and it was discovered that the functional groups corresponded to the Zn-O bands in the samples. The crystal size was found to increase with the amount of iron doping up to a maximum value of 20 wt%, then it decreased, just like what was visible in the SEM image. The particle size was found in the 143-233 nm range by using ImageJ software. The absorption peak indicates a strong UV absorption was present for all samples at λ=350 nm. For all the samples, the computed band gap value was around 3.0 eV. The photocatalytic degradation of methyl red dye in an aqueous medium exposed to UV-visible light irradiation was used to test the photocatalytic activity of Fe: ZnO

photocatalyst. The obtained results demonstrate that doping ZnO NPs is an effective method for enhancing their related biological and electrical characteristics, and they imply that a novel use for Fe-doped ZnO NPs in semiconductor device production and nanomedicine is feasible.
Keywords: lattice parameter, crystal structure, crystallite size, absorption, photocatalytic degradation.

PP-36: Investigation of Structural, Optical, Ferroelectric and Electrical Properties of Ce^{3+} Substituted Cu-Zn-Al Nanoferrites

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Rare earth Ce substituted $Cu_{0.65}Zn_{0.35}Fe_{1.925-x}$ $Al_{0.075}$ Ce_xO_4 (x = 0.00, 0.012, 0.024, 0.036, 0.048, 0.060) nanoparticles have synthesized through sol-gel process are being considered as novel technique to obtain nanoparticles in the scientific point of view due to their wide range of uses specially in high frequency devices and biomedical applications. Lightly substitution of Ce^{3+} in the Fe^{3+} sites have been shown a great impact on the structural parameters, optical ferroelectric and electrical behavior through XRD, FT-IR, UV-Vis, PE loop hysteresis and impedance analyzer characterization respectively. The XRD patterns confirmed the formation of single phase cubic spinel structure of the synthesized samples and analysis of XRD data showed the reduction in crystallites size, cell volume and lattice constant increases with Ce content. FTIR and UV–Vis also confirmed the indirect energy band gaps (E_g) were found in decreasing with Ce content. Moreover the cation distribution among tetrahedral (A) and octahedral (B) sites is performed through Rietveld analysis and thus the mechanism for the various in properties can be explained. Impedance analyzer inveterate that the dielectric constants have declining and ac conductivity have growing trend at fix value of Ce^{3+}concentration with rise of frequency. The study reveals the potentiality as a new class of functional materials with improved structural, optical and electrical properties to explore their potential application in different fields.
Keywords: Ce substituted CuZnAl nanoferriotes, FT-IR, UV-Vis and PE hysteresis.

PP-37: Synthesis of $Ca_{1-x}Sr_xMnO_4$ Scheelite novel nanoparticles by sol-gel method

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The preparation and characterization of $Ca_{1-x}Sr_xMnO_4$ (where x = 0.0, 0.1, 0.2, 0.3, 0.4) have been performed which is a possible candidate of cathode material for intermediate temperature solid oxide fuel cell. To prepare those materials, modified Pechini Sol-gel method has been utilized. The powders were characterized by X-ray diffraction, Fourier Transform Infrared spectroscopy (FTIR). The XRD data of the materials have been indexed with the Chekcell software and Rietveld refinements have been done by FullProf suite program and are found to be Single phase of cubic scheelite. The microstructural parameters such as size, stress, strain, crystal energy are obtained from XRD line broadening data. The characterized properties of this material reveal that it can be suitable to use as cathode material in solid oxide fuel cells (SOFCs)
Keywords: Scheelite, Nanoparticles, Solid oxide fuel cells, Sol-gel.

PP-38: Green Synthesis of Nickel Oxide Nanoparticles from Ocimum Sanctum by a Facile Hydrothermal Method for Biological Applications

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A simple, affordable and ecofriendly approach for synthesizing nanoparticles (NPs) has become a major focus in recent years. In the present work, the green synthesis of nickel oxide (NiO) NPs was prepared from aqueous leaf extracts of ocimum sanctum (Tulsi), which is considered a cheap, easy and non-toxic process. The leaf extract was prepared firstly by drying, downsizing and pulverizing the freshly collected leaf to make fine powder, and 0.3 g of powder was then poured in 30 mL of distilled water and stir on magnetic hot plate with 1000 rpm rotation at raised temperature up to 70 °C for a 10 min. For a hydrothermal synthesis adapted from literature with slight modifications [1,2], 0.5 M $NiSO_4 \cdot 6H_2O$ was dissolved in 30 mL distilled water and finally 12 mL leaf extract was added with vigorous stirred overnight with controlled pH at 7.6. The solution was poured into an autoclave, sealed and heated up to 80 °C for 6 hours. The final product was then washed and dried at 115 ^oC for 2 hours to obtain nanoparticles. The synthesized NiO NPs were annealed at different temperatures (400, 500, and 600 ^oC) to remove the organic residues. The distinctive peak in the UV/Vis spectrum seen at ~340 nm proved that the formation of NiO NPs. The synthesize NiO NPs were exhibited as face centered cubic structures confirmed by X-ray diffraction studies [2]. The presence of N–H, C–N, C–H, and O–H groups were confirmed by Fourier transform infrared spectroscopy, which corresponds to the presence of metabolites and proteins from leaf extract and NiO at ~3513 cm^{-1} [3]. The particle size distribution was further examined by scanning electron microscopy which depends on annealing temperature. The antibacterial activity of NiO NPs will be examined against gram negative bacteria, gram positive bacteria for further study and expected to high activity against bacterial strains.
Keywords: Green synthesis, tulsi leaf, nickel oxide, nanoparticles, hydrothermal process, antibacterial activity
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PP-39: Hydrothermal Synthesis and Characterization of SnO_2 Nanoparticles using Fruit Extract of Myristica fragrans: Antibacterial Activity Application

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This study is aimed to synthesize tin(II) oxide nanoparticles (SnO_2 NPs) by using the extract of Myristica fragrans fruit for antibacterial activities. In the present work, the green synthesis of SnO_2 NPs was prepared from fruit extracts of Myristica fragrans. The fruit extract was prepared firstly by drying, downsizing and pulverizing the freshly collected fruit to make fine powder, and 0.6 g of powder was then poured in 60 mL of distilled water and stir on magnetic hot plate with 800 rpm rotation at raised temperature up to 65 °C for a 10 min. The synthesis procedure was adapted from literature with slight modifications [1,2], 0.5 M $SnCl_2 \cdot 6H_2O$ was dissolved in 50 mL distilled water and finally 20 mL fruit extract was added with vigorous stirring for 4 hours with controlled pH at 7.0. The solution was poured into an autoclave, sealed and heated up to 80 °C for 5 h. The final product was then washed and dried at 115 ^oC for 2 h to obtain nanoparticles followed by annealing at 410 ^oC for 2 hours to remove the organic residues. Fourier transform infrared (FTIR), ultraviolet (UV), scanning electron microscopy (SEM), and thermogravimetric analysis (TGA) was used to analyze the SnO_2 NPs. The formation of SnO_2 NPs was confirmed by the maximum absorption peaks observed at 260 nm UV/Vis spectrum and diffraction peaks at 26.5, 34.05, and 52.2 in the XRD spectra. The spherical shape type with uniform particle distribution was also observed. FTIR spectra further confirmed the functional groups in charge

of stabilizing and capping SnO_2 NPs. SnO_2 NPs produced from Myristica fragrans might be used as promising candidates for biological applications because of easy and eco-friendly synthesis.
Keywords: Green synthesis, Myristica fragrans fruit, tin(II) oxide, nanoparticles, hydrothermal process
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Session: Environmental Science

PP-40: Probabilistic and deterministic approaches towards heavy metal accumulation, source identification and impact on ecological and human health in soil-vegetable system

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Heavy metal (HM) contaminated soil can affect human health via ingestion of foodstuffs, inhalation, and skin contact. This study thus sketched to estimate the level of six heavy metals (Cr, Fe, Cu, Zn, As and Pb) soil exposure and via dietary intake of vegetables. Mean concentrations of Cr, Fe, Cu, Zn, As and Pb in the affected soil were found to be 61.27, 27274, 42.36, 9.77, 28.08 and 13.69 mg/kg respectively, while in vegetables the respective values were 0.53, 119.59, 9.76, 7.14, 1.34 and 2.69 mg/kg. Multivariate statistical analysis revealed that Fe, Cu, Zn, and Pb originated from lithogenic sources, while Cr and As are derived from anthropogenic sources. A moderate enrichment was noted by Cr, As, and Pb in the entire sampling site, indicating a progressive depletion of soil quality.. The bioaccumulation factor (BCF) value for all the vegetables was recorded as BCF<1; however, the metal pollution index (MPI) stipulates moderately high value of heavy metal accumulation in the vegetable samples. Hazard Index (HI) was estimated at >0.1 for adults but >1 for children by direct soil exposure, whereas via dietary intake of vegetables, HI<1 for both children and adults. Estimated Total carcinogenic risk (TCR) value due to soil exposure showed safe for adults but unsafe for children, while both the population group found safe via food consumption. Children are found more vulnerable receptors than adults, and health risks (carcinogenic and non-carcinogenic) via direct soil exposure proved unsafe. However, this study can be used as a reference for similar types of studies to evaluate heavy metal contaminated soil impact on the population of Bangladesh and other countries as well.
Keywords: Health risk; metal translocation; multivariate statistical analysis; pollution degree; soil; vegetables

PP-41: An Experimental Study on Thermal Capacity Measurement for Metal-Based Packed Bed Latent Heat Energy Storage System

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Latent heat storage systems are a potential approach to storing and delivering thermal energy with the least amount of space, density and financial constraints [1]. The purpose of this work is to investigate the behavior of a packed bed latent heat thermal energy storage system. A spherical latent heat storage tank of 0.06 m diameter and 1.5 m length fully loaded with PCM encapsulated capsules was investigated in this research for the production of energy obtained by a solar collector basis over a period of time every day. The solar heating power is taken 380 watts. Paraffin wax is used as a phase transition substance in a High-Density Poly Ethylene spherical capsule. It has a heat capacity of 2900 J/(kg-K) at constant pressure and a thermal conductivity of 7.1 W/(m-K). The starting temperature is 310.15 K here. When the paraffin wax is mixed with the heat exchange

fluid (water) at 348.15 K, the tank's total storage capacity increases to 0.1504 W/(m-K). Numerous element and sample interval sizes with corresponding values of 1 mm and 21600 s were used in mathematical calculations. The overall charging time for the bed is 9 hours. The charging loop begins throughout the day when solar energy is absorbed and finishes with the full melting of PCM. After the PCM is fully solid, the discharging loop is over. This design is very beneficial in confined spaces like houses, schools and mosques, especially during the harsh winter months.

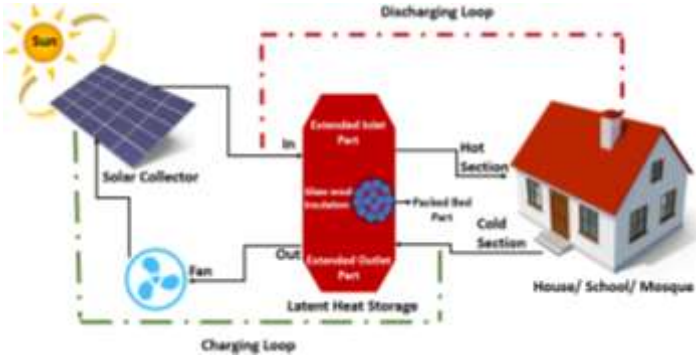

Fig.1: The Operation of Metal-Based Packed Bed Latent Heat Energy Storage System.

Keywords: Latent heat energy storage, Packed bed, Paraffin wax, Solar collector.

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PP-42: Natural Radioactivity Assessment in Various Tiles Used for Building Purposes in Bangladesh

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The two major natural sources through which human society is exposed to radiation externally are terrestrial gamma rays, cosmic rays, and both radon and thoron gas. Terrestrial gamma rays are derivatives of natural radionuclides that belong to ^{238}U, ^{232}Th, and ^{40}K. Nowadays most newly build house owners and offices in our country have a tendency to use tiles on the floor and walls of their houses. Depending on the presence of the above-mentioned radionuclide in the clay of the tiles and glaze, the dose due to gamma can vary in a wide range. Among various tiles available in the market, we have collected 25 different types of tiles. It was observed that U^{238}, Th^{232}, and K^{40} activity varies from 39±12 – 172±15 Bq/kg, 13±2.18 – 116±7.54 Bq/kg, and 92±18.4 – 740±29.6 Bq/kg. The radium equivalent activity varies from 77.56 – 343.73 Bq/kg which is less than the recommended value of 370 Bq/kg set by UNSCEAR. To assess radiological hazards associated with the tiles samples air absorbed dose rate, annual indoor and outdoor effective dose rate, and excess lifetime cancer risk were calculated.

PP-43: Adsorption of Cu(II) ions from Aqueous Solution Using Modified ETFE Film by Radiation Technique

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Copper-contaminated effluents are produced by a variety of sectors, including petroleum refineries, smelting, and metal cleaning, which have an impact on the environment and water quality. An excessive amount of copper can harm the liver and kidneys, as well as irritate the stomach and intestines. In this study, an adsorbent was built using ETFE film using pre-irradiation grafting in order to remove Cu (II) ions. Binary monomers of sodium styrene sulfonate (SSS) and acrylic acid (AAC) were used for the grafting process. Scanning electron microscopy (SEM) and Fourier transform infrared spectroscopy were used to analyze the grafted polymer (FTIR). The effects of pH, initial metal ion concentrations, contact time, and temperature on the adsorption of U(VI) were examined. The monomer solution of 30% (SSS:AAc=1:2) in water produced the highest graft yield of 470% with 50 kGy of radiation when 4% NaCl was added as an additive. With a starting concentration of 2500 ppm, a pH of 4.86, and a contact period of 24 hours at room temperature (25°C), the maximum adsorption capacity (412 mg/g) was found. The strong agreement between experimental results and the Langmuir Isotherm Model pointed to a monolayer adsorption. The pseudo-second-order process provided a good fit to the kinetic adsorption data. To sum up, the synthesized novel grafted polymer can be regarded as a good adsorbent for Cu (II) removal from wastewater due to its greater adsorption capacity and reusability.

Keywords: Cu (II), adsorption capacity, ETFE film, AAC, SSS, pseudo-second-order reaction, Langmuir Isotherm Model.

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PP-44: Edible Oils: An overview of healthful and some insalubrious compounds in some selected brands highly intake by Bangladeshi people

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Phytosterols are bioactive compounds found naturally in foods of plant origin are plant sterols and their saturated derivatives, which help to manage blood cholesterol levels, and to reduce cardiovascular disease. Polycyclic aromatic hydrocarbons (PAH)s are class of organic compounds consisting two or more fused benzene rings and considered of having adverse health effects. Our dissertation is about the presence of some phytosterols which is considered to be beneficial for human health and of some Polycyclic Aromatic Hydrocarbons (PAHs) which are harmful chemical compound in eleven brands of two categories edible oil samples like rice bran oil and mustard oil collected from Bangladeshi markets. The samples were hydrolyzed with methanolic hydroxide and the PAHs were extracted into 1:4 mixtures of dichloromethane (DCM) and Hexane. Gas chromatography and Mass spectroscopy technique showing high accuracy and precision with low detection limit, has been applied for the analysis of phytosterols and PAHs. β-sitosterol, campesterol, stigmesterol and γ-Sisterol were present in all the investigated rice bran oil samples. In contrast only β-sitosterol and campesterol were found in all the investigated mustard oil samples. PAHs like as naphthalene, fluorene, phenanthrene, anthracene, pyrene, chrysene, benzo[a] anthracene and benzo(a)pyrene were investigated in all the edible oil samples. Naphthalene was present almost in every investigated oil samples. Highest concentration of naphthalene in rice bran oil and mustard oil was 370µg/kg and 148.7µg/kg. Rice bran oil contained two carcinogenic PAHs, those were chrysene and benzo[a]anthracene. The highest concentration of chrysene and benzo[a]anthracene was 1346.8µg/kg and 359 µg/kg in rice bran oil. Fluorene, phenanthrene, anthracene, pyrene were found below the detection limit.

Keywords: Phytosterol, edible oil, carcinogenic, PAHs, GC-MS.

PP-45: Water Quality Analysis of Seawater at the Vicinity of St. Martin's Island through Studies of Physicochemical Parameters and Assessment of Heavy Metals

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Saint Martin's, a unique coral island off Bangladesh's southernmost coast, is vital ecologically since it serves as a nesting ground for various marine species that are globally vulnerable, and it also bears substantial environmental significance as the country's only coral island.(Amin et al., 2022) This island is critical to our country's blue economy policy, which influences how SDG-14: life below water is executed. This island's marine biodiversity is highly rich due to its ideal habitat, yet its marine ecology is constantly threatened by natural disasters, many types of pollution, and other man-made activities. As a result, it is critical to understand the current state of physicochemical qualities with heavy metal and mineral concentrations in order to assess the seawater quality of the seawater surrounding the island.(Hasan et al., 2016) On St. Martin's Island, the current study was carried out by evaluating the seawater quality parameters of various samples taken from 9 coastal water sampling stations using a water sampler and GPS-located sampling sites during March 2022. Temperature, pH, conductivity, turbidity, salinity, TDS, density, viscosity, refractive index, and DO were measured using diverse methodologies to analyze the water quality of these samples. Changes in these metrics reflect the quality of the seawater, the source(s) of the variations, and their consequences on the aquatic environment. An atomic absorption spectrophotometer (AAS) was used to determine the concentration of arsenic, lead, mercury, zinc, sodium, and magnesium. Furthermore, the water quality index (WQI) was calculated using the pH, DO, salinity, conductivity, and TDS of the aforementioned seawater samples and the seawater of St. Martin Island is found to be "good" during the season when the water samples were collected. Geographical Information System (GIS) based on water quality information system and spatial analysis with Inverse Distance Weighted (IDW) interpolation was used to monitor the geographical distributions of various physicochemical parameters. As a result, the surveys on seawater quality measurements were subjected to careful examination and correlation, yielding substantial results. The results demonstrate variation in the majority of Saint Martin's seawater quality parameters, as well as a strong relationship between them.

Keywords: Seawater quality parameters, water quality index, heavy metal pollution index, degree of contamination and correlation factor.

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PP-46: Distribution of naturally occurring radionuclides (^{226}Ra, ^{232}Th, and ^{40}K) in the sediment of Feni river

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The concentration of naturally occurring radioactive elements varies from place to place due to the geological property of soil with other natural and artificial phenomena. The radionuclides in soil and their contamination of the food chain have a huge impact on human health. To study the spatial and layer-wise distribution of natural radioactive material we have analyzed river (Feni, Bangladesh) sediments with HPGe detector. The concentration of ^{40}K, ^{232}Th, and ^{226}Ra at the surface varies from 224.34±40.387 to 549.59±98.531, 15.33±8.36 to 52.26±3.83, 8.45±1.94 to 25.68±4.88 Bq.kg^{-1} respectively. On the other hand, the concentration of those elements at 30 cm depth varies from 233.32±41.998 to 497.29±79.566, 18.33±3.85 to 55.49±8.32, 8.15±2.04 to 24.97±4.49 Bq.kg^{-1}. The result showed that the highest value of ^{40}K(549.59±98.531), ^{232}Th(52.27±8.36), ^{226}Ra(25.68±4.88) was found in the surface sediment of the Char Kalidas-3 region of the river. Whereas, for the

sediment collected from 30 cm depth, the maximum value of ^{40}K(497.29±79.566), ^{232}Th(55.49±8.32), was found at the above region but, the maximum value of ^{226}Ra(25.68±4.88) was found in Mobarakghona-3 region. These data will show the baseline level of natural radionuclides for this region and will be helpful for tracking and assessing any pollution inventory in the environment.

PP-47: An Overview of Vertical Greening Systems, A Process Tree for Green Facades and Living Walls.

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Vertical greening systems, such as green facades and living walls, have become increasingly popular to incorporate vegetation into urban environments and provide numerous benefits, including improving air quality, reducing the urban heat island effect, and increasing biodiversity. To create a successful vertical greening system, a process tree must be followed, which includes site assessment, design and planning, plant selection and procurement, installation, and maintenance. Site assessment involves evaluating environmental characteristics, such as sunlight exposure and water availability, to determine the feasibility of a vertical greening system. Design and planning involve selecting the appropriate system and developing a plan for irrigation and drainage. Plant selection and procurement are critical steps, as the plants must be suitable for the site's environmental conditions and able to thrive in a vertical growing environment. During installation, the support structure, plants, and irrigation and drainage systems are installed. Maintenance is vital to the long-term success of the system and includes watering, pruning, fertilizing, and inspecting the support structure for stability and safety. While creating a vertical greening system requires careful planning and attention to detail, the benefits make it a valuable addition to urban environments, helping to create healthier and more sustainable communities. Our study will illustrate the beneficial contribution of vertical greening systems to the urban environment.
Keywords: Facade greening. Living wall systems. Nature in cities. Environmental benefits. Environmental impact. Sustainability.

Session: Nuclear Physics

PP-48: DFT and DFT+U Insights into the Structural, Electronic, Magnetic, Thermal and Optical Properties Of UO_2

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UO_2 is a common fuel material used in Nuclear Power Reactor. This solid crystalline material exhibits interesting physical properties. This study reports the structural, electronic, magnetic, thermal and optical properties of UO_2 by employing DFT and DFT+U approximation methods for strongly correlated 5f electrons. The Mott-Insulating electronic properties are obtained for LDA+U and GGA+U approximation functionals (U= 4.5 and 5.5 eV) without applying any Hybrid functional. The band gap values are found in the range from 1.725 to 2.860 eV. The XRD and Neutron diffraction peaks confirmed the fcc structured fluorite type UO_2 with space group $Fm\bar{3}m$. UO_2 is found mechanically stable and ductile from elastic constants calculations. The calculated lattice thermal conductivity is found 8.8 $Wm^{-1}K^{-1}$ at 323 K which is very close to the experimental value. The frequency dependent optical parameters are calculated from complex dielectric function, which indicate that, UO_2 is simultaneously an efficient absorber and reflector for ultraviolet radiation in particular energy region. Although UO_2 is a potential nuclear fuel but the anisotropic optical properties, higher dielectric constant and semiconducting electronic property suggest that, the radioactive UO_2 material possesses interesting optoelectronic behaviors also.
Keywords: UO_2, DFT+U functional, XRD, Mott-Insulator, optical properties

PP-49: An Overview of Baec Triga Mark – II Research Reactor (BTRR)

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The Bangladesh Atomic Energy Commission's 3 MW TRIGA reactor has been operating at AERE, Savar, Dhaka since September 1986. It was used for various purposes such as Neutron Activation Analysis (NAA), Neutron Radiography (NRG), Neutron Scattering (NS), training and education of personnel and production of radioisotopes for medical applications [1]. 3MW TRIGA Mark-II Research Reactor is the country's only research reactor. It has been operating on the campus of the Atomic Energy Research Establishment (AERE), BAEC's largest research facility located at Savar, about 40 kilometers from the capital city of Dhaka. The reactor's construction began at the end of 1980 as a non-turnkey project with approximately 50% local participation. On September 14, 1986, the reactor reached criticality for the first time. At the end of October 1986, the reactor was fully tested and commissioned [2]. The paper highlights the history of operation, maintenance, future prospects and utilization of the research reactor. Additionally, some of the upgrades and modifications made to the research reactor's operating safety are shown [2].
Keywords: research, reactor, operating, neutron, savar, energy, TRIGA, NRG, AERE, BAEC
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Fig.1: TRIGA MARK-II Research Reactor [3]

Session: Radiation and Health Physics

PP-50: A Comparative Lung Dose Calculations Using Egs Energy Based Monte Carlo Simulation and Anisotropic Analytical Algorithm (AAA) and Verify with Practical Measurement, A CIRS Thorax Phantom Study

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This study is aimed at comparing the lung dose calculations using two methods: the EGS Energy-based Monte Carlo simulation and the Anisotropic Analytical Algorithm (AAA). The results of both methods will be verified through practical measurements using a CIRS Thorax Phantom. In the study, a CIRS Thorax Phantom will be used to calculate the lung dose using both the EGS Energy-based Monte Carlo simulation and the AAA. The results will then be verified through practical measurements. The results of the study will reveal the accuracy of

both methods for determining the lung dose. The EGS Energy-based Monte Carlo simulation is expected to have a slight advantage in terms of accuracy, while the AAA is anticipated to be more computationally efficient. The study will shed light on the importance of accurate dose calculations in radiation therapy and will provide useful information for choosing between the two methods. The results will suggest that both methods can be used in combination for optimal accuracy and efficiency. The study will provide valuable insights for radiation therapists and medical physicists, and demonstrate the utility of both the EGS Energy-based Monte Carlo simulation and the AAA in determining lung doses in radiation therapy. The findings will contribute to the continued improvement and advancement of radiation therapy as a safe and effective treatment option.

PP-51: A review of LLW management: Bangladesh Perspective

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This study provides a detailed overview of the Low-level radioactive waste (LLW) management techniques in Bangladesh, focusing on the sources of radioactive waste, current separation procedures, and current practices in Bangladesh and other nations. The analysis is based on an exhaustive review of the relevant literature, which includes papers, reports, and government records. The results indicate that Bangladesh faces a number of obstacles in the management of LLW, notably poor infrastructure, and capacity. This work also highlights a number of foreign best practices in LLW management, including a number of separation methods now in use, as well as the possibility of their application in Bangladesh. The paper concludes with recommendations for the development of a future management system and its implementation.

PP-52: Measurement of neutron dose in radiotherapy with 15 MV photon beam from medical LINAC

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Radiotherapy is the leading mechanism for the treatment of cancer patients in all over the world as well as in Bangladesh. The outcome of the radiotherapy is highly dependent on how precisely the dose is delivered to the tumor which should not be exceeded ±5% of the prescribed dose including all types of uncertainties involved in the treatment procedure such as dosimetry, treatment planning and dose stability of the treatment unit etc. High-energy linear accelerators (>10MV) are increasingly used in the medical field to treat cancer. Medical linear accelerators (LINACs) operating above 10 MV for high energy photon therapy produce unwanted neutrons by means of photonuclear reaction. The interaction occurs between high energetic X-ray photons with high Z materials of LINAC head and multi leaf collimator (MLC). These neutrons from LINACs can contribute to an additional dose to patients and increase the radiological risk to the medical staffs. In this study, we measured neutron dose contribution to the patient treated with 15 MV photon beam from Elekta medical linear accelerator at Enam Medical College and Hospital, Savar, Bangladesh. Albedo TLDs (^{6}LiF and ^{7}LiF) doped with Mg,Ti are used for evaluating neutron contamination. All TLDs were calibrated with a ^{137}Cs source in SSDL, AERE, Savar before LINAC exposures. ^{6}LiF crystal is sensitive to both photon and neutron radiation and ^{7}LiF crystal is sensitive to only photon radiation. The responses caused by only neutron radiation can be determined from the difference in responses between a ^{6}LiF and a ^{7}LiF TLDs exposed together. The TLD responses were read-out by RE 2000 reader. For the measurement of the ambient dose equivalent for neutrons, the LB 6411 neutron detector were positioned in different locations of treatment room. By irradiating a Rando phantom with 200cGy and 100cGy LINAC exposure in photon mode, we found that received dose was high near the iso-centre. The received contaminated neutron dose in head-neck, right lung and lung centre (irradiated area) are 175.82 µSv, 313.85 µSv and 1032.17 µSv respectively (irradiated with 200 cGy). The neutron dose of head neck is 133.69 µSv for 100cGy exposure and 175.82 µSv for 200 cGy exposure. We found neutron ambient dose equivalent H*(10) for 100 cm SSD on the right (on the side of maze entrance) and left of patient couch (opposite side of maze entrance) are 2.95 and 4.85 mSv/h respectively. The neutron dose found should be considered as

hazardous as overdose may contribute an excess life-time risk for cancer induction both to the patient and radiation worker.
Keywords: Cancer, IAEA, TLD, Medical Linear accelerator

PP-53: Estimation of Radiological Risk on Public around Khulna Medical College Hospital Campus, Bangladesh

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Radioactive material is being widely used in medicine, industry, agriculture, research & education, etc. in Bangladesh and its usage increases with the socio-economic development of the country. People of Bangladesh is mostly exposed due to the medical usage of the ionizing radiation. 96% of public exposure in the USA contributed from the medical uses of ionizing radiation during diagnostic & therapeutic purposes to patient among man-made sources as per NCRP Report No. 160. Although ionizing radiation offers tremendous benefit to patients in the hospital, but unnecessary radiation may increase the probability of getting cancer of the radiation worker & public. The objective of the study is to monitor the real-time radiation around the Khulna Medical College Hospital (KMCH) campus, Bangladesh and estimation of radiological risk on public based on annual effective dose. The study used real-time digital portable radiation monitoring device from September-November 2021 and Garmin HC Series Personal Navigator for location identification. The devices were set up on tripod one meter above the ground and data collection time for each location was 1 hour. Total 32 locations were selected around the KMCH campus, Bangladesh. The real-time radiation dose rates around the KMCH campus were ranged from 0.049-0.304 $\mu Sv.h^{-1}$ (mean: 0.139 ± 0.009 $\mu Sv.h^{-1}$). The annual effective dose to the public due to radiation was varied from 0.086-0.533 mSv. The excess life-time cancer risk (ELCR) on the public who are residing nearby the KMCH campus were ranged from 0.355×10^{-3} to 2.20×10^{-3} (mean: 1.005×10^{-3}). The ELCR on public around the KMCH campus are higher than that of the worldwide average value (0.29×10^{-3}). It is observed from the study that in every thousand people, one of them is at the risk of cancer caused by the scattered radiation exposure from the hospital without any knowledge of being exposed to ionizing radiation. Radiation workers have to handle the radiation generating equipment & radioactive material in the hospital as per national regulations and IAEA guidelines to maintain the ALARA concept in the hospital environment.
Key Words: Hospital, Radiation, In-Situ, ELCR, Worker & Public.

PP-54: Estimation of Radiological Risk on public around Chittagong Medical College Hospital Campus, Bangladesh

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Medical usage of ionizing radiation is being increased day by day in Bangladesh. Medical Staff and public are getting radiation from hospitals during diagnosis & treatment to patients. Although recent radiation generating equipments have considerably improved patient care, inappropriate or unsafe handling of the radiation generating equipments as well as radioactive material may also cause possible health risks to patients, workers and also public. Thus, real-time radiation monitoring around the Chittagong Medical College Hospital (CMCH) campus are carried out to identify the radiation hazard arising from medical use of ionizing radiation. The objective of the study is to monitor the real-time radiation around large hospital campus and estimation of radiological risk on public based on annual effective dose. The real-time radiation monitoring around the CMCH campus were carried out using digital portable radiation monitoring devices from October-November 2021 and those devices were placed at 1meter above the ground on tripod. 32 locations around the CMCH campus were selected for monitoring the real-time radiation and data collection time for each monitoring point (MP) was 1.0 hour. The MPs were marked-out using the Global Positioning System (GPS) device. The real-time radiation dose rates were ranged from 0.083-0.150 $\mu Sv.h^{-1}$ with an average of 0.119 ± 0.007 $\mu Sv.h^{-1}$. The

annual effective dose to the public due to radiation was varied from 0.171-0.328 mSv with an average of 0.209 ± 0.011 mSv. The excess life-time cancer risk (ELCR) on public who are residing nearby the hospital were ranged from 0.686×10^{-3}-2.123×10^{-3} with an average of 1.345×10^{-3}. The ELCR on public around the CMCH campus are higher than that of the worldwide average value (0.29×10^{-3}). It is observed from the study that in every thousand people, one of them is at the risk of cancer caused by the scattered radiation exposure from the hospital without any knowledge of being exposed to ionizing radiation. Medical Staff must handle the radiation generating equipments & radioactive material as per national regulations and IAEA guidelines for minimizing risk on public who are residing nearby area of the hospital.
Key Words: Hospital, Radiation, In-Situ, ELCR, Public.

PP-55: Real-time Radiation Monitoring in Mymensingh Medical College Hospital Campus and Estimation of Radiological Risk on Worker & Public

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Ionizing radiation has tremendous applications in diagnosis & treatment of patient in the hospital. Population of Bangladesh is mostly exposed due to the medical usage of the ionizing radiation. In USA, 96% public radiation exposure contributed from the medical procedures among the man-made radiation sources. Public who are living beside the large hospital campus is usually getting higher radiation comparing to others. The aim of the study is to monitor the real-time radiation around the Mymensigh Medical College Hospital (MMCH) campus and estimation of excess life-time cancer risk (ELCR) on public based on annual effective dose. The real-time radiation monitoring was performed using digital portable radiation monitoring devices from August-September 2022 and GARMIN eTrex HC Series Personal Navigator for location identification. The digital portable radiation monitoring device was placed at 1 meter above the ground on tripod and data collection time for each monitoring point (MP) was 1 hour. 32 MPs were selected for taking real-time radiation data in the MMCH campus. The measured dose rates due to natural and man-made radionuclides were ranged from 0.25-4.11 μSv/hr with an average of 1.438 ± 0.331 μSv/hr. The annual effective dose to the public due to hospital's radiation were varied from 0.438- 8.584 mSv with an average of 2.528 ± 0.627 mSv. ELCR on worker & public in the MMCH campus based on annual effective dose was calculated and varied from 8.436×10^{-3} to 16.572×10^{-3} with an average value of 10.667×10^{-3}. The annual effective dose on public is higher than that of the prescribed limit as per International Commission on Radiological Protection (ICRP). ELCR on public is higher than that of the worldwide average value (0.29×10^{-3}). Real-time radiation monitoring in the hospital is important for detection of the equipment's fault and improper operation of the radiation generating equipment. It is observed from the study that in every thousand people, ten of them are at the risk of developing cancer caused by the scattered radiation exposure from the MMCH during his/her life time.
Key words: Hospital, Ionizing Radiation, In-Situ, Public, Cancer.

PP-56: Dosimetric Evaluation of treatment Plans of 3DCRT, IMRT, and VMAT in Rectum Cancer

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Introduction: The purpose of my study is to compare the dosimetric differences between volumetric modulated arc therapy (VMAT), fixed field intensity-modulated radiotherapy (IMRT), and three-dimensional conformal radiotherapy (3DCRT) in rectal cancer.
Method: A group of patients (approx. 25) will be studied. For rectal cancer, I used three types of plans for different rectal cancer patients. I use 3DCRT IMRT and VMAT. In this study, the 3DCRT plan used 4 field

array techniques, the IMRT plan used 7 fields, and the VMAT plan also used double arcs. All planned prescriptions are 5040 cGy, and the number of fractions is 28.
Result and discussion: In this plan, protocols of filling the bladder after eating 500 ml of water were used, the patient waited 30 minutes at the end of the interval when the patient received radiation therapy each day. Two additional VMAT and 3DCRT plans were created for each patient. The VMAT plans were designed using the Smart Arc planning module. Both IMRT and Smart Arc had similar optimization goals. The prescriptions provide 50 Gy to the planned clinical target volume (PTV-C) and 56 Gy to the planned gross target volume (PTV-G). Target coverage and organs at risk (OAR) should be compared for all techniques.

Conclusion: A two-tailed Wilcox signed-rank test will be used for statistical analysis. The estimated outcome of this study will suggest that IMRT and Smart Arc may all be significantly superior to 3DCRT in most relevant values assessed as an objective response, OAR, and normal tissue examination. They provided comparable dosimetric parameters for the target volume. But IMRT shows better sparing for OAR and normal tissue.
Keywords: 3DCRT, IMRT, VMAT, OAR, and Rectum cancer.
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PP-57: Estimation of Effective Dose to Patients from ^{18}F-FDG Whole-Body Pet/Ct Examinations

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Introduction: The combination of Positron Emission Tomography (PET) and Computed Tomography (CT) has been a landmark for a better and more sensitive diagnosis of malignancy along with accurate functional and morphological imaging. However, the radiation exposure of the patients going through a PET/CT scan may turn concerning due to the high radiation dose of this certain imaging modality. Therefore, the objective of this study is to estimate the total effective dose of PET/CT imaging system for 100 oncological patients.
Methods: The retrospective study was conducted on 100 Bangladeshi patients (52 male, 48 female) in an age range of 10 to 80 years, at the Institute of Nuclear Physics, Bangladesh Atomic Energy Commission, Savar, Dhaka. The scan was performed by the institutional protocols. The injected ^{18}F-FDG dose for the total no. of patients is 210.01 ± 41.85 MBq (ranging from 129.5 to 336.7 MBq). The effective dose by PET was calculated by using multiplying injected dose (MBq) with the coefficient of 0.019 mSv MBq^{-1}, according to ICRP publication 106. The effective dose by CT was calculated by multiplying DLP (mGy.cm) with ICRP conversion coefficient k, which is 0.015 mSv.mGy^{-1}.cm^{-1} for the trunk region.
Results: The average effective dose for the 100 patients was 15.56 ± 1.80 mSv (ranging from 11.60 to 21.63 mSv). The mean effective doses from PET and CT scanning were 3.99 ± 0.80 mSv (ranging from 2.46 to 6.40 mSv) and 11.57 ± 1.57 mSv (ranging from 9.1 to 18.27 mSv) respectively.
Conclusion: In conclusion, we can say that the mean effective dose from a whole-body ^{18}F-FDG PET/CT from this study was moderately low compared to other studies. Proper justification of radiation exposure should be done to reduce the patient risk and ensure the safest imaging process. As most of the radiation dose results from the CT scan, bringing moderation into the hardware and software of the PET/Ct system may come in handy.

PP-58: The Rising Trend of Proton Therapy Use in Cancer Treatment

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A proton therapy (PT) treatment is one of the most precise forms of external beam radiation therapy. Proton therapy is becoming more popular worldwide because of its several benefits, including maximum target coverage, no exit dose, reduced radiation exposure and side effects, and reduced long-term effects. The effectiveness of PT was shown in many systematic reviews in different types of cancers e.g., head and neck cancer, breast cancer, prostate cancer, rectal cancer, nasopharyngeal cancer, gastrointestinal malignancies, chordoma, and gliomas and so on. To achieve these advantages proton centers became more numerous during the past two decades. According to the Particle Therapy Co-Operative Group (PTCOG) the number of PT centers was rapidly increasing in the last decades: in 2000, there were only 10 operational facilities worldwide and this number increased to 25 in 2010, and by the end of 2022, there were 100 PT facilities in clinical operation. Since, PT is more expensive than conventional radiation treatment technologies, smaller units became commercially available at a more affordable cost that could be reached by health care institutions and private oncology systems. Presently most of the PT centers are established in high-income countries. In parallel with high-income countries, more PT centers can be expected in middle and low-income countries with the growth of global economics.

PP-59: Consequences of Radon Air Pollution in Bangladesh and Risk of Lung Cancer

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Introduction: Lung cancer is a malignant lung tumor characterized by uncontrolled cell growth in tissues of the lung. This growth can spread beyond the lung by the process of metastasis into nearby tissue or other parts of the body. Radon exposure is the second leading cause of lung cancer, following tobacco smoke. Among those who smoke and are exposed to the same radon concentration, the risk of lung cancer is about 25 times greater. On a global level, tens of thousands of lung cancer deaths annually can be attributed to radon. Radon is a chemical element having the properties of natural radioactivity, colorless, odorless noble gas. It forms naturally and emanates from the decomposition of radioactive elements, such as uranium. Outdoor air and drinking water from rivers and lakes typically contain it at very low levels. It can be found at higher levels in the air in houses and other buildings, as well as in water from underground sources. Some experiments around Dhaka city had conducted for the measuring activity of radon gas in water and soil materials. These experiments showed that the observed radon activity was below the World Health Organization's threshold value. However, higher levels of radon activity were found in some northern regions, mud-made old buildings in eastern regions, and the southern part of coastal regions.
Material and methods: Water radon concentrations will be measured with a RAD7 detector, connected to a RAD H_2O accessory. The RAD H_2O is an accessory to the RAD7 that enables the measurement of radon in water over a concentration range of less than 10 pCi/L to greater than 400,000 pCi/L. The collection, preparation, and analysis of samples will be carried out following standard methods.
Conclusion: In this article, a comprehensive study focusing on the level of radon activity in the environment and its relative effect on lung cancer patients should be directly conducted on proper analysis of lung cancer patients.
Keywords: Radon, Lung Cancer, RAD7 detector,

PP-60: Use of High Frequency Ultraound in Detection and Localization Of Soft Tissue Foreign Body: A Case Series

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Accidental penetrating injuries with retention of foreign body in soft tissue are commonly encountered in surgery OPD, especially in extremities. Among different imaging modalities, X ray & CT scan can detect only high-density radio opaque materials having high atomic number and both have radiation burden. MRI provides excellent soft tissue contrast but contraindicated for metallic foreign body. CT and MRI, both are less available & expensive. Only high-resolution ultrasonography (HRUS) can detect both radio opaque and radiolucent foreign bodies. It uses high frequency ultrasound that has less penetration but excellent soft tissue resolution (1,2).
From December,2022 to february,2023, five patients were evaluated in INMAS, Mitford with HRUS using high frequency (10 MHz) linear transducer for clinical suspicion of radio lucent foreign body impaction following prick injury in soft tissue. In each case, foreign body was detected and localization done effectively.
HRUS is the first line imaging modality for detection & localization of soft tissue foreign body.
Key words: HRUS, foreign body, foreign body granuloma.
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PP-61: Synthesis and Characterization of $ZnLiBO_3$ for Thermoluminescence Dosimetry

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Thermoluminescence dosimeter (TLD) is a passive dosimeter that measures ionizing radiation exposure by measuring the intensity of visible light emitted from a sensitive crystal in the detector when the crystal is heated. There are many TLD materials available Viz., Lithium Fluoride (LiF), Calcium Fluoride (CaF), Lithium Borate ($Li_2B_4O_7$), Lithium Magnesium Borate ($LiMgBO_3$), and so on. The main drawbacks of such TLDs are that each dose cannot be read out more than once and the readout process effectively zeroes the TLD. Zinc Lithium Borate ($ZnLiBO_3$) is chosen as an exceptional potential TLD which can overcome all difficulties and can be read out more than once by irradiating it again and again. In this research work, zinc lithium borate ($ZnLiBO_3$) TLD material is synthesized by a simple, environmentally friendly high-temperature solid-state reaction method. The synthesized sample is characterized by different characterization techniques. The crystalline structure of the phosphor was confirmed by x-ray diffraction (XRD) analysis. Lattice parameters, unit cell volume, grain size, dislocated density, and microstrain were calculated from XRD data. Raman analysis and Fourier Transform analysis (FTIR) was used to collecting information about molecular bonds, vibrations, identity, and structure of the investigated material. From these investigations, it is confirmed that the deposited sample was composed of Zn, Li, B, and O. Importantly, the TL characteristics were reported by photon energy (6 MV) and electron energy (6 MeV) radiation for the dose range from 0.5 to 8 Gy. It is found that the TL dose response of the $ZnLiBO_3$ polycrystalline sample to photon energy radiation in the range from 0.5 to 8 Gy for radiation processing dose levels is almost linear. The TL studies of the $ZnLiBO_3$ sample show the main TL glow peak around at 160°C for peak 1, and 240°C for peak 2 for the photon energy and these glow peaks show great stability for a long time (28 days). The trap parameters namely: activation energy (E), order of kinetics (b), and frequency factor (s) of the main peak for $ZnLiBO_3$ were determined using the peak shape method. High sensitivity was exhibited by the new crystalline material for both photon energy and electron energy, and most sensitive for 8 Gy. Minimum detectable dose was found 40 mGy (average) for photon energy and 42.5 mGy (average) for electron energy. Reproducibility, repeatability, and thermal fading of the proposed TLD were investigated and show remarkable results that made the $ZnLiBO_3$ phosphor is suitable for radiation and environment dosimetry applications.
Keywords: Thermoluminescence, Radiation Dosimetry, TL materials, Borates, TL signal, Trap parameters.

PP-62: Depth-wise variation of natural radioactivity and evaluation of radiological hazards in sediment cores of the Sundarban, Bangladesh

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The naturally occurring radionuclides ^{226}Ra, ^{232}Th and ^{40}K in sediment cores (~50 cm long) from different Ranges of the Sundarban mangrove forest, Bangladesh were determined using gamma-ray spectrometry to assess temporal variation of the radionuclides and radiological hazards in the Sundarban. To obtain the depth-wise variation of the natural radioactivity, core samples were cut into a 2 cm slice and analyzed. The average activity concentrations of ^{226}Ra, ^{232}Th and ^{40}K in the first core were found to be 46.9 ± 8 Bq kg^{-1}, 61.6 ± 10.3 Bq kg^{-1}, and 2110 ± 44.8 Bq kg^{-1}, in the second core 73.4 ± 10.2 Bq kg^{-1}, 91.2 ± 11.6 Bq kg^{-1}and 2120 ± 44 Bq kg^{-1}, in third core 81.2 ± 7.6 Bq kg^{-1}, 82.8 ± 5.2 Bq kg^{-1} and 9770 ± 139 Bq kg^{-1}, and fourth core 33.8 ± 6.8 Bq kg^{-1}, 87.1 ± 5.0 Bq kg^{-1} and 1880 ± 123 Bq kg^{-1}, respectively. From the mean specific activities of the three radionuclides in sediment samples, the radium equivalent activity, the gamma absorbed dose rate, the annual effective dose rate and the external hazard index were calculated. The results of the radiological indices and dose rates obtained in this study were relatively higher than their worldwide mean values. The results of this study could serve as important radiometric data and variation of radioactivity levels in the Sundarban with time.
Keywords: Natural radionuclides, Sediment core, Radiological hazards, Sundarban mangrove forest.

PP-63: Synthesis and Investigation of Structural, and Thermoluminescence Properties of $LiCaPO_4$ Phosphor for TL Radiation Dosimetry Applications

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Many minerals and compounds show thermoluminescence properties but few of them can satisfy the required properties to be used in thermoluminescence radiation dosimeter. Phosphate materials are studied for low-dose dosimetry for the last few years. Among them, $ABPO_4$-type phosphate material shows interesting thermoluminescence properties. In this research work, an $ABPO_4$-type Lithium Calcium Phosphate ($LiCaPO_4$) phosphor is synthesized using modified solid-state diffusion method. To obtain the pure phase of $LiCaPO_4$, the temperature is maintained below 800°C in every step. XRD analysis confirmed the phase purity of the phosphor with rhombohedra structure. Lattice parameters, unit cell volume, grain size, dislocated density, and microstrain were also calculated from the XRD data. Raman analysis and Fourier Transform Infrared (FTIR) analysis were used to collect information about molecular bonds, vibrations, identity, and structure of the phosphor. To investigate thermoluminescence properties and study kinetic parameters, the phosphor is irradiated with a linear accelerator which produces 6.0 MV (photon energy) and 6.0 MeV (electron energy) for doses ranging from 0.5 Gy to 6.0 Gy. For both photon and electron beam, TL glow curves have two identical peaks near to 200°C and 240°C. Kinetic parameters such as geometric factor (μ_g), order of kinetics, activation energy (E), and frequency factor (s) are obtained from Chen's peak shape method. The dose against the thermoluminescence intensity curve shows the phosphor is almost linear to the dose. For photon energy, the phosphor is found to be most sensitive for 2.0 Gy, and for electron energy, the phosphor is found to be most sensitive for 4.0 Gy. The phosphor has very low fading and after 28 days it shows only 3% fading. For unexpected low fading, intense thermoluminescence glow curve, sensitivity, and linearity with proper other thermoluminescence properties, $LiCaPO_4$ phosphor can be a promising TLD material for radiation dosimetric applications.
Keywords: Thermoluminescence Dosimetry, TL materials, Phosphate, TL glow curves, Kinetic parameters, TL signal fading.

PP-64: Platelet Poor Plasma (PPP) Separation from Blood and It's Application as a Supplement in Cell Growth Media

Mahbuba Kader Meem, Sadia Islam, Sujan Mahamud**Error! Bookmark not defined.**, Swapan Kumar Sarkar*, and Nazmul Haque
Gono Bishwabidyalay

The focus of this study is to be improving the stem cell treatment. Only stem cell treatment is approved by the Food and Drug Administration (FDA). Stem cell therapy is the cell-based treatment that can help to enhance the growth of healthy tissue, production of collagen, stimulation of cell development after incision. It is an alternative solution to various unmanageable diseases failed by conventional treatments which would result in inferior quality of life with significant sufferings, distresses, and terminal illness. The therapy offers autologous, allogeneic, and rehabilitation therapy. Autologous therapy offers platelet rich plasma (PRP) treatment where PRP is the autologous product that is prepared from patient's own blood contains enriched platelet count at physiological P^H. After bringing to the ideal condition, the cells (autologous product) are kept in the medium with added cell growth media (animal cell). Cell growth media causes for cell proliferation. After that, the growing cells or regenerative medicine is injected to the patient's target areas. After preparing the regenerative medicine, they can be stored for a long time for treatment. Stem cell banking is the system that look after the patients overall. Stem cells are stored by thawing process for a fixed date that are used to treat patient for a variety of degenerative diseases. We use platelet poor plasma as a cell growth media during treatment process. We also experienced that if we collect platelet poor plasma from stem cell donor, cell proliferation would be more productive & secure. Then we were tried to experience how would be the cell proliferation by heat treatment process. The two group were arranged for heat treat (37^{o}C) & refrigeration (4^{o}C) after collecting the platelet poor plasma. Then completing the whole process, the result said that cell growth pattern was much better for heat treat. Initial report said that heat treat creates favorable environment than without heat treat. After preparation of regenerative medicine, injected at the site of injury releasing the enormous number of growth factors that were trying to use for restoring destroyed and aging cells, natural rejuvenation, activating regeneration of skin and tissue, relieving pain. The experiment was not qualitative stage treatment. In preliminary stage, we were trying to stand a homogenous report by using some cell serving images and in future we can be explained in detail.

PP-65: A DFT Investigation on Structural Properties of Transition Metal (V, Nb, and Ta) Doped in GaN Nanotube

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In recent years, Gallium Nitride (GaN) nanotubes have evolved unexpected features because of their low dimensionality and quantum size confinement, making them a promising material for use in the development of cutting-edge semiconductor industries [1]. Again, various experimental and theoretical studies confirm that doping with transition metal causes increasing the structural i.e., reactive properties [2]. In this regard, potential doping location is very important to develop nanoclusters in the most effective manner [2]. In this work, the structural properties of transition metals (V, Nb, and Ta) doped GaN nanotube have been investigated by employing Density Functional Theory (DFT) in B3LYP hybrid functional using LANL2DZ basis set in Gaussian 09 program for its corresponding veracity [2] for two distinct positions and observed significant changes in different structural properties. Among the studied nanotubes, Ga_9N_{10}_Ta has the highest average binding energy. Consequently, it is stable and has higher surface area. Again, from the computational study, the average binding energy of TM doped GaN is changed to the range of -4.689 eV ~ -4.857 eV which is initially -4.526 eV for the pristine nanotube. This result satisfies the structural stability due to this modification by the concerning transition metals. Finally, analyzing these reports it can be concluded that modification of GaN with the concerning transition metals such as V, Nb, and Ta could be a potential approach for further research for the development of sensing materials as well as other technological applications [3].

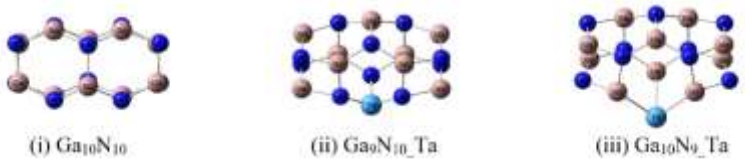

Fig.1: Stable configuration of pristine and Ta doped GaN nanotube.

Keywords: GaN, Nanotube, DFT, Transition Metal, Sensor Device.

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Session: Atomspheric Physics

PP-66: Scenario of cold wave conditions during 1990 to 2019 in Bangladesh

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A cold wave is a weather phenomenon that is distinguished by marked cooling of the air, or with the invasion of very cold air, over a large area. In the present study, mild cold to severe cold wave frequencies have been studied for the winter season (December to February) over most of the stations of Bangladesh for the period 1990-2019 and also for the three decades. The highest numbers of cold wave days are found in Srimangal of all types event during winter season. The significant highest very severe cold wave days were found in Sayedpur (4days) among the 30 years after that Srimangal (3 days) . The mostly Very severe cold occurred at Sayedpur in 2013, this year happen 9days out of 14 of very severe cold days in 30 years. At Middle decadal period, Cold days was less about all of the divisions except Chattogram and Sylhet divisions. January is the highest cold month in Bangladesh. Cold day is decreasing of all divisions except Barishal but for moderate cold day at Barishal & Khulna divisions is increasing. Overall Northwestern part and Srimangal region cold day has found from spatial distribution. The highest 5 coldest place is Srimangal, Rajshahi, Chuadanga, Ishurdi and Dinajpur and highest Coldest year is 1993,1995,2001,2011 and 2013

Key words: Cold day, decade, Trend analysis, spatial distribution, Divisions.

Session: Electronics and ICT

PP-67: A Modified S-G Filtering Technique to Design a Digital Dose Rate Meter Using Geiger–Mueller Counter

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In this paper, we present a way for developing a dose rate meter for assessing dose. A peripheral interface controller (PIC) has been used as the main controlling unit of the instrument. To detect the gamma events a Geiger Muller (GM) tube is used which is activated by a high voltage source. The output pulse of the GM tube is normalized using a transistor and then fed into the PIC microcontroller. The number of GM tube pulses per second is counted by PIC and filtered by a Savitzky-Golay(S-G) filter. Afterwards, the PIC converts the counts to dose rate by using an empirical equation that is developed in this work. The measured dose rate is then displayed on a liquid crystal display (LCD) and the radiation worker is warned through a buzzer attached to the

system. Furthermore, the designed system was calibrated from different distances with different activity at a secondary dosimetry laboratory which yielded calibration factors between 0.98 to 1.01 indicating the ability to be implemented in practical uses.
Keywords: Radiation Dose rate, Geiger-Mueller counter, Radioactive Sources, Gamma Radiation, Radiation Detector, Microcontroller, PIC code.

PP-68: Microcontroller Based Digital System for Monitoring and Analyzing Seismic Activity

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An earthquake is a devastating natural disaster that can have a significant negative impact on our civilization. To decrease the damage from an earthquake and save several lives, we need to gather deep knowledge about seismicity and also need to develop a seismic activity analyser like seismometer, which is an instrument used to record the ground motion that is caused by an earthquake. This article presents the design and development method of an Arduino-based low-cost seismicity analyzer that can be constructed easily and used to detect any seismic activity and give a warning alarm and also provides seismograph. The system was controlled with an Arduino microcontroller, which can receive analog signals from sensors and give the result in digital form through a laptop monitor. A microcontroller-based digital seismic activity analyzer is a device that uses a microcontroller to process and analyze data from a seismic sensor to provide accurate and real-time information about seismic activity. The microcontroller was interfaced with the highly vibration-sensitive ADXL 335 sensor, which utilizes a solid substrate as a dielectric, to detect vibrations and monitor earthquakes. In the present work, we also designed an analog seismic activity analyzer that works on the principle of a pendulum, which gives a deviation in one dimension. But the digital seismic activity analyzer provides several advantages over traditional analog-based systems, including improved accuracy, real-time processing and display of data, and the ability to store and analyze large amounts of data. This system can be proven to be a useful tool for saving human lives and will also store the data for further analysis by the scientist.
Keywords: Earthquake, Microcontroller, ADXL335 sensor, Seismicity, Ground fault, Epicenter, Hypocenter.

PP-69: Design a 3D Virtual Laboratory Simulator for Physics Education

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Students in impoverished rural areas of Bangladesh, do not have the opportunity to conduct hands-on physics-based practical assessments due to a lack of suitable laboratory equipment and trained teachers or instructors. This paper presents a 3D app-based virtually simulated laboratory to understand easily and quickly about the laboratory equipment and how to utilize it in the lab to gather knowledge looks like in reality. The virtual laboratory is a user friendly and cost effective interactive process for getting the facility of a laboratory. The creation of 3D model, design and develop a 3D virtual lab by combining the created models have been discussed. Simulation results show the merit of app in getting the experience of laboratory in an educational institution.

Fig.13. A virtual 3D Laboratory for Hand-on Experiment

Keywords: 3D model, virtual lab, virtual reality, simulation, education, mobile apps

PP-70: Analysis the Performance of Triangular Patch Antenna at THz Band

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Modern technology advancement requires a more extensive data rate to convey information more rapidly than ever. Improved bandwidth can satisfy the need for high-speed transmission demand. In order to gain significantly increased bandwidth for a high data rate communication, the antenna design at the THz band is essential. The microstrip patch antenna is one of the most prominent antennas for THz band applications. The performance of the antenna was improved by developing different patch shapes. As a result, we developed a triangular patch antenna with Rogers at the substrate and Graphene at the patch. Moreover, we improve the performance of the proposed antenna with partial ground technique and corner truncation methods. We analyze the performance of a triangular patch antenna using CST simulation software. The size of the proposed antenna is 160 x 120 μm^2. Based on the simulation results, we are using Graphene as the patch conducting material and Rogers as the substrate insulator, resulting in a wide bandwidth and minimal return loss. Additionally, the gain and efficiency of the suggested antenna show good improvement. As a result, our proposal triangular patch antenna with partial ground technique and corner truncation methods shows better performance.
Keywords: Triangular patch, THz band, CST simulator, partial ground, corner truncation.

PP-71: Design and Analysis of the Performance of Elliptical Patch Antenna for IoT-Based Application

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The Internet of Things (IoT) depends heavily on wireless communication to transmit, receive and exchange data with each other. Antennas play a vital role in wireless communications. In this work, an elliptical-shaped microstrip patch antenna is proposed for IoT applications due to their (microstrip patch antenna) small size, low profile, low cost, and easy fabricating. To enhance the performance of our proposed antenna, silver is used at the patch and ground layer as a conductor, and Roggers at the substrate as an insulator. The dimension of the proposed antenna is 80×60 mm^2, and the thickness is 0.035mm. The proposed antenna was simulated and analyzed using CST Software. The simulation result indicates wide bandwidth, low return loss, high gain, and satisfactory efficiency. Hence, the proposed antenna with its attribute will be a better option for IoT sensor units.
Keywords: Elliptical patch, THz band, CST simulator, IoT application.

PP-72: Development of Low-Cost IoT-Based Water Purity Identification System

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In our daily life, water is one of the essential food elements for survival in the world. However, this lifesaving water can harm our life due to the surrounding pollution. Ensuring pure and safe water is a critical issue for us. In many parts of the world, the availability of usable water is a major concern, with water pollution and contamination posing significant risks to public health and the environment. This paper proposes developing a low-cost IoT-based system for identifying pure water. The system utilizes a combination of sensors and IoT technology to collect and transmit data on water quality parameters such as pH, Conductivity, Dissolved Oxygen, Temperature, Chlorine, TDS (Total Dissolved Solids), Nitrates, Salinity, Turbidity and Nanoparticles. Our proposed system aims to show the purity of water suitable for us and the environment. The IoT-based system collects data from water and transmits it to a cloud-based platform for analysis and interpretation. The

findings of this analysis can be used to guide the development of cost-effective IoT-based solutions for identifying usable water, improving public health, and promoting environmental sustainability.
Keywords: IoT, sensor, water purity, pH, public health.

PP-73: Enhancement of IoT Based Smart Home Security System

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IoT (Internet of Things) based security refers to using connected devices and sensors to enrich the security of homes, buildings, and other environments. IoT devices can be used to monitor, control, detect and alert security threats, and automate security processes in the IoT-based smart home system. These devices can be controlled and monitored through a smartphone app or a web interface. IoT-based smart home security systems are becoming essential for several reasons, such as remote monitoring, on-time alerts, and easy integration. In a conventional home system, there is a key to pull or push the door, and we have to operate it manually. However, in a smart home system, the door can be operated automatically by applying a security lock, sensor-based lock, biometrics etc. This work focuses on the security enhancement of IoT-based smart home systems using the Arduino platform. The system will be operated based on three different modes i.e sensor lock system, Global System for Mobile Communication (GSM) and metal detector modules. The door can be opened or closed by an authorized person using either a security lock or other biometric locks such as an eye retina scan, face detection, or fingerprint. Suppose any unauthorized person makes three consecutive unsuccessful attempts to enter the room. In that case, the Arduino controller will send a warning message to the preset owner's GSM mobile number and the nearest police station. Furthermore, this system will provide extended security to detect any metal with an inductive proximity sensor. The sensor will notify the owner through the GSM system if a person enters the house with metal. Our proposed security system will be able to detect mischievous people by analyzing their behaviors through deep-learning approaches. Therefore, our proposed security system is expected to provide security enhancement in IoT-based smart home systems.
Keywords: IoT, smart home security, sensor lock, deep learning.

PP-74: Design and Implementation of a Web-based Application for University Class Scheduling and Rescheduling

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The present article outlines the design and development of a sophisticated, interactive platform for managing class scheduling and rescheduling system for colleges and universities. Numerous studies have shown that fluctuations in class schedules can seriously impact students' academic performance, time management, and overall learning experience. The analysis reveals that most students aim to reduce the amount of time wasted on scheduling conflicts. With limited time available for each class, it is a challenge for both teachers and students to complete their coursework within the allotted time frame. This system provides an efficient interface that streamlines communication between students and teachers in the event of changes to class schedules, alleviating the inconsistencies that often arise. The proposed web application offers logistical support to teachers, enabling them to plan lesson periods remotely, share resources, and create timetables for their classes, simplifying the entire scheduling process. This web application is primarily designed for educational institutions where class routines are subject to frequent changes and students need to be informed well in advance.
Keywords: class scheduling, resource allocation, rescheduling, personal preference, schedule management system, web application.

PP-75: Saving Lives with IoT An Innovative Approach to Earthquake Rescue Operations

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Unpredictable earthquakes cause devastation and loss of life in their aftermath. But what if we could influence the outcome, offer hope to the defenseless, and save lives that had previously appeared to be lost? The answer lies in the power of technology, specifically the integration of sensors in earthquake rescue operations. We notice that many people lose their lives when they become stuck in these major emergencies simply because they didn't receive help when they needed it. Introducing "Saving Lives with IoT An Innovative Approach to Earthquake Rescue Operations". This paper delves into the innovative use of Node MCU, thermal sensor, gas sensor, and temperature & humidity sensor, to revolutionize the way we respond to earthquakes. By measuring vital parameters like temperature, passive motion detector that waits for infrared temperature from body heat to trigger an activity [1, 2], humidity, and hazardous gas levels, rescuers can gain a deeper understanding of the conditions inside a collapsed building and make more informed decisions about how to proceed [3].

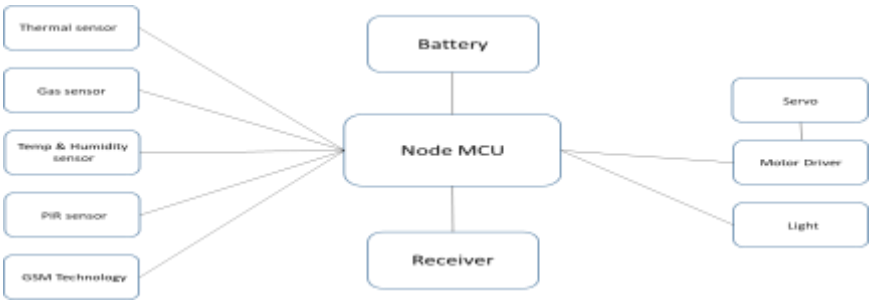

Fig: Block diagram

Keywords: IoT, Earthquake Rescue Operation

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PP-76: Revolutionizing Gas Supply in Bangladesh and a Smart Solution to Overcome the Natural Gas Crisis

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The depletion of natural gas reserves has become a matter of great concern, and it's high time we take action to preserve this precious resource. This paper sheds light on a groundbreaking solution - a smart gas management system aimed at reducing gas wastage and promoting efficient usage. Using cutting-edge technology like the NodeMcu [3, 4] and Metal Detector sensors [1,2], this system has the power to monitor and control the flow of gas in households. The moment a pan is placed on the stove, the gas flow ignites the stove automatically, and as soon as the pan is removed, the gas flow stops. The authorities can keep a watchful eye on gas usage through software and rectify any issues if the system malfunctions. This ensures accurate billing and conservation of our natural gas reserves. This study delves into the importance of incorporating technology in the energy sector and the positive impact it can have on sustainability and resource conservation. The smart gas management system is a leap forward towards a greener future, where energy utilization is optimized and wastage is a thing of the past.

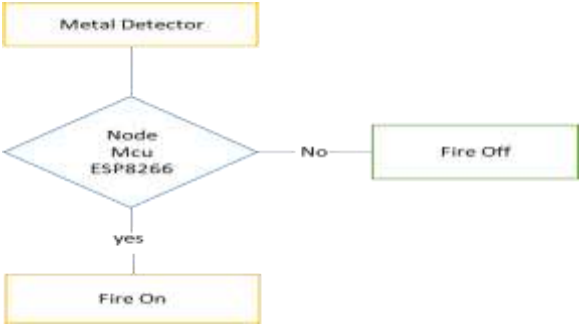

Fig: block diagram

Keywords: Node Mcu, Cutting-edge technology, Rectify, Malfunctions.

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PP-77: Aquatic Automation: Revolutionizing Fish Farming

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Fish farming in Bangladesh plays a vital role in the agricultural economy and nourishes the daily diets of the population. Yet, traditional fish farming methods are plagued by challenges such as water degradation, oxygen deprivation, food shortages, and environmental deterioration. To tackle these obstacles, a revolutionary device has emerged to modernize the industry. The device, powered by a microcontroller, is equipped with sensors such as humidity [1], temperature, pH [2], barometer, and more, to keep a vigilant eye on the pond environment. It collects and processes data to provide the fish farmer with real-time updates on any abnormalities in the pond. With the ESP 8266 microcontroller [3] at its core, the device is capable of taking automatic corrective measures to ensure optimal conditions for fish growth. This innovative device operates 24/7, is fueled by its own solar power system, and reduces the need for manual labor. Its implementation in fish farming is poised to elevate the industry to new heights, boosting efficiency, sustainability, and profitability. Fish farmers will now have the ability to monitor water quality, temperature, pH, and other critical environmental factors, enabling them to respond swiftly to any changes and ensure the best possible conditions for their fish. In a nutshell, it is poised to revolutionize traditional methods, increasing fish production, improving the overall pond environment, and making fish farming more efficient, sustainable, and profitable.

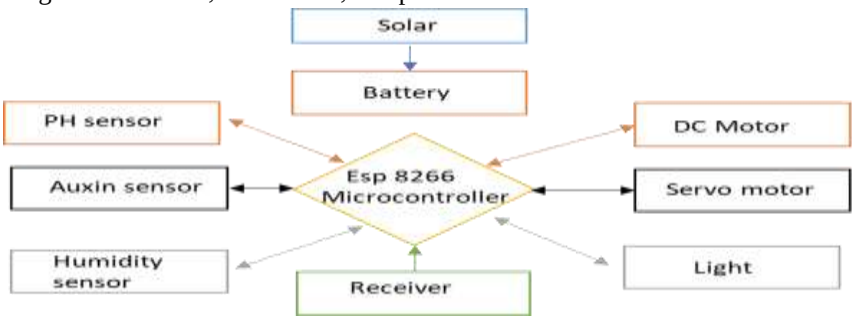

Fig: Block diagram

Keywords: IoT, Esp-8266, Auxin sensor.

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3. ESP 8266 For Control And Monitoring In Smart Home Application. Lailis Syafa'ah, Agus Eko Minarno, Fauzi Dwi Setiawan Sumadi.

PP-78: Optimized and Safe Internet of Medical Things (IoMT) via Federated Machine Learning for Diagnosing Human Skin Diseases

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The human integumentary system has a variety of nonpathological conditions, such as skin diseases [1]. It can also damage the soft tissues that are connected to the skin, such as fibrous tissue and mucous membranes. Skin issues can be triggered by viruses, allergies, hormones, immune system issues and so more. The most frequent skin problems are acne (blocked skin pores by creating oil, bacteria and dead skin cell), Alopecia areata (hair losing) and Atopic dermatitis (dry, sensitive skin which breaks) [2]. Because of their complicated shapes and patterns, skin diseases are more difficult to identify using medical images. Convolution neural networks for identification and federated learning systems for protecting information both performed well in the field of medical imaging. Throughout this research, a customized image dataset with 3 types of skin disease was created, a CNN model was analyzed with numerous standard CNN algorithms and an experiment was performed to assure privacy protection using a federated learning method. To increase the magnitude of the dataset and generalize the model, we used an image augmentation mechanism. In this model, the density of healthy human skin is 1.02 g/c$m^2$and the Poisson's ratio is 0.5. The skin's Young's modulus varies between 0.42 MPa to 0.85 MPa. Our suggested model demonstrated an accuracy of 80 %, 50 % and 68.4 % and a recall of 68 %, 60.64 % and 62% for acne, alopecia areata and atopic dermatitis, respectively. After spreading the dataset to 1500, 2000 and 2500 clients using the federated learning system, our model achieved an average accuracy rate of 88%, 90.55% and 95%, accordingly. Identifying human skin disorders with the use of CNN and a federated learning system is the best idea that can be implemented without affecting data privacy.

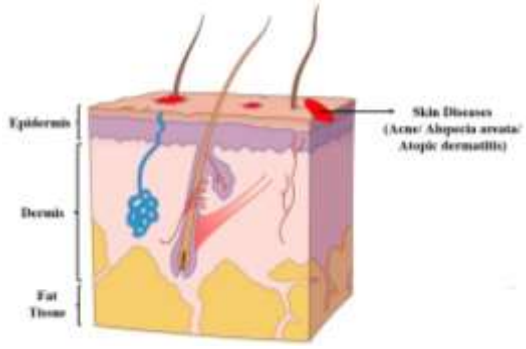

Fig.1: Human skin is made up of different layers and the epidermis layer is where skin issues arise.

Keywords: Internet of Medical Things (IoMT), Federated Machine Learning, Human Skin Diseases, CNN model.

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PP-79: Detection of Cardiovascular Diseases (CVDs) with Federated Learning System

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Cardiovascular diseases (CVDs) are the global major cause of death, claiming around 17.9 million lives each year [1]. These illnesses include problems that impact the function of human heart, such as coronary heart disease, vascular disease, stroke, peripheral vascular disease and cardiomyopathy. The most frequent symptoms of cardiovascular disorders include chest discomfort, dyspnea, dizziness, numbness in the face or legs and issues

while talking, seeing or walking. Average adult (Age, 18+) has a heart rate of 60 to 100 beats per minute and the abnormal heart rate is above 100 or under 60 beats per minute. Besides that, the ideal weight of the cardiac is 230-280 g for women and 280-340 g for men. More than 75% of CVDs fatalities occur in poor and medium-income nations. They lack access to primary medical services for lower-income which might let them avoid cardiovascular disease. As a consequence, CVDs are often detected too late and patients die at a pretty young age. Especially keeping them in mind, this study developed a low-cost machine learning approach for detecting heart disease from a single data set. Throughout this scenario, federated learning is applied to generate a shared model from patient data that is divided into several data stores. The current state updates of numerous users scattered throughout a subnet can be summed together to create a shared model. On user devices, the Logistic Regression and Support Vector Machine techniques are implemented to develop this model. All of the updates are forwarded to the main system. According to testing results, the UCI dataset has a 90% accuracy. Electronic health records can be analyzed using a federated learning system to develop a single model while maintaining the information's distribution pattern. Only Bangladesh was utilized in this research to represent the poorest countries in Asia. In the future, more countries will be included in this investigation.

Keywords: Cardiovascular diseases (CVDs), Federated Learning System, Logistic Regression, Support Vector Machine techniques.

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Session: Others

PP-80: Improvement of Productivity of a Sewing Line by Using Line Balancing Technique.

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Line Balancing is one of the methods which is helping to level the workload across the work station. Remove the bottleneck, stations and remove excess capacity in the manufacturing line and optimal resources are being used to meet the customer requirements on time. If the manufacturing line is not balanced properly and will lead to short supply as against customer will happen. To prevent this kind of situation. The manufacturing line to be balanced in an effective manner on the line balancing like the groping of the work station. leveling of work load removing bottleneck station. removing excess capacity, removing excess work in progress. Effetely use of no of manpower utilization, man movement, material movements, utilization, manufacturing lead time. Throughput analysis, customer demand. line balancing and after line balancing improvement results discussed. Line balancing technique balancing the production lines changing the product layout. Before SMV 5.26 and After SMV 4.28, Before manpower 24and After manpower 21, Before productivity 0.1423 and After productivity 0.1824 , Before Efficiency 74.88% and After Efficiency 78.12%, Before production per hour 205 and After production per hour 230 pcs. After using the line balancing system, productivity increases, smooth workflow, balanced cycle time, also reduced bottleneck. The line balancing method will be useful for process planning, production, manufacturing, design and plant engineers in the industry.

PP-81: TiO_2 photoanode modification by garlic-extracted MnO_2 nanoparticles for dye-sensitized solar cells (DSSC) application

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In this experiment, we have focused on the modification of a TiO_2 photoanode by garlic-extracted MnO_2 nanoparticles for enhancing the power conversion efficiency of a dye-sensitized solar cell (DSSC) application. Firstly, we have synthesized nanostructured MnO_2 from the garlic extract via a facile green technique. Then, we modified the TiO_2 photoanode by adding different percentages (0.1, 0.2, 0.4, and 0.6%) of MnO_2 and prepared the thin films onto FTO glass by using the doctor blade method for cell application. In this process, we have used a carbon electrode, iodine/triiodide ion (I/I^-_3) and pomegranate-extract natural dye as anodes, electrolytes, and photosensitizers, respectively. MnO_2 nanoparticles and all prepared thin films were characterized in terms of structural, morphological, optical, and chemical bonding using XRD, SEM, UV-vis, and FTIR, respectively. The MnO_2 nanoparticles showed a spherical shape. The effect of synthesized nanometal oxide on the cell performance of DSSC was demonstrated by V-I curves. V-I characterization showed that the highest power conversion efficiency was obtained from the fabrication of a 0.2% MnO_2 doped TiO_2 photoanode with a short circuit current of.42 mA, an open circuit voltage of 308.3 mV, a fill factor of 0.461, and an efficiency of 59%. The highest efficiency was 25% higher compared to the undoped TiO_2 photoanode (34%).
Keywords: TiO_2 photoanode; MnO_2 nanoparticles; Dye-sensitized solar cells (DSSC); Garlic-extracted; efficiency enhancement

PP-82: Comprehensive Comparison between IMRT and VMAT treatment techniques for Preoperative Rectal Cancer

Kazim Uddin Olin
Gono Bishwabidyalay

Background: The main purpose of this study is to perform the dosimetric comparison among intensity-modulated radiation therapy (IMRT) and volumetric—modulated arc therapy (VMAT) plans for rectal cancer.

Methods: In this study, treatment plans were generated by Eclipse software for six rectal cancer patients. For each patient, 7 plans were generated with the planning CT scan: 4 plans using 5,7,9 and 11 field using 6-MV and 10-MV photon beam energy for IMRT and 3 plans using the VMAT techniques: 1-Arc, 2-Arc and 3-Arc using 6-MV and 10-MV. Dose prescribed to the PTV was 25 Gy in 5 fractions in a week. DVH, conformity index (CI), homogeneity index (HI) in Target volume (TV), dose and volume of this OAR irradiated including small bowel, bladder, femoral heads were compared among the IMRT (4 plans), VMAT (3 plans) and MU also reported.
Results: For both IMRT and VMAT plans, differences in dose distribution to the target were observed up to 2.6%. For X6, Homogeneity index (HI) improved by 47.3% but MUs increased by 28.3% for 9F-IMRT compared to 5F-IMRT. Although MUs decreased by 6.7% with X10 and mixed X6 & X10, HI fall by 6.0% for 9F-IMRT in compared to X6. For X6, HI and MUs increased by 37.6% and 7.0% respectively for 2A-VMAT in compared to 1A-VMAT. With 2A-VMAT for X6, HI
was higher by 12.3% and MUs was lower by 5.7% than X10 and mixed X6 & X10. The difference among 7F, 9F and 11F IMRT, and between 2A and 3A VMAT were not significant. No considerable difference was observed for dose distribution to the target between 9F-IMRT and 2A-VMAT. However, a significant increase of MUs (72.7%) with 9F-IMRT was found. Regardless of techniques, energy, number of fields and arcs, OARs dose varied not more than 10.0%.
Conclusion: Compared to the both 9F-IMRT and 2A-VMAT plans are recommended for rectal cancer with short course. However, VMAT is more feasible to the patients due to significant reduction of MU.
Keywords: Rectal cancer, intensity-modulated radiation therapy, volumetric modulated arc therapy, homogeneity index.

PP-83: Natural and Artificial Radioactivity Level in Sediment of the Pasur River

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The study has been carried out to determine the concentrations of natural and artificial radionuclides in sediment sample of Pasur River adjacent to Maitree Super Thermal Power Plant (MSTPP), Rampal, Bagerhat. The aim of this study is to establish a database for radioactivity levels of MSTPP peripheral sediment of Pasur river. Five sediment samples have been collected from different locations of Pasur river adjacent to MSTPP. Each sample was counted for about 7200 sec using γ - ray spectrometry High Purity Germanium (HPGe) at Radioactivity Testing and Monitoring Laboratory, Mongla of Bangladesh Atomic Energy Commission. The observed activity concentrations of ^{226}Ra varies from 38 $Bqkg^{-1}$ to 57 $Bqkg^{-1}$ with an average value of 46.4 $Bqkg^{-1}$. The activity concentrations of ^{232}Th of the samples have been found to be varied from 54 $Bqkg^{-1}$ to 79 $Bqkg^{-1}$ with an average value of 66.4 $Bqkg^{-1}$. The activity concentrations of ^{40}K of the samples have been found to be varied from 650 $Bqkg^{-1}$ to 860 $Bqkg^{-1}$ with an average value of 772 $Bqkg^{-1}$. The average values from the soil samples under the study are more than the corresponding worldwide average values (35, 30 and 400 $BqKg^{-1}$) but less than the recommended limits. The results show the soil sediment of the study area does not pose health hazard to people residing in this area.

Keywords: Radioactivity, Pasur River, ^{226}Ra, ^{40}K, ^{232}Th.

PP-84: Synthesis and Characterization of Graphene Oxide Reinforced Cobalt Doped Bismuth Titanate Nanocomposites

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In this work, an attempt has been taken to synthesize and analyze nanocomposites composed of graphene oxide (GO) using modified Hummer's, and bismuth titanate (BTO) via pechini and sol-gel methods. The sol-gel process was chosen to create 10%, 30%, and 50% cobalt-doped bismuth titanate (CBTO) rather than pechini method due to superior performance across all characterization techniques. A separate addition route in a hydrothermal method was then employed to add graphene oxide and form graphene oxide cobalt-doped bismuth titanate (GO/CBTO) nanocomposites with varying percentages of GO. The nanocomposites were characterized by X-ray diffraction analysis (XRD), Fourier-transform infrared spectroscopy (FTIR), ultra-violate visible differential reflectance spectroscopy (UV-vis DRS), and physical property measurement system (PPMS). The XRD study confirmed the pure orthorhombic perovskite phase of the nanocomposites and the crystallite size decreased with Co doping and increased after GO reinforcement with the optimized 9% GO CBTO having 46.97 nm. FTIR analysis confirmed the presence of functional groups in the prepared nanocomposites and indicated the perfect formation of CBTO and GO-CBTO nanocomposites. The UV-vis DRS analysis revealed a decrease in the bandgap after Co doping and GO reinforcement from 3.36 eV. The magnetic properties of all composites were studied using PPMS, showing a soft magnetic nature with the increase of GO percentage. The as-synthesized samples show improved characteristics which will be used as potential materials for photocatalysis in order to remove dyes from industrial wastes.

Keywords: Graphene oxide, cobalt-doped bismuth titanate, Nanocomposites, Hydrothermal, Optical and magnetic properties.

PP-85: Structural and Optical Properties of $Bi_{25}FeNiO_{40}$@MWCNTs Nanocomposites Synthesized by Hydrothermal in-situ Growth Method

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Nickel substituted sillenite phase bismuth ferrite nanoparticles (BNF) were synthesized by cost-effective hydrothermal technique at a reaction temperature of 160-200 °C. Then multi-walled carbon nanotubes (MWCNTs of different weight fractions) were incorporated with synthesized BNF nanoparticles. Two different routes of the hydrothermal method were used at an optimized reaction temperature of 180 °C to form

BNF@MWCNT nanocomposite. The as-synthesized samples were characterized by X-ray diffraction (XRD) measurements, Fourier-transform infrared spectra analyzer (FTIR), and Ultraviolet-Visible Diffuse Reflectance Spectroscopy (UV–Vis DRS). The XRD measurements of the as-synthesized materials confirmed the formation of sillenite-type BNF and BNF@MWCNT nanocomposites with increased crystallinity. Due to the substitution of Ni on $Bi_{25}FeO_{40}$, the crystal peak position shifted to the higher values of theta angle. Incorporating 5% weight fractions of MWCNTs into BNF decreased the average crystallite size from 29.36 nm to 28.04 nm, as calculated by the Stokes-Wilson equation. The optical analysis of synthesized materials revealed that the optical band gaps were found to increase from 2.10 to 2.29 eV with the increase in Ni substitution in the $Bi_{25}FeO_{40}$ crystal. The optical study of composite materials with 5% weight fractions of MWCNT, obtained a lower bandgap among all the samples, produced by the separable growth technique. FTIR investigation confirmed the better adhesion of MWCNT with sillenite bismuth nickel ferrite crystal and also confirmed the presence of functional groups in BNF@MWCNT composites.

Keywords: Bismuth Nickel ferrite, MWCNT, Hydrothermal, Structural properties, Bandgap

PP-86: Thickness-Dependent Plasma Polymerized N-Vinyl-2-Pyrrolidone Thin Films: Investigation of Structural and Optical Properties

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Plasma polymerized N-Vinyl-2-Pyrrolidone (PPNVP) thin films of different thicknesses are prepared onto glass substrates at room temperature under the pressure of 60 torr by a capacitively coupled AC glow discharge plasma system as shown in Fig.1. Fourier Transform Infrared Spectroscopy (FTIR), Field-Emission Scanning Electron Microscopy (FESEM), Energy Dispersive X-Ray (EDX) Spectroscopy, and Ultraviolet-Visible (UV-Vis) Spectroscopy are used to obtain thickness-dependent structural, morphological, elemental, and optical properties of PPNVP thin films. According to FESEM analysis, the polymeric structure of PPNVP thin films displays frequent cleavage-type fractures and indicates the presence of hydrophilic functional groups. The intensity of the FTIR spectra of PPNVP thin films is found to increase with increasing film thickness, retaining most of the absorption features of conventional PVP in the PPNVP spectrum with a little shift in the wavenumbers due to the structural modification or cross-linking in the plasma polymerization process. According to the EDX results, as the thickness of the film increases, the mass (%) of carbon and nitrogen increases while the mass (%) of oxygen decreases. Based on the results of the UV-Visible spectroscopy, the optical absorbance of all the PPNVP thin films increases sharply in the UV region, showing a peak at around 300 nm, and then rapidly decreases up to around 350 nm. The direct (3.23-2.98 eV) and indirect (2.77-2.62 eV) band gaps get narrower as the thickness of a thin film increases, which is characterized by structural variation with film thickness.
Keywords: Plasma polymerization, N-Vinyl-2-Pyrrolidone, FTIR, FESEM, EDX, UV-Vis spectroscopy.

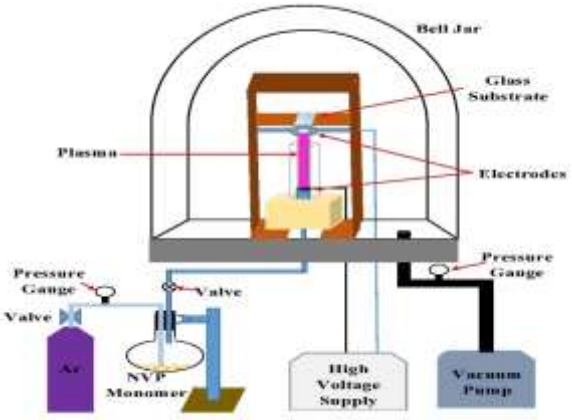

Fig.1: Schematic diagram of AC glow discharge

PP-87: Optimizing The Cell Performance of MnO_2-treated Electron Transport Layer Based Perovskite Solar Cell

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Due to high efficiency and affordable manufacturing costs, perovskite solar cells have been the major focus of solar cell development research over the past several years[1]. Through altering the interfacial anode, there are numerous possibilities to improve the efficiency of perovskite solar cells[2]. In this study, 0.1, 0.2 and 0.3 wt %, of MnO_2-treated TiO_2 have been utilized as an electron transport layer (ETL), a perovskite solution was prepared by using methylammonium triiodide CH_3NH_3I (MAI), methylammonium lead triiodide $CH_3NH_3PbI_3$ (MAPbI) at a 3:1 ratio. The ETL layer was coated to the glass substrate using the doctor blade technique, and then the perovskite layer was deposited by spin coating at 1200 rpm. A mixture of 0.2 wt % of graphene oxide (GO) and hydroiodic acid (HI) was placed between the cathode and anode and observed the cell performance. FTIR and SEM spectroscopy techniques were used to characterize the coatings. FTIR analyses revealed several vibrational modes, mainly dominated by the organic salt (MAI) in both structures and a few novel bonds. The structural characterization of the perovskite layer is investigated by SEM. The photoelectric properties of PSC were measured under the simulated white light source (100 mW/cm2 and AM 1.5) as follows: Isc = 1.075 mA, Voc = 198 mV, Vmax = 40 mV, Imax = 1.015 mA, FF = 0.19, and efficiency = 0.40%.
Keywords: Perovskite solar cell (PSC), MnO_2-treated TiO_2, Cell performance, Efficiency, Electron transport layer (ETL).
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PP-88: Improving the Cell Efficiency of Dye-Sensitized Solar Cell byIncorporating Carbon Nanotubes with Titanium Dioxide.

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Dye-sensitized solar cells (DSSC) have attracted a lot of scientific interest in recent years due to their physically portable form and simple manufacturing method [1]. Nevertheless, the inefficient performance brought on by sluggish electron transport, ineffective light harvesting and considerable charge recombination is a serious issue in DSSCs. Carbon nanotubes (CNTs) are potential candidates to solve these problems, according to recent research, because of their distinctive electrical, optical, chemical, physical, and catalytic capabilities [2]. In this study, we incorporated single-wall carbon nanotubes into TiO_2 in various proportions and observed the cell performance, then the result was compared with the pure TiO_2-based cell's efficacy. We utilized a natural dye like *Tectona grandis* as a sensitizer. The surface morphology, functional group and crystal structure of the cells were characterized by using SEM, FTIR and X-rd analysis. A calibrated solar simulator with a 500W Xenon arc lamp and 100 mW/cm2 of light intensity in AM 1.5G was used to measure the power conversion efficiency of the dye-solar cells. The photoelectric performance of pure TiO_2 and 10 µl of CNT incorporated TiO_2-based cell was shown as Voc=229mV, Isc=.42 mA, FF=0.303, η=.3 and Voc=330mV, Isc=.52 mA, FF=0.436, η =.748

respectively. As a result of 10 µl CNT incorporated into TiO_2, the cell efficiency increased by 149.333% as compared to pure TiO_2.

Keywords: Dye-sensitized solar cell, Efficiency, CNT incorporated DSSC, Cell performance.

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