KARNATAKA PHYSICS ASSOCIATION (R)

&

VIJAYA COLLEGE

RV Road, Basavanagudi, Bengaluru-560 004
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Conferred "College with Potential for Excellence" by UGC

An IQAC and IIC Initiative

Jointly Organizing

Two Day National Conference on

Quantum Science and Technology, Role of Artificial Intelligence in Physics Teaching and Materials Science (NCQAPM-25)

SOUVENIR
&
BOOK OF ABSTRACTS

Organized by
Physics Department, Vijaya College & Karnataka Physics Association
In collaboration with
PRAYOGA Institute of Education Research

Venue: Indoor auditorium, Vijaya College, RV Road,
Basavanagudi , Bangalore-560 004 .

VIJAYA COLLEGE
RV ROAD, BASAVANAGUDI, BENGALURU-560 004

Designed by AJ

ಕರ್ನಾಟಕ ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ಅಕಾಡೆಮಿ

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SOUVENIR

Two Day National Conference on Quantum Science and Technology Role of Artificial Intelligence in Physics Teaching and Materials Science (NCQAPM -25)

21 – 22, March 2025

Organized by Karnataka Physics Association (KPA)

&

Vijaya College

In association with Prayoga Institute of Education Research

ABSTRACTS

Venue
Indoor Auditorium, Vijaya College
RV Road, Basavana Gudi, Bengaluru 560 004

Email; Karnataka.physics@gmail.com

Phone: 07019976835

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Editorial Board

Dr. B A Kagali
Dr. R S Keshavamurthy
Dr. P Nagaraju (Co-ordinator)
Compilation of the Abstracts: Smt Lakshmi S

CONTENTS

From the Coordinator's Desk

It is my great privilege and honour to welcome all the delegates to this wonderful gathering in the Garden City and the premises of one of the best co-educational Colleges of Bengaluru city. I am thankful to Karnataka Physics Association (KPA) for having given the opportunity of organizing "Two Day National Conference on Quantum Science and Technology, Role of Artificial Intelligence in Teaching Physics and Materials Science" during March 21 and 22, 2025 at Vijaya College. I am extremely thankful to the Management of the BHS Higher Education Society, Jayanagar, Bengaluru and special thanks to Sri G V Vishwanath, IAS (Retd), President and Dr T A Balakrishna Secretary for the their unstinted support and encouragement to conduct this event.

I take this opportunity to express my sincere thanks to the delegates for their interest and effort to attend and participate actively in the Conference, which will be beneficial to all of us. This is a National event and a unique opportunity for participants to present their Research work and share intellectual interactions with their peer group.

The 2- days National Conference is a flagship activity of the KPA. I am sure, the invited talks from the experts and ORAL/POSTER presentations by the participants will make the Conference vibrant.

On behalf of the organizing committee, I sincerely thank all those who have supported the Conference by way of sponsorship. I would like to express my gratitude to Dr. H S Nagaraja, Chief mentor, Prayoga, Bengaluru, Dr. Harikrishna Maram, Vision Digital India, Dr V G Joseph, Chancellor, Garden City University, Dr. T Somasekhar, Chairman, Indian Academy Group of Institutions, Karnataka Science and Technology Academy (KSTA), Karnataka State Council for Science and Technology (KSCST), Mr Anil Kumar, Kamaljeeth Scientific, Mr S Rajashekar, Vijaya College alumni, and Mr Lakshmikeshava. My sincere thanks to KPA members Dr. S K Nataraju, Prof M R Nandan and Prof K M Raghavendran for their financial support. I thank the members of the National Advisory and the Organizing committees and the Executive committee (EC) of KPA for their constant support. My special thanks are due to Padmasri A S Kiran Kumar, Prof P Venkataramaiah, Prof K Siddappa, Prof B A Kagali, and Prof R S Keshavamurthy.

I would like to express my gratitude to all the founder & Life members of KPA and staff of the Vijaya College, Basavanagudi, Bengaluru. My sincere thanks to Dr K S Suresh(Retd Principal) and the Principal Dr M Sbramanya Bhat. I am thankful to the invited speakers Prof Apoorva D. Patel High Energy Phsysics, IISc, Prof Chandan Kumar, Centre for Nano Science and Engineering, IISc and Sri Pavan Kumar A G, Software Architect, IBM, ISDL Labs, I sincerely thank Dr B S Srrikanta, Dr S Somasekara, Dr S P Basavaraju and Dr B Rudraswamy for their constant support and advice

I thank Lakshmi S for the help in compilation of the Abstracts and Arul Jyothi, student of Vijaya College for helped me in designing the Invitation Card, Banner and Certificate. My special thanks to Prof N Jabeen, Prof C R Shreedhar and Volunteers of the Vijaya College.

Dr. P Nagaraju
General Secretary, Karnataka Physics Association
Co Ordinator, NCQAPM - 25

PROFILES

Conference preamble: The conference aims at innovation, research and collaboration to holistic development of our education system in all dimensions. The National new education policy recommends the spirit of innovation and creativity into our education system. Indeed this conference will be an opportunity to reflect on what has been happening in the field of application of AI into the physics teaching and research. Further, it is expected that how materials give new directions in the years to come? The conference will provide a platform for experts from academia and industry to show case their latest findings in the areas of expertise with inclusiveness of physics and allied subjects. It is also a forum for the dissemination of original research findings on both theory and experiments. The format of the conference consists of invited talks by experts, oral and poster presentations by the participants.

About Karnataka Physics Association (KPA): Karnataka Physics Association (KPA) is a registered non-profit organisation with a jurisdiction extending over the entire state of Karnataka. The main objective is to encourage and improve the teaching, learning and application of Physics and its allied disciplines at all levels. The association organizes events such as workshops, programmes to develop innovative teaching methods and holding popular lectures by experts for general public.

About BHS Higher Education Society: The BHS Managing Committee was established in 1942 by a group of eminent educationists and philanthropists and was registered as a non-profit body dedicated to the cause of education. The mission of BHS Higher Education Society is to achieve EXCELLENCE IN EDUCATION with the philosophy that education is the prime contributor to the development of self, society and the diverse human enterprise.

About Vijaya College, RV Road: Established in 1945, Vijaya College is a well-known landmark in South Bengaluru. It is a full-fledged undergraduate and postgraduate degree college that has contributed significantly to the development of society and student community over a period of more than 80 years of its purposeful existence

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A.S. KIRAN KUMAR
Member, Space Commission
Former Chairman, ISRO

MESSAGE

It is heartening to learn that Karnataka Physics Association is organizing a 2-day National Conference on Quantum Science and Technology, Role of AI in Physics Teaching and Materials Science on March 21-22, 2025 at Vijaya College, Basavanagudi, Bengaluru.

The efforts of KPA aiming to improve teaching and learning through organising conferences, workshops, talks as well as by way of publishing periodicals, journals and newsletters in Kannada and English, are praiseworthy.

I am sure, the National Conference – organized by KPA for the first time - will provide a platform for the participants to interact with experts in the respective fields and to gain from the deliberations enabling them to strengthen their understanding about the topics.

I wish all success to the National Conference as well as the endeavours of Karnataka Physics Association.

ए.एस. किरण कुमार
(A.S. Kiran Kumar)

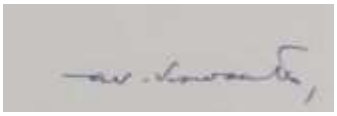
Bengaluru
March 17, 2025

MESSAGE

Sri G V Vishwanath
IAS (Retd), President
BHS Higher Education Society
Bengaluru 560 011

Karnataka Physics Association is organizing a two day National Conference on “Quantum Sciece and Technology, Role of Artificial intelligence in Physics Teaching and materials Science”. These are sunrise subjects which play a leading role in the development of Physics. They are also the forerunners of advances in Physics. I am sure that this conference will take stock of current developments and lay down a road map for the future.

I wish the conference all success.



MESSAGE

Dr.T.A.Balakrishna Adiga. M.Sc., Ph.D .
(Science Writer and Communicator)
Hon.Secretary,
BHS HIGHER EDUCATION SOCIETY
BENGALURU -560 011

I am extremely happy to know that **Karnataka Physics Association** is holding a Two-day National Conference on **Quantum Science and Technology-Role of AI in Physics Teaching and Material science,** 21st and 22nd March, 2025, at Vijaya College, R.V.Road, Bengaluru -560 004. It is a on a proud privilege that the conference is being co-hosted by **BHS Higher Education Society,** which is managing Vijaya College and 13 sister institutions and **Prayoga Institute of Education Research, Bengaluru.**

Quantum Technology is an advanced field that leverages the principles of quantum mechanics, to develop innovative applications in computing, communication, sensing and metrology and, cryptography. Similarly, **Generative A I** has been another fascinating field which has attracted the attention of Educationists all over the world, because of the innumerable opportunities it provides in improving Teaching and Learning. In view of this, I consider that the deliberations of this conference, are eagerly awaited by the concerned experts.

On behalf of **BHS Higher Education Society,** I extend a warm Welcome to the Organizers, Sponsorers, Chief guest, Speakers, Delegates, Invitees and Participants to this Two-day conference. Wishing you all a memorable day, a fruitful time and a purposeful association.

With Regards

Professor P Venkataramaiah
Formerly
Professor, Department of Physics, UOM
Vice-Chancellor, Kuvempu University
Chairman, Souuthern Regional Committee
National Council for Teacher Education
UGC Emeritus Fellow, Mysore University
Current Chairman, Centre for Science
Education in Schools, University of Mysore

04-02-2025

Message to the National Conference.

I have great pleasure in sending my best wishes to the National Conference organized to be held at Vijaya College Bangalore. The subject of the Conference is "Quantum Science and Technology and the Role of A I on Teaching Science and Material Science".

The word Quantum was first used in Physics when Quantum Mechanics was developed during the later part of 20th century. Artificial Intelligence was developed in the 21st Century. It is gratifying to know that under the aegis of Karnataka Physics Association a Conference is organized on the above topic in association of Vijaya College.

The use of A I in education is transforming various dimensions of the education system, such as instructional practices, assessment strategies and administrative processes. It also plays an active role in the progression of science education. The study of the AI has helped in understanding the evidence based interaction between AI and science education. An in depth study of this offers a consolidated analysis of AI's impact on students' learning outcomes, context of its adoption, the perceptions of students and Teachers about its use and challenges of its use within science education. This shows that adoption of AI in teaching process has large benefits. Therefore it is a very useful decision of the KPA to have planned to organize a National Conference on this topic. This helps our teachers in the colleges to get themselves exposed to this new emerging topic so that they get empowered to be better teachers.

In the Conference the teachers are also exposed to the new concepts in the development of Quantum Science and Technology. I only wish that our Teacher friends participating in the Conference will make use of the best through their interaction with the expert resource persons.

I complement the President and other office bearers of KPA for having conceived of this useful topic and organizing the Conference. I Wish the Conference a great success.

P Venkataramaiah

The Karnataka Association for the Advancement of Science (Regd)
Bengaluru

Prof. K Siddappa
President KAAS
Former Vice Chancellor, Bangalore University
Former Director, Microtron Centre
Mangalore University

MESSAGE

I am indeed very happy that the Karnataka Physics Association and Vijaya College, Bengaluru are jointly organising a two-day National Conference on Quantum Science and Technology, Role of Artificial Intelligence in Physics Teaching And Material Science during March 21-22, 2025. The conference assumes a Special significance in the context of the New Education Policy which focuses on the spirit of innovation and creativity in our education system. The organizers of the conference are aiming to achieve this in physics teaching and research. Recent advances in quantum physical research papers have paved the way for a big boost in Quantum computing materials research. Advances in artificial intelligence are also inspiring. These developments have given new Phillip to the researchers and innovators to excel. The invited talks by experts in these fields and oral / poster presentations by researchers in these areas will provide, I hope, a feast of interesting information to the participants and inspire them. My hearty congratulations to the organizers for their efforts. And, I wish the conference a grand success.

Bangalore
12.03.2025

K Siddappa

PRAYOGA

Dr H S Nagaraja
Founder and Chief Mentor, Prayoga

I am delighted to know that Karnataka Physics Association in collaboration with Viaya College is conductng a National Conference. Its is further gratifying to know that the Karnataka Physics Association which is a very young organization venturing into organizing the conference demonstrates its commitment to the cause of Physics Education and the importance of Research in today's world.

I congratulate the Organisers and wish the Conference Success.

H S Nagaraja

Karnataka Science and Technology Academy (KSTA)
Department of Science and Technology, Government of Karnataka
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Chief Executive Officer

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March 7, 2025

Message

I am delighted to learn that the **Karnataka Physics Association (KPA)** is organizing a two-day National Conference on the theme, **"Quantum Science and Technology (QST), Role of Artificial intelligence (AI) in Physics Teaching and Materials Science,"** in association with my alma mater, **Vijaya College**, Basavanagudi, Bengaluru on 21st and 22nd March 2025.

This conference will offer an excellent opportunity to reflect on the latest advancements in the field of QST. It will also provide a platform to deliberate on the applications of AI in physics teaching and research. Furthermore, the conference is expected to shed light on materials that are driving new innovations and applications in the coming years.

I am particularly pleased to note that young research scholars have been given the opportunity to present their research work through oral and poster presentations, with the best presentations receiving cash prizes during the event.

I am confident that this conference will serve as a valuable platform for scientific exchange, enabling discussions on the latest research and innovations in QST, AI and Materials Science. It will also provide good opportunity for young researchers to network with eminent scientists, researchers, and subject matter experts, which motivates them to pursue careers in advanced research in physical sciences.

I commend the efforts of KPA in encouraging and improving the teaching, learning, and applications of physics at all educational levels.

On behalf of the Karnataka Science and Technology Academy, I extend my best wishes for the success of the conference and look forward to engaging discussions.

A M Ramesh

Dr. Ashok M Raichur

Professor, Materials Engineering, IISC

Secretary
Karnataka State Council for Science and Technology

Dr. U T Vijay
Executive Secretary

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Karnataka State Council for Science and Technology (KSCST) an autonomous S&T organization under Department of Science & Technology, Government of Karnataka established in the year 1975 is one of the first State S&T Councils to be set up in the country. During the last 45 years of its existence, KSCST has been pro-actively engaging itself to identify, propose and implement S&T based solutions to locale specific needs / problems in the broad areas of Water, Education, Geospatial Technologies, Housing, Energy, Digital Heritage, Health and E- governance. In association with the Indian Institute of Science and several other premier R&D institutions, KSCST has been executing many projects and programmes aimed at improving socio-economic conditions of the people of the state.

Over the years, a number of technologies have been translated, from research and demonstration phase to the implementation and operational phase. KSCST provides support to the State Government in formulation of S&T based policies and to both Central and State Governments in scientific surveys, project implementation, evaluation, co-ordination & monitoring, organization of scientific meets and awareness campaigns.

Two Day National Conference on Quantum Science & Technology, Role of Artificial Intelligence in Physics Teaching and Materials Science (NCQAPM – 25)

March 21 & 22, 2025 (Friday & Saturday)

PROGRAMME SCHEDULE

DAY -1 (21.03.2025, Friday)	
Timings	Description

08.30 am – 09.30 am **Registration of Participants / Break fast**

09.30 am – 09.35 am	Invocation / Prayer	College Students
09.35 am – 09.45 am	Welcome address	Dr. P Nagaraju, Co ordinator
09.45 am – 09.50 am	Inauguration by Lighting the Lamp and Release of Souvenir	Chief guest and guest of honor
09.50 am – 09.55 am	About the college	Dr. M Subramanya Bhat Prinicipal
09.55 am – 10.00 am	About the Conference	Dr. B A Kagali President, KPA
10.00 am – 10.15 am	Inaugural address	Chief Guest Prof K P J Reddy IISc; Chairman, Machstar Group of Companies
10.15 am – 10.20 am	Address by Guests of honor	Dr T A BalaKrishna, Secretary BHS HES Dr H S Nagaraja, Prayoga
10.20 am – 10.25 am	Presidential remarks	Sri G V Vishwanath, President, BHS HES
10.25 am – 10.30 am	Vote of thanks	Prof N Jabeen, HOD, Physics
10.30 am – 10.45 am	Tea / Coffee	

10.45 am – 01.15 pm	ACADEMIC SESSIONS

Session- 1, Chair- 1: Prof. N Udayashankar, RRI, Bengaluru

10.45 am – 11.35 am	Invited talk – Quantum Technology: Directions and Prospects	Prof. Apoorva D. Patel High Energy Physics, IISc
Session -2 , ORAL Presentations; Chair -2 : Prof. N Udayashankar, RRI, Bengaluru		
11.40 am – 11.50 am	OP1 – Altaf Pasha Dr Geetha Balakrishnan	Jain University, Bengaluru
11.50 am – 12.00 pm	OP2 – S Ajay Dr.Prabhu Tej	M S Ramaiah University, Bengaluru
12.00 pm – 12.10 pm	OP3 – Nishanth P Dr K M Udayanandan	College of Engineering, Trikaripur, Cheemeni P. O. Kerala-671313
12.10 pm – 12.20 pm	OP4 – T Humera, B P Govindaraj et al	Bangalore Universty, Jnana Bharathi Campus, Bengaluru
12.20 pm – 12.30 pm	OP5 – Prasanth P Dr K M Udayanandan	Sreerama Government Polytechnic College, Thriprayar, Kerala-680567
12.30 pm – 12.40 pm	OP6 - Dr B A Kagali	Bangalore University
12.40 pm – 01.45 pm	LUNCH	---

Session – 3, Chair – 3, Sri T S Sridhar, BHS HES and Dr B S Srikanta, Vice president, KPA

01..45 pm – 02.35 pm	Invited talk : Computer Vision: Intuition and Applications	Sri Pavan Kumar A G Software Architect, IBM, ISDL Labs, Bengaluru

Session – 4, ORAL Presentations: Chair – 4, Dr. M S Jogad, Vice president KPA and

Dr. B S Srikanta Vice president, KPA

02.40 pm – 02.50 pm	OP8- Anuradha P	Indian Academy Degree College, Bengaluru
02.50 pm– 03.00 pm	OP9- Akilandeswari R & Hemalatha R	Sindhi College, Bengaluru
03.00 pm – 03.10 pm	OP10 – Amrita Singh, Deekshitha H L Purvaprashanth Saphre	Acharya Institute of Graduate Studies, Bengaluru
03.10 pm – 03.20 pm	OP11 – Dr Lakshminarayana KG	Vijaya College, Jayanagar Bengaluru
03.20 pm – 03.30 pm	OP12 – Dr N Ragini	Principal, GFGC, HSR Layout Bengaluru
03.30 pm – 03.40 pm	OP13 – Mukund A Kulkarni Praveen Nambisan	Sun Mobilty Pvt. Ltd, Bengaluru
03.40 pm – 04.00 pm Tea/Coffee		

04.00 pm – 05.45 pm	**Session – 5, POSTER Presentations: PP1 – PP 15**
05.45 pm – 06.15 pm, OP19 –Dr. M S Jogad, OP17 – Dr A G Kulkarni, OP7 – Dr Ashoka	
06.15 pm – 07.15 pm	**Sky Observation with Telescope / Cultural Programme**
07.30 pm – 08.15 pm	**DINNER**
DAY -2 (22.03.2025 Saturday)	
08.30 am – 09.30 am	Break fast

Soft Session – 6, Chair -5, Prof C V Yelamaggad, Centre for Nano Science and Matter

09.30 am – 10.20 am	Invited talk: Probing Quantum Matter by Electronic Noise	Prof Chandan KumarCentre for Nano Science and Engineering, IISc

Session – 7, ORAL Presentations: Chair – 6, Prof Somasekara S, KPA Joint Secretary

10.20 am – 10.30 am	OP14 – Sanskar Jain	Jabalpur Enginerring College, Madhya Pradesh RRI – visiting student
10.30 am – 10. 40 am	OP15 – Dr Sujatha R	GFGC, HSR Lay out, Bengaluru
10.40 am – 10.50 am	OP16 – Dr Hariharan Nalatore, Dr Abhiram J	Sir M Vishweshwaraya Institute of Technology,Bengaluru
10.50 am – 11.00 am	OP18 – Dr Bhargavi K S	East – West College of Engineering, Bengaluru
11.00 am – 11.10 am	OP20 – Dr Omprakash SS	PRAYOGA ,Bengaluru
11.10 am – 11.20 am	**Tea/ Coffee**	
11.20 am – 01.15 pm	**Session – 8,:POSTER Presentations;**	**P16 – P29**

01.15 pm – 02.00 pm	**LUNCH**

Session – 8, ORAL presentations: Dr R S Keshava Murthy, Former Scientist, IGKAR Kalpakkam and Prof. Eraiah B, Chairman, Department of Physics, Bangalore University

02.00 pm – 02.10 pm	OP21 – Dr Ramya Prabhu B	PRAYOGA, Bengaluru
02.10 pm – 02.20 pm	OP22 – Dr Jeelan Basha	Indian Academy Degree College, Bengaluru
02.20 pm – 02.30 pm	OP23- Dr Ashwitha Nancy D'Souza K R Vignesh et al	Acharya Institute of Graduate Studies, Bengaluru
02.30 pm – 02.40 pm	OP24 – Dr Kavitha R, Dr Punith	PG Dept of Chemistry, Vijaya

	Kumar Munianjinappa, Basavarajaiah S M	College, Bengaluru
02.40 pm – 02.50 pm	OP25 – P Krishnamurthy,Dr. K S Kiran Dr. E Melagiriyappa	Jain Deemed to be University Bengaluru
02.50 pm – 03.00 pm	OP26 – Dr Revanasiddappa M et al	PES University, Electronic city campus, Bengaluru
03.00 pm – 03.10 pm	OP27 – Supriya Nayaka M K et al	Presidency University Bengaluru
03.10 pm – 03.20 pm	OP28 – Dr.Sharanya et al	East – West College of Engineering, Bengaluru
03.20 pm – 03.30 pm	OP29- Dr. Thontadharya	VijayaCollege

03.30 pm – 04.30 pm	**Valedictory Function**	
03.30 pm – 0.3.35 pm	Welcome address	Prof C R Shreedhar, Convener
03.35 pm – 03.40 pm	Feedback	Participants
03.40 pm – 03.50 pm	Address by Chief guest	Dr K S Nagabhushana Director, Research – Prayoga Institute of Education
03.50 pm – 04.00 pm	Prize announcement/Distribution	Guests
04.00 pm – 04.05	Presidential Remarks	Principal, Vijaya College
04.05 pm – 04.10 pm	Vote of Thanks	Dr R S Geetha, Convener
04.10 pm – 04.20 pm Distribution of Certificates **04. 20 pm National Anthem** **04.30 pm HIGH TEA**		

Invited Talks

Quantum Technology: Directions an prospects

Dr. Apporva D. Patel
Professor, High Energy Physics
IISc, Bengaluru

The fact that quantum algorithms can solve computational problems more efficiently than their classical counterparts has bee the driving force behind the intense effort to develop quantum technology. I will give an overview of subject highlighting the mathematical features that providethe quantum advantage and the physical properties underpinning them.

Computer vision: Intuition and Applications

Pavan Kumar A.G
Software Architect
IBM ISDL Labs

Computer vision bridges the gap between raw visual data and actionable insights. It's about teaching machines to "see", interpret and respond to the world, making it indispensible in AI-powered systems. At its heart, computer vision merges the eleganee of mathematical modelling with the opower of data-drven machine learnin, paving the way for smarter, more intuitive systems.

Probing Quantum Matter by Electronic Noise

Chandan Kumar
Centre for Nano Science and Engineering
Indian Institute of Science, Bengaluru - 560012

For practical applications, devices require a high signal-to-noise ratio. Consequently, electronic noise is often regarded as undesirable. In this talk, I will present specific examples of van der Waals graphene heterostructures to demonstrate how measuring electronic noise can reveal its origin, ultimately enabling the enhancement of the signal-to-noise ratio. Furthermore, I will illustrate how noise can function as a detector, providing insights into defect energy levels in various materials. The talk will conclude with a discussion on noise measurements in graphene moiré superlattices.

List of Oral presentations

Oral No.	Title of the paper	Name of the author/s	Affiliation
OP-01	On-chip, low-cost single-photon sources for next generation quantum optical communication and sensing	Altaf Phasha Dr Geetha Balakrishnan	JainUniversity, Bengaluru
OP-02	Single mode quantum phase estimation using displaced	S Ajay Dr.Prabhu Tej	M S Ramaiah University, Bengaluru
OP-03	Teaching the foundations of quantum mechanics	Nishanth P Dr K M Udayanandan	College of Engineering, Trikaripur, Cheemeni P. O. Kerala-671313
OP-04	Geometric visualization of two and three qubit states	T Humera, B P Govindaraj et al	Bangalore Universty, Jnana Bharathi Campus, Bengaluru
OP-05	Teaching quantum mechanics in high school Classical to Quantum approach	Prasanth P Dr K M Udayanandan	Sreerama Government Polytechnic College, Thriprayar, Kerala-680567
OP-06	Another kind of Paradox in Relativistic Quantum	Dr B A Kagali	Bangalore University
OP-07	Unification Theory: A Quantum Gravity Approach	Dr. Ashoka R	Mc Gan Medical College Shimga
OP-08	Leveraging the potential ofArtificial Intelligence to revolutionize physics education-	Anuradha P	Indian Academy Degree College, Bengaluru
OP-09	AI In Physics Education: Enhancing learning and expanding	Akilandeswari R & Hemalatha R	Sindhi College, Bengaluru
OP-10	The Role of Piezoelec	Amrita Singh, Deekshitha H L Purvaprashanth Saphre	Acharya Institute of Graduate Studies, Bengaluru
OP-11	AI in Education	Dr.Lakshminarayana KG	Vijaya College, Jayanagar
OP-12	AI and Quantum Synergy:	Dr N Ragini	Principal, GFGC, HSR Layout Bengaluru

OP-13	AI for next generation battery materials and EV technology	Mukund A Kulkarni Praveen Nambisan	Sun Mobilty Pvt. Ltd, Bengaluru
OP-14	How to use MacLearning for decoding slowly varyial	Sanskar Jain	Jabalpur Engineering College, Madhya Pradesh RRI – visiting student
OP-15	The Convergence of Physics and AI: A Transformative Partnership	Dr Sujatha R	GFGC, HSR Lay out, Bengaluru
OP-16	Effective Utilization of AI tools For Physics Learning, Teaching and Evaluation	Dr Hariharan Nalatore, Dr Abhiram J	Sir M VIT, Bengaluru
OP-17	Growing Ubiquity of AI in the Global Scenario, especially in Education & Scientific Research"	Dr. A G Kulkarni	K P A Member
OP-18	Eco – friendly synthesis of Cobalt Oxide Nanoparticles Using S.aromatium.	Dr Bhargavi K S	East – West College of Engineering, Bengaluru
OP-19	Glass and Glassceramics PreparationTechniques	Dr. M S Jogad,	Kalaburagi
OP-20	Fabrication of Amorphous ZnO TFT with Tunable Channel Length	Dr Omprakash SS	PRAYOGA ,Bengaluru
OP-21	Engineering the Cerium Oxide Nanoparticles with enhanced hydrophobicity	Dr Ramya Prabhu B	PRAYOGA, Bengaluru
OP-22	Isolation, semi-synthesis, druglike ness and virtual screening of small molecules as potent Inhibitors of p300 and STAT3	Dr Jeelan Basha	Indian Academy Degree College, Bengaluru
OP-23	Er3+/Tm3+ codoping and its influence onphysical	Dr Ashwitha Nancy D'Souza K R Vignesh et al	Acharya Institute of Graduate Studies, Bengaluru
OP-24	Biosynthesis, Characterization, DFT calculations, Molecular Modeling of Silver (Ag/Ag2O) Nanocomposite:	Dr Kavitha R, Dr Punith Kumar, Munianjinappa, Basavarajaiah S M	PG Department of Chemistry, Vijaya College, Bengaluru
OP-25	Effect of Nd^{3+} on structural,	P Krishnamurthy,Dr.	Jain Deemed to be

	dielectric and impedance properties of Nickel Cadmium nanostructured ferrites	K S Kiran Dr. E Melagiriyappa	UniversityBengaluru
OP-26	Polyaniline/Cerium-doped Alumina Nano hybrids	Dr Revanasiddappa M et al	PES University, Electronic city campus, Bengaluru
OP-27	A review on physical and thermal effect on borate by inclusion of the RE's	Supriya Nayaka M K et al	Presidency University Bengaluru
OP-28	An analysis of the use of photo catalysis to reduce	Dr.Sharanya et al	East – West College of Engineering, Bengaluru
OP-29	The AI Catalyst in Education: Reshaping Physics Learning	Dr. Thontadharya	Vijaya College

OP- 01

On-chip, low-cost single-photon sources for next generation quantum optical communication and sensing

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Colloidal perovskite quantum dots (PQDs) have emerged as a highly promising platform for developing advanced quantum and classical optoelectronic and photonic devices. However, their practical application is hindered by inherent challenges, including extreme sensitivity and low stability, which stem from their weak intrinsic lattice bond energy and complex surface chemistry. These limitations often lead to issues such as surface defects, blinking, and spectral diffusion, which degrade their optical performance and reliability.

To address these challenges, we introduce a novel platform of buried perovskite quantum dots (b-PQDs), embedded within a three-dimensional perovskite thin film. This innovative architecture is fabricated using a one-step, flash annealing process, which effectively mitigates surface-related instabilities commonly observed in colloidal PQDs. The b-PQDs exhibit exceptional optical properties, including ultrabright and stable single-dot emission with resolution-limited linewidths below 130 μeV, demonstrating their high spectral purity. Furthermore, they display photon antibunching with a $g^2(0)$ value of 0.1, confirming their capability as single-photon emitters. Remarkably, the b-PQDs show no blinking, suppressed spectral diffusion, and high photon count rates of up to 10^4 photons per second, consistent with near-unity quantum yield.

The ultrasharp emission linewidths of the b-PQDs enable the resolution of exciton fine structures, including dark and triplet excitons, and provide insights into their dynamics under an applied magnetic field. Additionally, the b-PQDs can be electrically driven to emit single photons with a narrow linewidth of 1 meV and photon antibunching ($g^2(0)$ = 0.4), highlighting their potential for practical integration into electrically operated devices.

These findings represent a significant advancement in the field of quantum emitters, offering a robust and scalable solution for overcoming the stability and performance limitations of traditional colloidal PQDs. The b-PQD platform paves the way for the development of on-chip, low-cost single-photon sources, which are essential for next-generation quantum optical communication, sensing, and computing technologies. By combining high performance with simplified fabrication, this approach brings us closer to realizing the full potential of perovskite-based quantum devices in real-world applications.

Single mode quantum phase estimation using displaced

OP- 02 Fock states and Photon added coherent states

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Quantum metrology or quantum estimation theory is a framework for estimating un-known parameters using quantum mechanical protocols. It helps us to evaluate the funda-mental limit on estimating parameters for a particular probe state. In this work, we study the phase precision of displaced Fock states and photon added coherent states by evaluat-ing the quantum Fisher information. While adding photons to a coherent state makes the phase estimation worse than the shot noise limit, displacing the Fock state is better than the shot noise limit and also approaches the Heisenberg limit for a particular case of the state parameters.

OP- 03

Teaching the foundations of quantum mechanics based on experiments for high-school students

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Quantum Physics require good mathematical support, creative and abstract thinking to understand the concepts. The foundational concepts of the subject are seen as difficult to grasp by undergraduate students as they are completely new to the ideas of quantum mechanics [1, 2]. To overcome such issues, it is essential to introduce fundamental concepts of quantum mechanics at school level. In school level introduction of quantum mechanics often encounter difficulties of the students to understand and compare the core concepts like wave function and wave-particle duality with day-to-day realities around them [3, 4]. Hence, we suggest that quantum physics must be introduced with the help of experiments, simulations and games at school level [5, 6, 7]. To inculcate the core concepts of quantum mechanics and to understand formal representation of those basic concepts real and simulation experiments are essential. So, in this paper, we introduce some real experiments with the help of python programmes. These set of experiments were presented to selected students of 8th, 9th and 10th in Kerala. The outcome of which showed a positive response.

OP- 04

Geometric visualization of two and three qubit states using Bloch sphere embeddings

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We have carried out experimental reconstruction of 2-qubit Bell states and 3-qubit W state using IBM quantum processors *ibmq_nairobi* and *ibmq_osaka.* We map the experimental data to represent the states geometrically in terms of ellipsoids inscribed within the Bloch sphere. The geometric visualization enables benchmarking quantum devices, which are subjected in general to intrinsic noises. This geometric representation is an extension of the Bloch sphere picture of qubits and it serves as a useful tool in quantum information processing tasks.

OP-05

Teaching quantum mechanics in high school Classical to Quantum approach

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Quantum Theory (QT) stands as a pivotal milestone in modern physics, revolutionizing our understanding of the physical world. However, the typical school curriculum often focuses solely on the historical narrative of select phenomena, such as the discovery of the Raman effect or the explanation of the photoelectric effect. Assessment methods frequently rely on formula-based problems, neglecting the fundamental conceptual distinction between classical and quantum theories[1,2]. This oversight is significant, as these two paradigms represent profoundly different worldviews that underpin our comprehension of reality. Quantum Mechanics is the second pillar of modern physics next to Einstein's Relativity theory[3]. This study presents an approach to teach quantum mechanics in high school physics courses which contains the extremely small content of quantum mechanics at present.

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ANOTHER KIND OF PARADOX IN RELATIVISTIC QUANTUM

OP- 06 **MECHANICS**

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It was found long time ago by O.Klein (ref.1) that electrons incident on a steep potential barrier get reflected from it in such a way the reflected flux is higher than the incident flux. The phenomenon has been discussed in detail by Bjorken and Drell (ref.2).The paradox is shown to be a manifestation of the limitations of a single particle picture in relativistic quantum mechanics. Similar results have been discussed for relativistic spin zero particles by Landau (ref.3) and Greiner (ref.4).We have found that another paradoxical result appears when relativistic spin zero particles are incident on a strong potential hill. It is found that, when the potential is sufficiently strong, one obtains genuine bound states of the particle. It is found to exist on one, two and three dimensional cases as well. It is another paradoxical result, quite contrary to what we find in non-relativistic quantum mechanics, that has to be understood (ref.5) on the basis of particle production in strong potentials- once again showing the shortcomings of a single particle relativistic quantum mechanics. It is natural to expect the existence of similar results for spin half particles too.

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OP- 07

Unification Theory: A Quantum Gravity Approach to Planetary Motion

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The Sun and planets form an integrated yet non-living system, where the Sun acts as the central force governing planetary motion.

To resolve these discrepancies, a 'Unification Theory' is proposed, integrating all four fundamental forces—gravitational, electromagnetic, strong nuclear, and weak nuclear forces. This theory introduces the concept of an energy gradient, where different regions of the Sun interact with specific planets through distinct energy exchanges. The planetary motion is governed by the interaction of gravitons and magnons. The interplay between these forces regulates both the Sun's internal rotation and planetary orbits.

OP- 08 Leveraging the potential of Artificial Intelligence to revolutionize physics education- A review

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Physics education plays a crucial role in developing critical thinking, problem-solving skills, and a deeper understanding of the natural world. As a branch of science, physics examines the fundamental principles that govern matter, energy, and the forces shaping the universe. By studying physics, students not only gain theoretical knowledge but also learn how to apply scientific concepts to real-world situations. Effective physics education emphasizes a balance between conceptual understanding and hands-on learning. Interactive experiments, simulations, and practical demonstrations help students connect abstract theories with tangible experiences. Moreover, integrating technology and innovative teaching methods enriches the learning process and fosters engagement.

One such technological advancement, Artificial Intelligence (AI), has emerged as a powerful tool capable of transforming education through its ability to perform tasks namely, learning, reasoning, problem-solving, perception, language understanding and generation, which traditionally requires human intelligence. Education has seen ground breaking developments largely due to AI, especially in the area of physics, where students often have difficulty in understanding challenging topics. AI-based solutions in physics education namely, personalized learning means, real- time response, and deeply engaging simulations can greatly improve access to learning resources, increase student engagement and improve comprehension of abstract concepts. This study emphasizes the transformative power of AI in physics education, calling for in-depth research to create ethical, methodological, and integrative approaches that amplify its advantages while mitigating its disadvantages.

AI IN PHYSICS EDUCATION: ENHANCING LEARNING AND EXPANDING POSSIBILITIES

OP- 09

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Artificial Intelligence (AI) is transforming physics education by enhancing teaching methodologies and improving student learning experiences. AI-driven tools, such as intelligent tutoring systems, virtual simulations, and automated grading, provide personalized learning, instant feedback, and interactive engagement. These technologies allow students to visualize complex physics concepts, conduct virtual experiments, and receive adaptive instruction tailored to their needs. AI also supports educators by automating administrative tasks, analyzing student performance, and facilitating data-driven teaching strategies. Additionally, AI plays a crucial role in physics research, assisting with large-scale data analysis and simulations. Despite its advantages, challenges such as high implementation costs, data privacy concerns, and over-reliance on technology must be addressed. As AI continues to evolve, its integration into physics education will become increasingly significant, making learning more accessible, efficient, and engaging. This paper explores the role of AI in physics teaching, its benefits, challenges, and future potential.

OP-10

Advanced Sensing Technologies: The Role of Piezoelectric Sensors in Next-Generation Robotics

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Piezoelectric sensors have become crucial to robotics advancements, significantly enhancing motion-sensing accuracy and driving the development of sophisticated, adaptive robotic systems. These sensors convert mechanical stress into electrical signals, enabling precise measurement of forces, vibrations, and pressures, making them indispensable under dynamic conditions. This review examines the benefits of piezoelectric sensors in enhancing robotic precision and responsiveness, thereby facilitating smooth communication with humans and other systems. Continuous monitoring of vibrations, accelerations, and strain is essential for machine predictive maintenance and wearable motion tracking applications. The results highlight the groundbreaking significance of piezoelectric sensors in shaping the future of robotics and sensor-based technology.

AI in Education

OP- 11

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Artificial Intelligence (AI) is revolutionizing various sectors, including education. This paper explores the integration of AI in education, examining its impact on traditional teaching methods, its applications in teaching, and its potential future developments. By analyzing current trends and case studies, it's aim is to provide a comprehensive understanding of how AI is transforming the educational landscape. The discussion includes the benefits and challenges of AI in education, highlighting the need for a balanced approach to harness its full potential.

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OP- 12

AI and Quantum Synergy: Safeguarding Industries and propelling Physics forward, an Overview

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This paper, entitled "AI and Quantum Synergy: Safeguarding Industries and Propelling Physics Forward," investigates the profound influence of Artificial Intelligence (AI) on diverse industries, specifically emphasizing its ground breaking contributions to the field of Physics. The study underscores the critical need to protect data from potential AI-driven attacks and thoroughly explores AI's advantages, applications, and limitations [10]. Moreover, it underscores the intersection of AI and quantum computing, analyzing their collaborative potential to propel advancements across various sectors. The examination extends to the contemporary landscape of cyber security, recognizing the pivotal role of AI in strengthening defences against evolving cyber threats. Additionally, the paper scrutinizes the viewpoints of former British Prime Minister Rishi Sunak on AI regulation and the establishment of an AI Safety Institute [5]. In conclusion, this article projects the future strategy of AI in physics, envisioning breakthroughs that enhance our understanding of the universe and enable the resolution of grand challenges. This study adheres to the standards set by Scopus Journals, ensuring rigorous exploration and discussion of the transformative impact of AI on both industries and the realm of Physics.

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OP-13

AI for next generation battery materials and EV technology

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In recent years, electric vehicles (EVs) have been rapidly introduced as an environmental measure. It is said, however, one of the challenges to accelerate their spread rests in how to increase their driving range. To meet this challenge, efforts are being made to reduce vehicle weight through the use of resin parts and to increase the capacity of lithium-ion batteries. In addition, another challenge is to improve safety. Since electric vehicle fires caused by lithium-ion battery ignition have been occurring frequently, it is expected that lithium-ion battery packs are made fireproof. In order to increase the passenger safety, recent regulations have been made very stringent in the wake of thermal runaway in a battery pack. The battery pack in expected to withstand intense ignition during the event of thermal runaway. To meet the regulatory safety needs, a wide range of thermal and electrical insulation materials have been selected. The materials selected combines key characteristics such as flame resistance, heat insulation, and light weight.

The development of new battery materials can be a time-consuming and expensive endeavor. However, artificial intelligence may hold the key to more rapid and cost-effective material development. To achieve high battery efficiency and operational reliability, predictive intelligence, and data analytics will play key roles as artificial intelligence becomes more disruptive in the battery technology space. Long and costly material development cycles are being replaced by quick and affordable computational processing methods. This paper will discuss how AI & ML can be used to create and select battery materials and how digital twins can be used as a tool to monitor battery degradation.

Recent advancements in artificial intelligence (AI), particularly in algorithms and computing power, have led to the widespread adoption of AI techniques in various scientific and engineering disciplines. Among these, materials science has seen a significant transformation due to the availability of vast datasets, through which AI techniques, such as machine learning (ML) and deep learning (DL), can solve complex problems. One area where AI is proving to be highly impactful is in the design of high-performance Li-ion batteries (LIBs). The ability to accelerate the discovery of new materials with optimized structures using AI can potentially revolutionize the development of LIBs, which are important for energy storage and electric vehicle technologies. However, while there is growing interest in using AI to design LIBs, the application of AI to discover new electrolytic systems for LIBs needs more investigation. The gap in existing research lies in the lack of a comprehensive framework that integrates AI-driven techniques with the specific requirements for electrolyte development in LIBs. This research aims to fill this gap by reviewing the application of AI for discovering and designing new electrolytic systems for LIBs. In this study, we outlined the fundamental processes involved in applying AI to this domain, including data processing, feature engineering, model training, testing, and validation.

OP-14

How to use Machine Learning for decoding slowly varying signals?

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Machine Learning allows exploring information from otherwise fuzzy and poorly identifiable detectable signals. There are many practical situations, such as inadequately lit images, where information fades or is hidden. Information is contaminated by foreground information. We found such a situation in our study of short-time-varying signals. They quickly vary with time and exist amidst strong backgrounds and foregrounds. We investigated machine learning for decoding facial activities, especially eye movements, using particular signatures buried in the waveforms of the EEG signals. One application could eventually build equivalent of a brain to computer interface. Other similar example applications are decoding natural waveforms seen from the seismic and gravitational activities. In some cases, training humans to characterize these signals visually is much faster as it yields more acceptable results than automatic deterministic algorithm-based approaches. However, human-aided approaches are limited when data size is extensive or if continued monitoring is required, as the decision-making becomes cumbersome for humans. Machine learning comes to aid such limitations. Machine learning under one umbrella is a gamut of linear algebra, probability, and specific heuristic techniques; machine learning requires certain tools and methods to be applied to real-world scenarios. In this talk, I'll present how machine learning decodes poorly identifiable and slowly varying signals. The example I'll take is of EEG signals, but these techniques can be suitable applied to other physical signals produced by nature after some modifications. Hence, it also has applications in the different fields of science, technology, engineering and medicine. I'll also briefly discuss the entire process involved in bringing up a machine learning solution, highlighting the cautions and limitations on the use of machine learning and how to overcome them.

OP- 15 The Convergence of Physics and AI: A Transformative Partnership

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Artificial intelligence (AI) is rapidly becoming an indispensable tool for physicists, offering powerful new approaches to solving complex problems. Physics, a fundamental science concerned with the nature and properties of matter and energy, is now also experiencing a profound transformation due to AI. This paper investigates the burgeoning role of artificial intelligence (AI) in physics, a field undergoing significant transformation through the integration of AI methodologies. AI's capacity to accelerate research, improve complex data analysis, and facilitate the discovery of novel phenomena across diverse physical domains, from quantum mechanics to optics, is explored. Furthermore, the paper examines the reciprocal influence of physics on AI development, demonstrating how physical principles contribute to the creation of more efficient and interpretable algorithms. By reviewing recent advancements and collaborative endeavors, this work underscores the revolutionary potential of the physics-AI synergy for the future of physics research.[1,2]

OP-16 Effective Utilization of AI tools For Physics Learning, Teaching and Evaluation

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AI tools play a significant role in solving some major issues related to coding and development. It caters to the needs of several domains ranging from food, fashion, entertainment, sports, and predominantly in technological development in various industrial sectors. Academically, AI tools have been effective in preparation of notes, but there are some challenges in academia, which can get addressed and resolved using AI. This work highlights the role of Physics teachers getting acquainted with AI tools to create solutions for physics problems, to find a new research problem, to create the question bank for students, to create test question paper. Also, to extract vital statistics from Student Marks data thereby helping the Evaluation process which is the need of the hour.

Keywords: *Juluis AI, Hyperwrite, LearnFast*

OP- 17

"Growing Ubiquity of AI in the Global Scenario, especially in Education & Scientific Research"

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The rapid proliferation of artificial intelligence (AI) is reshaping the global landscape, permeating diverse sectors with transformative potential. Notably, its growing ubiquity in education and scientific research is driving significant advancements and sparking considerable discourse.

In the realm of education, AI is facilitating personalized learning experiences. Adaptive learning platforms, powered by AI algorithms, can tailor educational content to individual student needs, fostering deeper engagement and improved learning outcomes. AI-driven tools are also streamlining administrative tasks for educators, freeing up valuable time for instruction and student interaction. Furthermore, AI is enabling the development of intelligent tutoring systems, providing students with personalized feedback and support. However, the integration of AI in education also raises ethical considerations, such as data privacy and the potential for algorithmic bias, necessitating careful implementation and oversight.

Similarly, AI is revolutionizing scientific research across various disciplines. In fields like genomics, AI algorithms are accelerating the analysis of vast datasets, leading to breakthroughs in disease diagnosis and treatment. In astronomy, AI is aiding in the identification of celestial objects and the analysis of complex astronomical data. Moreover, AI is playing a crucial role in drug discovery, materials science, and climate modeling, enabling researchers to tackle complex challenges with unprecedented efficiency. The use of machine learning is also heavily used in analysis of very large data sets, that would have been impossible to analyse in previous times.

However, the increasing reliance on AI in scientific research also raises concerns about the reproducibility of AI-driven findings and the potential for algorithmic bias to influence research outcomes. Therefore, it is essential to establish robust guidelines and ethical frameworks to ensure the responsible and transparent use of AI in scientific research.

In conclusion, the growing ubiquity of AI in education and scientific research presents both immense opportunities and significant challenges. By embracing a thoughtful and ethical approach to AI implementation, we can harness its transformative potential to advance knowledge, enhance learning, and address pressing global challenges.

OP-18

Eco – friendly synthesis of Cobalt Oxide Nanoparticles Using S.aromatium.

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A new and ecologically friendly technique that has a wide range of biomedical uses is the green production of nanoparticles (NPs) using various plant extract components. A naturally occurring spice with important biological qualities is Indian clove (S.aromaticum). The capacity of clove to aid in the treatment of illnesses brought on by a variety of bacteria and fungi, such as E. coli, P. aeruginosa, and S. aureus, is one of its noteworthy advantages. Clove leaf extract was effectively used to synthesize cobalt oxide nanoparticles (Co_3O_4 NPs) as a green, possibly inexpensive, and simple biosynthetic technique. When creating metal nanoparticles (NPs) from cobalt chloride hexahydrate as a precursor, the organic bioactive chemicals found in clove leaf extract served as both stabilizing and reducing agents. High alkaline pH was shown to be advantageous for the production of pure and crystallized single-phase Co_3O_4 NPs, as demonstrated by UV/visible spectroscopy and X-ray diffraction analysis (XRD) investigations. Fourier transform infrared spectroscopy (FTIR) analysis was used to define the interaction between biomolecules from clove leaf extract and Co_3O_4 NPs.

OP-19 Glass and Glassceramics Preparation Techniques (and Characterization techniques)

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During the past few decades there had been tremendous growth in the field of material science and a variety of new materials with user specific properties have been developed such as smart shape memory alloys, hybrid materials like glassceramics, cermets, met-glasses, inorganic- organic composite layered structures, mixed oxides with negative thermal expansion, functional polymer materials and nanomaterials etc. This has led to the emergence of a variety of advanced techniques, which need to brought to the attention of the young researchers working in the field of materials science which requires the expertise of physics, chemistry and process engineering.
Glass/Glassceramics/Ceramics are considered materials for sustainable development influencing in a positive manner both the health and environment sectors. There are various research and development efforts going on in different laboratories/institutions and industries in the country on glasses/glassceramics for biomaterials and materials for health and environment, laser, communication, radioactive waste immobilization, building materials, radiation shielding, encapsulation/sealing. The role of glasses and advanced ceramics (borides, carbides,silicised etc) in various applications such as RSW, radio-active waste immobilization, structural and control rod components in high temperature reactor research, is of special signification. Sustainable development is not just about" saving the planet", but also about securing a future for ourselves and coming of future generations. Glass is one of the most ancient of all materials known and used by mankind. Glassceramics are the materials derived from glass and possess both the properties of the glasses and crystalline materials and they have got a number of technological applications. In this paper/report/presentation, I will mainly discuss Glass(oxide and nonoxide)/Glassceramics Preparation-Melt Quench Technique and initial characterization-Density, Vicker hardness, XRD,TMA and DSC/DTA. Most important property of the glass is the glass transition temperature corresponding to the onset of structural relaxations. The glass transition temperature can be determined experimentally by techniques like Dilatometry(using thermo-mechanical analyser (TMA)), Differential thermal Analyser(DTA),Differential scanning calorimetry (DSC) etc. It would first try to answer "what is Glass"? and then discuss features that are different than other materials. After brief historical journey and definition of glass, principles of glass formation, glass melting, types of glasses and their structure will be discussed.

OP-20

Fabrication of Amorphous ZnO TFT with Tunable Channel Length

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The paper discusses the fabrication of amorphous zinc oxide (a:ZnO)-top gate top contact (the gate is situated on the top and the contacts are taken from the top) thin-film transistor (TFT) using spin-spray pyrolysis (SSP) unit. The solutions of ZnO and poly-vinyl-alcohol (PVA) are synthesized separately by the sol–gel method. The ZnO and PVA solution are coated over glass substrate using the SSP unit and drop-cast technique, respectively. These films are characterized using an optical profilometer, X-ray diffractometer, energy dispersive X-ray analysis, ultraviolet–visible spectrophotometry and Keithley measurement system. The XRD and EDAX measurement confirm the amorphous nature and composition respectively. The thickness of the ZnO and PVA film are 460 nm and 600 nm, respectively. The resistance of ZnO film is 100 KΩ. Using the absorption spectrum, we calculate the bandgap of ZnO and PVA thin film samples which are 3.05 eV and 3.9 eV respectively. The metal–insulator–metal (MIM) structure is fabricated using fluorine-doped tin oxide, PVA and silver paste. The MIM structure is characterized for the electrical parameters such as capacitance and dielectric constant (εr) which is found to be 0.4 μF and 8 respectively at 40 Hz frequency. The TFT is fabricated by depositing the aluminium as electrode, ZnO as channel layer and and PVA as insulator layer of TFT with different W/L ratios. The TFT parameters such as threshold voltage (V_{th}), on/off current ratio ($I_{on/off}$) and mobility are studied and presented. The results confirm that V_{th} decreases with the shrinking of channel length. Current ratio $I_{on/off}$ increases with the reduction of the channel length due to the increase in on-current value.

OP- 21

Engineering the Cerium Oxide Nanoparticles with enhanced hydrophobicity

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The synthesis and design of nanomaterials with distinctive physical and chemical properties provide novel opportunities for utilizing them for various applications. In general, the structures and surface characteristics of the nanomaterials have a major influence on their physicochemical properties. It is feasible to carefully modify the properties of the nanomaterials by tuning the reaction parameters. Here, we provide a simple and effective wet chemical method for the controlled synthesis of functionalized cerium oxide nanoparticles (CeO_2 Nps) by varying the capping agents (CA) i.e. citric acid and Cetrimonium bromide. The synthesized CeO_2 Nps are characterized using XRD, Raman spectroscopy, FESEM, TEM, and FTIR to study the crystal structure, morphology, and functional groups, respectively. The synthesized CeO_2 NPs are highly crystalline and belong to a cubic crystal system. We investigated surface wettability for various functionalized CeO_2 NPs by contact angle measurements. The CA is critical in achieving morphology and imparting hydrophobicity to the NPs. The functionalization of CeO_2 with CTAB resulted in maximum enhancement in the contact angle of 92.2°±3.3. This work provides valuable insights into the influence of surface functionalization of nanoparticles on controlling their sizes and wetting properties.

OP- 22

Isolation, semi-synthesis, druglike ness and virtual screening of small molecules as potent Inhibitors of p300 and STAT3 **dimerization.**

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One of the Histone acetyltransferases (HAT), p300, plays a crucial role in STAT-3 (Signal transducer and activator of transcription 3) dimerization during the transcription process. However, deregulation of this enzyme causes inflammation, cancer, and memory-related diseases. Nonetheless, this will be a target of small molecules as therapeutics. To date, AI-assisted virtual screening filters large small molecule libraries for finding potent drug candidates based on the binding affinity to target protein. Because of this, we are reporting the semi-synthesis and spectral characterization of bioactive molecules isolated from medicinal plants. Further, molecular docking studies were used to find the binding affinity with the p300 HAT domain (PDB ID:3BIY) and STAT-3 (PDB ID: 1BG1) using the Vina-Auto dock. Among all the compounds, CMP has displayed strong binding with these proteins (-**9.1 kcal**/mol and -**7.7 kcal/mol**) compared to potent p300 and STAT-3 inhibitor garcinol (**-7.9 kcal/mol** and **-6.8 kcal/mol**). Also, druglike properties of potent molecules were studied using SWISS ADME. Based on the obtained results, we conclude that CMP may be used to study the molecular mechanism of p300/STAT-3 in cancer development and therapeutics. All the results will be discussed.

OP- 23

Er3+/Tm3+ co-doping and its influence on physical, optical and luminescence properties of Er3+ doped borate glasses

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Erbium singly doped and erbium- thulium co- doped borate glasses were fabricated by conventional melt- quench technique. The physical, optical and luminescence properties were investigated for these samples to study the role of Tm^{3+} in improving the quality of glasses for optical applications. UV-visible-NIR absorption spectra of these glasses contained many absorption bands due to the transitions between different energy levels corresponding to both the rare-earth ions. Luminescence studies involved getting emission peaks in visible and near infrared (NIR) region of the spectrum for two different excitation wavelengths 358 and 980 nm, respectively (*Figure 1*). Decreasing intensity of prominent 453 nm emission peak was witnessed in visible region due to self-quenching or cross- relaxation process of Tm^{3+} ions. The intensity of typical broadband emission produced by Er^{3+} ions at around 1530 nm due to $^4I13/2 \rightarrow {}^4I15/2$ transition dropped down significantly on co-doping with Tm^{3+} ions which confirmed the non-resonant energy transfer occurring between the two rare-earth ions. The emission peaks at 453, 476 and 1532 nm were considered for decay analysis and the calculated lifetime values shortened on

increasing Tm2O3 content for all three cases. Energy transfer parameters were also calculated for 1532 nm emission with the help of Inokuti- Hirayama (I-H) model fitting for decay curves. (x, y) co- ordinates of CIE- chromaticity diagram lying in blue region for 453 nm emission pointed towards the potentiality of the present co- doped glasses in blue LED application.

OP- 24

Biosynthesis, Characterization, DFT calculations, Molecular Modeling of Silver (Ag/Ag_2O) Nanocomposite: A Promising Material against Human breast Cancer

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The scope of present research work is to synthesis an ecofriendly silver nanocomposite (Ag/Ag_2O) by using alcoholic fruit extract of *Pheonix slyvestris* and its efficiency was evaluated for anticancer activity. PXRD results and HRTEM images confirmed that Ag/Ag_2O was crystalline in nature with diverse morphology and possessed an average particle size of 23-50nm. Surface plasmon resonance of Ag/Ag_2O was observed at 465-500 nm in UV-DRS. The PL spectrum of Ag/Ag_2O NPs shows two asymmetric peaks confirming the formation of Ag/Ag_2O heterocomposite. The cytotoxicity study Ag/Ag_2Osynthesized via green chemistry was performed using the MTT assay against breast cancer cell line (MCF7) with an IC_{50} 21.61µg/mL. The results of the cytotoxicity tests showed a concentration dependent outcome against tumor cells and a correlation between dosage and effectiveness against tested cancer cell line. DFT studies revealed the sensing response of Ag/Ag_2O composite towards doxorubicin drug confirmed by relative work function changes. Molecular docking and dynamics simulation resulted that the Ag/Ag_2O illustrates to be an excellent lead molecule.

OP-25

Effect of Nd^{3+} on structural, dielectric and impedance properties of Nickel Cadmium nanostructured ferrites

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Nanosized $Ni_{1-x}Cd_xNd_yFe_{2-y}O_4$ ($0 \leq x \leq 0.1$ in steps of 0.2: $y = 0.0$ and 1.0) ferrites synthesized by solution combustion method. Analar grade, nickel nitrate, Cadmium nitrate, Ferric nitrate and Neodymium nitrate as oxidiser and urea as reducing agent. In the present investigation, XRD analysis confirmed that the ferrite samples exhibited a cubic spinel structure The lattice parameter gradually increases from 0.77549 nm to 0.85725 nm. The average grain sizes of all the samples by selecting 20,000 magnification range. The room temperature dielectric constant decrease sharply with increasing frequency and thereafter, remains constant at higher frequencies. The variation reveals the dispersion due to Maxwell–Wagner type interfacial polarization which is in agreement with Koop's phenomenological theory. This dispersion is sharp at lower frequencies and almost constant for higher frequencies. The decrease in dielectric constant is attributed to the decrease in the polarization of the sample because the hoping of charge carriers cannot follow up the field variation. At lower frequencies, the large value of dielectric constant is due to the predominance of species like Fe^{2+} ions, due to which interfacial dislocation pile-ups at grain boundaries, oxygen vacancies and grain boundary defects. The observed low value of dielectric constant is attributed to homogeneity, better symmetry, uniform and smaller grains. Further, the polarization decreases substantially with increasing frequency and remains constant value beyond a certain frequency of external field. However, at higher frequencies, the electron/hole exchange frequency cannot keep up with the applied electric field leading to lower polarization. Further, the dielectric loss decreases with increasing frequency. At lower frequencies of an applied ac electric field,

frequency of an electron exchange between $Fe^{2+} \leftrightarrow Fe^{3+}$ ions, follow the field and hence the loss is maximum. At higher frequencies, the frequency of an electron exchange between $Fe^{2+} \leftrightarrow Fe^{3+}$ -*ions cannot follow the frequency of the applied field beyond certain critical value. Thus, the loss is minimum.

It is evident that the ac electrical conductivity gradually increases with increasing frequency of the applied alternating electric field. The conduction mechanism in ferrites can be explained on the basis of electron exchange between Ni^{2+} + $Fe^{3+} \leftrightarrow Fe^{2+}$+$Ni^{3+}$ ions at adjacent octahedral sites. At lower frequencies, the grain boundaries are found to be more effective; hence the frequency of electron exchange between Fe^{2+} and Fe^{3+} ions is very less. At higher frequencies, the conductive grains are becoming more active by promoting the electrons exchange between Fe^{2+} and Fe^{3+} ions, thereby increasing the conduction mechanism. Therefore, ac electrical conductivity increases with increasing frequency. It can be seen that dielectric parameters such as dielectric constant, dielectric loss tangent and ac conductivity are found to are found to be increase with Cd^{2+} ion concentration, attains maximum value at x = 0.4 for y = 0.0; 0.1), there after decrease. For higher Cd^{2+} ion concentrations the conductivity decreases for x > 0.4 for y = 0.0; 0.1 is possibly due to larger formation Fe^{2+} ions.

From the impedance spectra analysis, the values of Z**'** and Z**''** are found to decrease with increasing frequency 100 kHz-10MHz of nanoferrites respectively followed by maxima and attain a constant value at higher frequencies. The decrease in real Z**'** and Z**''** with frequency may be due to increase in ac conductivity because of the presence of space charge polarization in a material at higher frequencies. The appearance of peaks in an imaginary part of complex impedance spectra at lower frequencies attributed to presence of space–charge relaxation related to the charge carriers in association with the oxygen vacancies.

A typical set of Cole–Cole plot shown that an incomplete semicircular but somewhat approaching towards the shape or straight line with a positive slope. This is due to characteristic of very high impedance is found especially in case of Nd^{3+} ions substituted samples. It may be concluded that contribution to the conductivity in all the investigated samples is mainly due to grain boundary but from the gain is not well resolved.

OP-26 Polyaniline/Cerium-doped Alumina Nano hybrids with heterogeneous interfaces for wideband Electromagnetic Interference Shielding

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Electrically conducting polyaniline-based nanocomposites have shown huge potential in a broad range of technological applications. The current work reports the synthesis and tunable electromagnetic interference (EMI) shielding properties of polyaniline/cerium-doped alumina (PANI/Ce-Al_2O_3) nanocomposites. These composites were synthesized by solution combustion at 500°C using urea as a fuel with aluminium nitrate and cerium nitrate with subsequent blending with conducting polyaniline. The concentrations (weight percentage) of the of Ce-Al_2O_3 nanoparticles in polyaniline has been chosen as 5, 10, 15, 20 and 25%. The structure-morphological features of the composite samples have been investigated by P-XRD, FTIR, and SEM. The composites with varying concentrations of the dispersed phase of Ce- Al_2O_3 content showed distinct property modifications for wide band EMI shielding. The observed shielding efficiency demonstrates the potential of these nanohybrids as a wide band EMI shield with relevant tunability. The composites have shown a percolation threshold around 25 wt%. Electromagnetic energy interaction through interfacial polarization and the subsequent loss have been used to investigate the electromagnetic dissipation mechanism of these nanocomposites. The results clearly open up the opportunity for the possible development of broadband EMI shielding for diverse shielding applications.

OP- 27

A review on physical and thermal effect on borate by inclusion of the RE's, HMO's and TMO's

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This paper we review the effect of physical and thermal properties were determined with different RE's, HMO's and TMI's doped on borate as base glass. The physical properties of the glasses were evaluated and the change in density, molar volume and ionic packing density in these glasses indicates the effect of RE's, HMO's and TMO's. The study of thermal properties shows computational depend trend. These studies which affects the structural modification in the glass which convert BO_3 to BO_4 vice-versa. The glasses doped or co- doped with RE's, HMO's and TMO's ions have generated much interest due to the possibility of many potential applications in the field of photonics such as optical communication fibers, up conversion, photonic memories, display systems, X-ray image processing, sensors, optical amplifiers, optoelectronics, magneto-Optical devices.

OP-

An analysis of the use of photo catalysis to reduce the toxicity of actual waste water

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For the breakdown of organic pollutants or contaminants of rising importance, advanced oxidation techniques like photo catalysis are being investigated extensively. But as organic pollutants break down, byproducts

are created that could be much more hazardous than the original poisons. A current concern is the toxicity of wastewater treated by photo catalysis. This review study compiled and critically examined previous findings on photo catalytic detoxification of actual industrial and municipal effluent. A number of factors were taken into consideration, including the difficulties in using photocatalytic wastewater detoxification, the viability of different toxicity tests, the reuse of photocatalysts, cost estimation, etc. According to the reviewed literature, photocatalysis may not always be a viable treatment option for the organic contaminants in actual wastewaters to be degraded and/or for the detoxification of wastewater from an application standpoint.

The AI Catalyst in Education: Reshaping Physics Learning

OP - 29

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The integration of Artificial Intelligence (AI) into physics education has emerged as a transformative approach to enhancing teaching and learning experiences. This paper explores the potential of AI-driven tools and methodologies in physics instruction, focusing on personalized learning, automated assessment, and interactive simulations. By leveraging machine learning algorithms, natural language processing, and adaptive learning systems, AI can cater to diverse learning styles, identify student misconceptions, and provide real-time feedback. Furthermore, AI-powered virtual labs and simulations offer immersive environments for students to experiment with complex physical phenomena, bridging the gap between theoretical concepts and practical applications. This study reviews current advancements in AI applications for physics education, evaluates their effectiveness in improving student outcomes, and discusses challenges such as ethical considerations, data privacy, and the need for teacher training. The findings suggest that AI has the potential to revolutionize physics teaching by making it more engaging, accessible, and tailored to individual learner needs, ultimately fostering a deeper understanding of fundamental physical principles.

List of Poster Presentations

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PP2	Quantum Formulation of the Foucault Pendulum Using Group Theoretical Methods	Felan Amal, Dr T Shivalinga Swamy	St Philomen's College, Mysore
PP3	Local unitary invariant spin-squeezing in experimentally	Govindaraja B P, T Humera	Department of Physics, Kuvempu University, Shankaraghatta
PP4	Next generation-infrared telescopy through quantum enhancement	Harshini T et al	National College (Autonomous), Jayanagar Bengaluru
PP5	Quantum enhanced Precision in Rotation sensing	Mubarak Taj	Bangalore University, JnanaBharathi Bengaluru
PP6	A Study on Quantum tunneling	Gowthami S, Bhargavi K S, Shabnum, P Nagaraju	Constituent VTU College, Chintamani Kolar Dt
PP7	Quantum materials for energy harvesting in space missions	Puja Sharma, K M Preeti	National College (Autonomous), Jayanagar Bengaluru
PP8	Energy Eigenvalues of Quartic Anharmonic Oscillator by the Method of Tridiagonalization	Dr. Sharadangabhushana	Retd Professor, APS College, Bengaluru
PP9	Energy Eigenvalues of 1-D Anharmonic Oscillators by Rayleigh-Ritz Variational Method	Rashmi P E, Dr Shivalinga Swamy	Maharani's College for women, Mysore
PP10	Energy Eigenvalues of 1-D Anharmonic Oscillators by Hill Determinant Method	Dr Shivalingaswamy, Rashmi P E	Maharani's College for women, Mysore

PP11	Ai in higher education: opportunities and challenges	Hemalatha R & Akilandeswari R	Sindhi College, Bengaluru
PP12	Cosmic-conn: a cosmic-ray detection deep-learning framework, data set, and toolkit	Prajwal Kalyan V, Hemant Kumar N, K T Vasudevan, Ganesh Shridhar Hedge	National college, Jayanagar,Bengaluru REVA University, Bengaluru
PP13	A new approach on the Lanthanide doped ZnFe2O4 nanoparticles Impacted from the combustion method	Dr. Thejas R	Nagarjuna College, Chikkaballapur
PP14	Properties of the Multi-Oxide Glass Systems	Kiran D S, Dr. Susheela K Lenkennavar	Bangalore University, Jnana Bharathi,Bengaluru
PP15	An Evaluation of Computational Methods for Assessing Radiation Shielding Effectiveness in Mixed Glass Formers	Kiran Nagaraju, Dr.Susheela K Lenkennavar	Bangalore University, Jnana Bharathi, Bengaluru
PP16	Microwave oven aided synthesis of Strontium oxide nanoparticles with dye degradation studies	M K Triveni I, Mallikarjuna, Ananda HT Dr. Shivalinga Swamy T	Department of Chemistry, Maharaja I T, Maharani's Science College, Mysore
PP17	Study of the Effectiveness of Silver Doped Boro Tellurite Glasses in Gamma-Ray Shielding	Praveen Kumar R,Dr. Susheela K lenkennavar	Bangalore University, Jnana Bharathi, Bengaluru
PP18	Synthesis Characterization Of Polypyrrole –Carbon Nano Tube ,Zinc Oxide,Ternary Nano Composites For As A Flocculating Agent	Spoorthi B E, Arun kumar, Raghavendra Naik, Dr. Revanasiddappa M	PES University, Electronic city campus Bengaluru
PP19	Investigations on physical, electrical, and structural properties of some alkali borate glasses doped with transition metal oxides	Vinay B C, Akansha Vaishnav, Bhuvana K C, Anjitha, et al	National College, Jayanagar, Bengaluru
PP20	Investigation on structural and optical properties of Alkaline Earth Borate glasses	Bhuva R, Gurukiran S, Nithyashree et al	National College, Jayanagar, Bengaluru
PP21	Solar cell testing	Sandhya N S, Prathvi, Muniraju	National College, Jayanagar, Bengaluru
PP22	Physical and optical	Ganesh Kumar H N, Dr	Bangalore University, Jnana

	properties of iron doped sodium borate glasses	B Eraiah	Bharathi, Bengaluru
PP23	Structural studies of thermally decomposed potassium chromate salts	Pragathi M S, Abhishrutha R	B M S College of Engineering, bengaluru
PP24	Engineering the Cerium Oxide Nanoparticles with enhanced hydrophobicity	Tanesha K, Dr. Ramya Prabhu	Prayoga Institute of Education Research
PP25	Utilizing AI to Optimize the Design of Aerodynamics Structures	Shravani R	Bangalore University, Jnana Bharathi, Bengaluru
PP26	Characterization of O2 annealed RF sputtered undoped and Aluminium doped ZnO Thin Films	Dr Raghu, Uday B	Govt College, Mandya
PP27	“Quantum Computers and Artificial Intelligence – Futuristic Transformation”	Hemalata N	Vijaya College, Bangalore
PP28	“Time Travel: A Scientific and Fictional Perspective”	B K Adithya Sai	Vijaya College, Student, Bengaluru
PP29	Transport properties of samarium doped Boro-tellurite glasses	Jalajakshi B R	Department of Physics, Bangalore University

PP-01

INTERFERENCE AND DIFFRACTION OF QUANTUM PARTICLES

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Elementary particles such as electrons and neutrons are shown to exhibit wave like properties such as interference and diffraction. This is usually explained, in a semi-classical way, by associating a de Broglie wave with particles and then using the methods of optical interference and diffraction through various slits (refs.1, 2,3,4,5). Such an explanation is totally unsatisfactory from a conceptual point of view. It is necessary to show the emergence of interference and diffraction of massive particles from proper quantum mechanical principles. Such a result is achieved here making use of the well-known path integral formulation of Feynman (ref.6) wherein the quantum mechanical amplitude for propagation from one point to another is rigorously deduced. The de Broglie wavelength then emerges naturally for all massive particles when the amplitudes are combined. Of course, as expected, the interference and diffraction patterns of massive particles matches with the results of the semi classical approach commonly followed. It is interesting to extend the path integral approach to interference of more than two paths.

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PP- 02

Quantum Formulation of the Foucault Pendulum Using Group Theoretical Methods

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The Foucault pendulum, first demonstrated by Léon Foucault in 1851, is a striking experimental proof of Earth's rotation, showcasing the influence of the Coriolis force on a freely swinging pendulum. This classical system has been widely studied in physics due to its fundamental role in rotational dynamics and inertial frames. In this paper, we present a quantum mechanical formulation of the Foucault pendulum using the classical Lagrangian for small oscillations. By employing cylindrical coordinates, we construct the corresponding Hamiltonian and analyze the system through an algebraic approach. The quantized eigenstates are expressed in terms of Sturmian functions associated with the unitary irreducible representations of SU(1,1). Furthermore, we derive the Perelomov number coherent states, revealing their analogy to the quantum states of a charged particle in an external magnetic field. Our study provides a novel perspective on the quantum dynamics of the Foucault pendulum, highlighting the role of symmetry and group theory in its description.

Keywords: Foucault pendulum, quantum mechanics, bound states, SU(1,1) group theory, coherent states.

PP- 03

Local unitary invariant spin-squeezing in experimentally constructed three-qubit W-superpostion state using *ibmq_osaka*

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We evaluate the local unitary invariant spin squeezing (LUISS) parameter in experimentally generated W-superposition state $|W\bar{W}_3\rangle$, an equal superposition of three-qubit W and obverse W states. We make use of a three-qubit tomography scheme for determining the density matrix of the W-superposition state from the experimental data obtained by employing IBM open-access 127 qubit quantum processor *ibmq_osaka*. We also make use of a two-qubit tomography scheme for the experimental determination of two of two-qubit subsystems of $|W\bar{W}_3\rangle$. We reconstruct the state $|W\bar{W}_3\rangle$ from its experimentally determined subsystems using a well-known theoretical protocol. The LUISS parameter of the state reconstructed from its experimentally determined subsystems is found to match well with the actual value 0.577 of the W-superposition state $|W\bar{W}_3\rangle$.

Introduction: Spin squeezing has been an intense area of study due to its theoretical importance and practical applications in high-precision spectroscopy and quantum information science [1,2]. Spin squeezing and quantum entanglement are related to each other and it has been shown that all spin squeezed states exhibit pairwise entanglement [3,4].

According to Kitegawa-Ueda spin squeezing criteria [1], a multiqubit state is spin squeezed if the minimum of $\Delta J_{\perp}$ (or $\Delta J'$) of a spin component normal to the mean spin direction is smaller than the standard quantum limit $\sqrt{N}$ of the coherent spin states.

and hence the spin squeezing parameter is defined as $\xi = \frac{2(\Delta J_{\perp})_{min}}{N}$; It is a quantitative $\sqrt{N}$ measure of spin squeezing and a multiqubit state is spin squeezed iff $0 \leq \xi < 1$. In order to unambiguously establish the connection between spin-squeezing and quantum entanglement, a local unitary invariant spin squeezing (LUISS) criterion and an operational procedure to evaluate the LUISS parameter has been identified in Ref. [5]. Using it, we evaluate the LUISS parameter of the experimentally generated W-superposition state, an equal superposition of W and obverse W state:
is a spin squeezed state with LUISS parameter 0.577. Here, we examine the closeness of the experimentally obtained states to $|WW\bar{3}\rangle$, through evaluation of LUISS parameter.

Experiment using IBM open access quantum processor [6]: We employ the IBM open- access 127 qubit quantum processor *ibmq_osaka* to experimentally determine the state $|WW\bar{3}\rangle$ and its two-qubit subsystems ρAB, ρBC. We carry out six trials of tomographic measurements on the qubits 97, 98, 99 of *ibmq_osaka*, with 10,000 shots in each measurement. The trials are conducted on different dates spread over four months period. Using the experimental data and the three-qubit tomography scheme, we construct the density matrix of $|WW\bar{3}\rangle$. Also, using the experimentally determined two-qubit subsystems, we reconstruct the state $|WW\bar{3}\rangle^{expt}$ using the theoretical scheme in Ref. [7]. We carry out error-mitigation of the states obtained in all six trials of the experiment and evaluate their LUISS parameter.

Summary: We have evaluated the local unitary invariant spin squeezing parameter of the experimentally obtained three-qubit W-superposition state. The experiments are performed on IBM open-access 127 qubit quantum processor *ibmq_osaka.* We have determined the W- superposition state using (i) three-qubit tomography (ii) reconstruction using two-qubit subsystems. The values of LUISS parameter of the state determined from its parts is found to lie in the range (0.58, 0.6) and match well with the actual value 0.577 of $|WW\bar{3}\rangle$. The work is an illustration of the performance of one of the IBM quantum processors available on the cloud.

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PP- 04

NEXT GENERATION-INFRARED TELESCOPY THROUGH QUANTUM ENHANCEMENT

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The Author proposes two optimal phase-estimation schemes for quantum-enhanced long- baseline interferometry, leveraging distributed entanglement to eliminate stellar photon loss over transmission baselines. The first scheme employs a sequence of gates using nonlinear optical elements, optimized across all possible measurement strategies to saturate the Cramér- Rao bound, ensuring the highest precision in phase estimation. The second approach enhances an existing protocol by encoding the stellar photon's time of arrival into a quantum memory, allowing for improved measurement fidelity. Our modified version significantly reduces the computational overhead, halving both the number of ancilla qubits and gate operations while maintaining performance. These advancements provide a practical path toward the realization of quantum-enhanced astronomical interferometry, offering improved sensitivity and robustness against photon loss. By minimizing resource requirements and optimizing entanglement distribution, The author schemes pave the way for future experimental implementations in long-baseline quantum optics. The proposed techniques could significantly enhance astronomical imaging and precision measurements in fundamental physics by exploiting the unique advantages of quantum mechanics. The author findings demonstrate that leveraging entanglement and optimized measurement protocols can effectively overcome fundamental limitations in traditional interferometry, marking a step forward in the application of quantum technologies to observational astrophysics.

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PP- 05

Quantum enhanced Precision in Rotation sensing

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Utilizing quantum resources to achieve enhanced precision in the measurements of physical quantities is the main theme of quantum metrology. Estimating rotation angle (termed as *rotation sensing*) between the axes belonging to two different orthonormal co-ordinate systems, owned by two observers, requires suitable collective measurements on an entangled bipartite input state shared between the observers. In this paper we investigate *rotation sensing* using entangled states of N-qubits, which are symmetric under permutations. We show that *perfect determination* of rotation angle α between the axes Z_1 and Z_2 of the reference frames S1:$OX_1Y_1Z_1$ and S2: $OX_2Y_2Z_2$ is possible. We evaluate the quantum fidelity of the input & the rotated quantum states to recognize the *best* choice of the state and the measurement. Based on this knowledge, we compute quantum Fisher information for estimating rotation angle α for 1, 2 and 3 qubit permutation symmetric states. We present our results on *rotation sensing* by carrying out simulations using the IBM's backend FakeManilaV2, which hosts 5 qubits. Our work is a contribution towards efficient synchronizing of quantization axes of two different reference frames using quantum resources.

Introduction: Information theory applied to the quantum world throws open several remarkable insights, which would not have been possible in the classical scenario [1]. Use of best encoding quantum states and best possible measurements result in optimal strategies reveal quantum advantage in carrying out several important information processing tasks. Estimation of angle of rotation has immense applications in geodesy [2], magnetometry [3] and so on [4]. We study the precision in discriminating *quantization axes* of two observers. To this end, we encode the angle of rotation in the input quantum state and decode it with the help of suitable measurements. We

show that the quantum fidelity between the input quantum state and the rotation encoded output state vanishes - implying that perfect discrimination of two quantization axes is possible. It is well-known that maximizing Fisher information leads to minimum variance in the estimation of any parameter. Hence, we evaluate Fisher information

[4] as a figure-or-merit for sensing the angle of rotation between the axes. Simulation of our encoding-decoding framework for 1, 2 and 3 qubits in IBM's 5-qubit backend processor FakeManilaV2 [5] is reported.

Zero-error discrimination of rotation using N-qubit permutation symmetric states:

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PP- 06

A Study on Quantum tunneling

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Quantum tunnelling refers to quantum mechanical phenomenon, where a particle tunnels through a barrier that is classically couldn't surmount. It is one of the most interesting and striking effects of quantum mechanics that has been confirmed by numerous experiments. Friederich Hund was the first person to notice tunneling (1927), when he was calculating the ground state of the double well potential. The tunnelling occurs in less than a few attosecond (10^{-18} s). Its first application was a mathematical explanation for alpha decay. The tunnelling is taken place even diodes and transistors. It has important applications to modern devices such as the tunnelling diode, quantum computing and the scanning tunnelling microscope. The work of Leo Esaki Ivor Giaever and Brain Josephson predicted the tunnelling superconducting pairs. In 2016, the tunnelling of water was discovered. It has been established that the alpha particle within the parent nucleus bounces back and forth knocking the nuclear well, the probability of leaking out in each hit is $T = e^{-G}$,

PP- 07

Quantum materials for energy harvesting in space missions

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Space missions demand energy systems that are lightweight, efficient, and resilient to extreme conditions like radiation and temperature fluctuations. Quantum materials particularly atomically thin 2D structures such as graphene and transition metal dichalcogenides (TMDs) offer groundbreaking solutions by leveraging their unique quantum properties. These materials excel at converting ambient energy sources (e.g., sunlight, waste heat, or mechanical vibrations) into electricity. Their lightweight nature significantly reduces launch costs, and their flexibility allows them to be integrated into various spacecraft surfaces. For instance, ultrathin TMD- based solar cells could replace conventional panels on spacecraft, enabling efficient power generation even in low-light environments far from the sun. Similarly, quantum materials with strong electron interactions can harness heat from onboard electronics, generating power even in the cold vacuum of space. Their flexibility and inherent resistance to radiation damage further make them durable for long-term missions. Challenges remain, such as maintaining material stability during rapid temperature changes or prolonged radiation exposure. However, innovations in chemical engineering like adding protective coating sand hybrid designs combining multiple quantum materials could address these limitations. This highlights how quantum materials can transform energy harvesting for satellites, planetary rovers, and deep-space probes, providing smarter, more adaptable alternatives to traditional bulky or fragile systems. By bridging cutting-edge material science with practical space applications, this field promises to unlock sustainable energy solutions for humanity's next-generation exploration efforts.

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PP- 08

Energy Eigenvalues of Quartic Anharmonic Oscillator by the Method of Tridiagonalization

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Non relativistic Quantum mechanical anharmonic oscillators (AHO) have received extensive attention because of their importance in field theory, molecular physics, solid state physics etc. They have been studied both by analytical and numerical methods. The main quantities of interest are the energy eigenvalues, eigenfunctions and moments of various powers of position operators in different eigenstates. Our article here is mainly concerned with developing a novel analytical and numerical method to determine the energy eigenvalues starting from very low to very high anharmonic parameter λ.

The energy eigenvalues of the quantum system are computed by solving the Schrodinger equation with the Hamiltonian operator 'H' of the form:

Here λ is the anharmonicity parameter, ω = the angular frequency of the corresponding anharmonic oscillator, m = mass of the oscillator, p = the momentum operator and γ = position operator. A novel non perturbative method developed by us is presented here.Tridiagonal matrices are having all its non-zero elements on the main diagonal and in the positions immediately adjacent to the main diagonal. Matrix eigenvalues can be evaluated by the method of tridiagonalisation. This may be achieved by different procedures. To have numerical stability, orthogonal transformations are efficient methods. In the present context, the anharmonic oscillator Hamiltonian is taken in the form of a matrix. It is transformed to tridiagonal form by using one of the efficient methods called 'Householder's transformation'. Then, by using the results of Gerschgorin's theorem on matrix eigenvalues, the remaining off- diagonal elements are properly minimized with a variable parameter. Using this, the diagonal elements of the matrix are evaluated, which are the required eigenvalues in this approximation.

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PP- 09

Energy Eigenvalues of 1-D Anharmonic Oscillators by Rayleigh-Ritz Variational Method

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The study of anharmonic oscillators is pivotal in understanding various physical systems, including molecular vibrations and quantum field theories. This research investigates the energy eigenvalues of a one-dimensional anharmonic oscillator using the Rayleigh-Ritz variational method, a powerful technique in quantum mechanics for approximating the eigenstates and eigenvalues of non-solvable systems. The anharmonic potential considered in this study is of the form $(x) = {}^{1}\ m\omega^2x^2 + \lambda x^{2\alpha}$, where λ represents the strength of the 2 anharmonicity and α = 2, 3, 4 … for quartic, sextic, octic…. anharmonic oscillators respectively.

We begin by constructing a suitable trial wave function that incorporates the essential features of the system, including the harmonic oscillator's ground state and additional terms to account for the anharmonicity. The trial wave function is expressed as a linear combination of basis functions, which are chosen to ensure normalization and smoothness. The variational principle is then applied, leading to the minimization of the expectation value of the Hamiltonian, $\langle\phi|H|\phi\rangle$, with respect to the parameters of the trial wave function.

The optimization process involves calculating the matrix elements of the Hamiltonian and the overlap integrals, which are performed using numerical integration techniques. The results yield a set of energy eigenvalues that are compared with known results from perturbation theory and numerical methods, demonstrating the accuracy and efficiency of the Rayleigh-Ritz method in capturing the effects of anharmonicity.

Furthermore, we analyze the dependence of the energy eigenvalues on the anharmonic parameter (λ) and discuss the implications for physical systems exhibiting anharmonic behavior. The findings reveal significant deviations from the harmonic oscillator predictions, highlighting the importance of

considering anharmonic effects in quantum mechanical models.

This research not only provides a deeper understanding of the anharmonic oscillator but also showcases the versatility of the Rayleigh-Ritz variational method as a robust tool for tackling complex quantum systems.

Keywords: Anharmonic oscillator, energy eigenvalues, Rayleigh-Ritz variational method, quantum mechanics, perturbation theory, numerical integration.

PP- 10

Energy Eigenvalues of 1-D Anharmonic Oscillators by Hill Determinant Method

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The study of anharmonic oscillators is very much important in understanding various physical systems, particularly in quantum mechanics and molecular dynamics. This research investigates the eigen energy values of anharmonic oscillators using the Hill determinant method, a powerful numerical technique that provides accurate approximations for the energy levels of quantum systems. The Hill determinant method is particularly advantageous for systems where traditional perturbative approaches may fail due to strong anharmonicity. In this work, we first establish the theoretical framework for the anharmonic oscillator, characterized by a potential energy function that deviates from the harmonic approximation. We consider a general form of the potential, $V(x) = \frac{1}{2} m\omega^2 x^2 + \lambda x^{\alpha}$, where λ represents the strength of the

anharmonic term and (α) is an integer greater than 2, α = 2, 3, 4 … for quartic, sextic, octic…. anharmonic oscillators respectively. The Schrödinger equation is then reformulated in terms of a dimensionless variable to facilitate the application of the Hill determinant method.

The Hill determinant method involves constructing a matrix whose eigenvalues correspond to the energy levels of the system. We derive the recurrence relations for the wave functions and subsequently form the Hill determinant, which encapsulates the boundary conditions and normalization constraints of the quantum states. By analysing the determinant's behaviour as a function of the anharmonic parameter ( ) and the quantum number ( ), we extract the eigen energy values. The Hill determinant method is a numerical technique used to find the eigenvalues and eigenfunctions of differential equations, particularly in the context of quantum mechanics. It is especially useful for systems where the potential is not purely harmonic, such as anharmonic oscillators. The Hill determinant method is based on the theory of linear differential equations and is particularly effective for second-order linear differential equations. It is named after the mathematician T. L. Hill, who developed the method in the context of

stability analysis. The method typically starts with a second-order linear differential equation of the form:

$\frac{d^2y}{dx^2}$ + (x) = 0, where q(x) is a function that can represent the potential energy in a quantum

mechanical system. For an anharmonic oscillator, q(x) would be derived from the potential energy function. To apply the Hill determinant method, we first express the solution y(x) in

terms of a power series: $y(x) = \sum_{r=0}^{\infty} a_r x^r$. By substituting this series into the differential

equation, we can derive recurrence relations for the coefficients (a_r). These relations allow us to express each coefficient in terms of the previous ones. The recurrence relations can be organized into a matrix form. The coefficients ( ) can be viewed as components of a vector, and the recurrence relations can be represented as a matrix equation. This matrix is often referred to as the "Hill matrix". The key idea is to construct a determinant from this matrix, known as the Hill determinant. The determinant is a function of the parameters in the system (such as energy levels) and is defined as: [D(E) = |M(E)|] where (M(E)) is the matrix constructed from the recurrence relations, and (E) represents the energy levels we are trying to find. The eigenvalues of the system correspond to the values of (E) for which the Hill determinant (D(E) = 0). Solving for these eigenvalues gives us the energy levels of the system. The roots of the Hill determinant can be found using numerical methods, such as root-finding algorithms. Once the eigenvalues (energy levels) are determined, the corresponding eigenfunctions can be obtained by substituting the eigenvalues back into the recurrence relations. This provides a complete description of the quantum states of the system.

In summary, the Hill determinant method is a powerful tool for solving differential equations in quantum mechanics, providing a systematic approach to finding eigenvalues and eigenfunctions for a variety of systems, particularly those exhibiting anharmonic behaviour.

Our results demonstrate that the Hill determinant method yields highly accurate eigen energy values, even for strong anharmonicities. We compare our findings with those obtained from other numerical methods, such as the variational approach and numerical diagonalization, highlighting the efficiency and robustness of the Hill determinant method. Additionally, we explore the implications of our results for physical systems, including vibrational modes in polyatomic molecules and the dynamics of trapped ions. This research not only enhances the understanding of anharmonic oscillators but also provides a reliable computational tool for future studies in quantum mechanics and related fields. The findings underscore the significance of the Hill determinant method as a versatile approach for tackling complex quantum systems characterized by non-linear interactions.

PP- 11

AI IN HIGHER EDUCATION: OPPORTUNITIES AND CHALLENGES

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Artificial Intelligence (AI) is rapidly reshaping the landscape of higher education by providing innovative solutions to traditional challenges. From personalized learning experiences and administrative efficiency to predictive analytics and intelligent tutoring systems, AI is transforming how universities operate and engage with students. This paper examines the opportunities that AI presents in higher education, such as the enhancement of teaching and learning, improved student outcomes, and more efficient institutional management. However, the integration of AI into higher education also comes with challenges, including ethical concerns, data privacy issues, the digital divide, and the need for appropriate infrastructure. This paper discusses both the opportunities and challenges AI introduces and suggests ways to address potential barriers to ensure its effective and equitable adoption in higher education institutions.

PP- 12

Cosmic-conn: a cosmic-ray detection deep-learning framework, data set, and toolkit

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Rejecting cosmic rays (CRs) is essential for the scientific interpretation of CCD-captured data, but detecting CRs in single-exposure images has remained challenging. Conventional CR detectors require experimental parameter tuning for different instruments, and recent deep-learning methods only produce instrument-specific models that suffer from performance loss on telescopes not included in the training data. We present Cosmic-CoNN, a generic CR detector deployed for 24 telescopes at the Las Cumbres Observatory, which has been made possible by the three contributions in this work:(1) We build a large and diverse ground-based CR data set leveraging thousands of images from a global telescope network.(2) We propose a novel loss function and a neural network optimized for telescope imaging data to train generic CR-detection models. At 95% recall, our model achieves a precision of 93.70% on Las Cumbres imaging data and maintains a consistent performance on new ground-based instruments never used for training. Specifically, the Cosmic-CoNN model trained on the Las Cumbres CR data set maintains high precisions of 92.03% and 96.69% on Gemini GMOS- N/S 1× 1 and 2× 2 binning images, respectively.(3) We build a suite of tools including an interactive CR mask visualization and editing interface, console commands, and Python APIs to make automatic, robust CR detection widely accessible by the community of astronomers. Our data set, open-source code base, and trained models are available at https://github. com/cy-xu/cosmic-conn.

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PP- 13

A new approach on the Lanthanide doped ZnFe2O4 nanoparticles Impacted from the combustion method

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The nanoparticle based on metal oxides have a high surface area, so they use good carriers, absorbents and catalysts. Recently, the cancer cell is one of the most difficult diseases that the world has faced in recent years due to the increase in the number of cases up to 25 million annually in last recent years. There are many common methods of treating cancer, such as radiotherapy, surgery, and chemotherapy, etc. Metal oxides are extremely important technological materials to be used in different fields such as electronic, photonic, optoelectrical devices, magnetic-optic, etc., in that metal oxide spinel ferrites with the general formula MFe2O4 enable a vast number of applications. Lanthanides induced at M-site of spinel ferrites there will be an enhancement in the ferrite systems for different medical applications. Specifically, the distribution of the metal species between the octahedral and tetrahedral sites of the spinel crystal structure enhances the properties of the material. From the literature review, there are less literatures focuses on the lanthanides doped ferrites systems, the present research focuses on the doping lanthanides to the metallic site and retaining the ferrite sites in the zinc ferrite systems. The combustion method is one of the most efficient and forthright ways to produce nanoparticles, and this method will be adopted to prepare the nanomaterials. The structural, morphological, optical, magnetic, and photocatalytic properties of these materials will also be investigated in later investigations.

Keywords: Lanthanum, Ferrite nanoparticles, combustion, magnetic, structural.

PP- 14

Comprehensive Investigation of Radiation Shielding Properties of the Multi-Oxide Glass Systems

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Multi-oxide glasses are advanced materials composed of multiple metal oxides, offering tunable physical, optical, and structural properties. This study evaluates the radiation shielding properties analyzed using a computational method, considering key parameters such as mass attenuation coefficient (MAC), linear attenuation coefficient (LAC), mean free path (MFP), half-value layer (HVL), tenth-value layer (TVL), and effective atomic number (Z_{eff}) across a broad gamma-ray energy range (0.015–15 MeV). These results indicate that higher concentration of heavy metal oxide significantly enhance the shielding performance of these glasses. Glasses with elevated heavy metal oxide content demonstrate superior MAC values, reduced HVL and MFP, and lower photon buildup factors, leading to improved gamma-ray attenuation. The enhanced shielding properties of these multi-oxide glasses make them promising materials for radiation protection in nuclear, medical and industrial applications.

PP- 15

An Evaluation of Computational Methods for Assessing Radiation Shielding Effectiveness in Mixed Glass Formers.

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This research focused on the theoretical calculation of attenuation parameters for mixed glass former (MGF) glasses. The primary goal is to investigate how the combination of B_2O_3, TeO_2 and V_2O_5 influences the radiation shielding properties of the glass. The evaluation of shielding properties was carried out within the photon energy spectrum ranging from 15 keV to 15 MeV, utilizing suitable tool. The results demonstrated that atomic number dependent factors, such as the mass attenuation coefficient (MAC) and effective atomic number (Zeff), shows improved performance due to the higher atomic number of tellurium (Te) in comparison to boron (B) and Vanadium. Additionally, density dependent factors, including the linear attenuation coefficient (LAC), mean-free path (MFP), half-value layer (HVL), and tenth-value layer (TVL), exhibits enhancements with increased concentrations of TeO_2 and V_2O_5 , reflecting the higher density values obtained.

PP- 16

Microwave oven aided synthesis of Strontium oxide nanoparticles with dye degradation studies

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The synthesis of strontium oxide (SrO) nanoparticles (NPs) has attracted significant interest due to their wide range of applications in various fields, such as catalysis, environmental remediation, and optoelectronics. In this study, we present a novel approach for the synthesis of SrO NPs using microwave-assisted methods, which offers several advantages, including rapid heating, uniform distribution of energy, and energy efficiency. For the synthesis of nanoparticles, Solution combustion method synthesis (SCS) is used for the synthesis of SrO nanoparticles. SCS is one of the popular methods. In this method, an exothermic redox reaction takes place between a fuel and an oxidizer. The temperature provided by microwave oven and the heat liberated due to exothermic reaction will make the process a self-propagating. SCS is a versatile and efficient method for producing a wide range of nanomaterials, including oxides, metals, alloys, and sulfides. This technique is cost-effective and energy-efficient, making it suitable for large-scale production of nanostructured materials. SCS allows for precise control over material properties by adjusting process parameters, enabling the synthesis of materials with desired characteristics. Additionally, the rapid and exothermic nature of the combustion reaction facilitates the formation of high-purity products in a relatively short time. The synthesis process involves the reaction of strontium

salts with a suitable reducing agent in the presence of a microwave irradiation source, leading to the formation of SrO NPs in a controlled manner. Characterization of the SrO NPs was performed using a combination of techniques, including X-ray diffraction (XRD), scanning electron microscopy (SEM) and Fourier-transform infrared spectroscopy (FTIR). The XRD patterns confirmed the formation of crystalline SrO, while SEM and TEM analyses revealed the formation of nanoparticles with an average size falling well within nm range. The surface functional groups of the NPs were identified through FTIR spectra. UV-Visible spectrometry characterization is done using UV-visible spectrometer labtronics MODEL LT-291 with single beam of range from 200nm to 900nm at room temperature for SrO sample prepared without and with gums of different concentrations by dispersing them in fixed amount of water medium to determine energy gap of SrO NPs. In addition to structural characterization, the photocatalytic performance of SrO NPs was evaluated by conducting dye degradation studies. The evaluation of photo catalytic efficiency of SrO nanoparticles was done by measuring the degradation of aqueous methylene blue under visible lamp(125W Hg lamp as source) irradiation. The SrO NPs exhibited significant photocatalytic activity, with a high degradation rate for both dyes, especially under UV light. The enhanced photocatalytic performance was attributed to the high surface area, large number of reactive sites, and effective absorption of light by the SrO NPs.

This study highlights the effectiveness of microwave-assisted synthesis in producing highly efficient SrO nanoparticles for environmental applications, particularly in the degradation of organic dye pollutants. The ease of synthesis, coupled with excellent photocatalytic performance, makes SrO NPs a promising candidate for use in water purification and environmental cleanup processes.

Keywords: Microwave-assisted synthesis, Solution combustion method, Strontium oxide nanoparticles, Dye degradation, Photocatalysis

PP- 17

Study of the Effectiveness of Silver Doped Boro Tellurite Glasses in Gamma-Ray Shielding.

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The linear attenuation coefficient is a significant factor in the realm of radiation shielding and protection. Data suggests that there is a direct relationship between material density and the linear attenuation coefficient, with higher density resulting in a greater coefficient. To enhance the radiation protection capabilities of a material, it is recommended to increase its density.This analysis investigated the radiation protection features of Ag_2O doped boro-tellurite glass samples, employing suitable software for the simulations. The results summarize the radiation shielding capabilities of boro-tellurite glasses, emphasizing their superior properties. It compiles critical shielding parameters, including mass attenuation coefficient (MAC), linear attenuation coefficient (LAC), effective atomic numbers (Z_{eff}), half-value layers (HVL), mean free path (MFP), and exposure buildup factors (EBF). The examination of these parameters reveals that the glass material demonstrates commendable shielding performance, characterized by low HVL, TVL, MFP, and EABF values, along with N_{eff} , C_{eff} and ΣR values.

PP- 18

Synthesis Characterization Of Polypyrrole –Carbon Nano Tube ,Zinc Oxide,Ternary Nano Composites For As A Flocculating Agent

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Polypyrrole (PPy) is a solid conductive polymer synthesized from pyrrole and is naturally conductive. Carbon nanotubes (CNTs) are tiny cylindrical structures composed of carbon atoms arranged in a hexagonal lattice, possessing exceptional mechanical, electrical, and thermal properties. Zinc oxide (ZnO) functions as a nanoparticle in various applications. In this study, we synthesized and characterized carbon nanotube/polypyrrole/zinc oxide (CNT/PPy/ZnO) nanocomposites, which act as flocculating agents. The synthesized complexes were characterized using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM). The data reveal that CNTs and ZnO nanoparticles are uniformly distributed within the nanocomposite. These ternary nanocomposites have been utilized for water purification, specifically for the removal of heavy metal ions such as cadmium (Cd), mercury (Hg), and lead (Pb). The results indicate that heavy metal ions are effectively adsorbed onto the CNT/PPy/ZnO nanocomposites, demonstrating their potential use as efficient flocculating agents.

Keywords: Carbon nanotube; Zinc oxide; XRD; FTIR; SEM; Metal ions

PP- 19

Investigations on physical, electrical, and structural properties of some alkali borate glasses doped with transition metal oxides

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Solids can be classified as crystalline and non-crystalline solids depending on the arrangement of atoms and molecules. Glasses being non-crystalline materials, don't have long-range order. In glass families of interest, silicate glasses are popular but require high melting temperatures. However, borate glasses, on the other hand, have low melting temperatures, are optically transparent and possess application potential.

Borate glasses containing alkali ions like Li+ and Na+ exhibit superionic conductivity and high the dielectric constant, making them suitable for energy storage and other electronic applications. Alkali metals Li+ and Na+ are incorporated into these glasses due to their high ionic mobility and these elements when added to glasses enhance overall ionic conductivity. Transition elements like Cu^{2+} and Fe^{3+} are doped into the glasses, as these elements can exhibit multiple oxidation states, which helps to enhance the electrical properties of the glasses.

The physical, electrical, and structural properties of alkali borate glasses containing transition metal oxides of composition xM;0-6OB2O3-(40-x)D (M=Li or Na & D=Fe2O3; or CuO and x=0, 5, 10 , and 15 mol%) are prepared using a melt-quenching technique. The stoichiometric amounts of each compound were calculated in terms of mol % and weighed using 0.001g digital balance and mixed thoroughly using a mortar and pestle. The mixture was transferred into a porcelain crucible and melted in a muffle furnace at temperatures around 1000°C to 1100 °C. The melts were poured on a brass mold and pressed with another handle. The quenched glasses were annealed at temperatures around 250°C for 24 hours. The glasses were characterized by X-ray diffraction measurement to confirm the non-crystalline nature of the prepared glasses. The density of the samples was measured using the Archimedes principle using toluene as buoyant fluid at room temperature. The samples were finally polished using abrasive

papers of Different grades to obtain a smooth glass surface which was then used for refractive index measurements using a gem refractometer.

From XRD measurements, no sharp peaks were observed in the diffractogram confirming the non-crystalline nature of the prepared samples. The density of glasses was found to be increasing with increasing TMO at the expense of alkali oxide.

PP- 20

Investigation on structural and optical properties of Alkaline Earth Borate glasses.

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Borate glasses are primarily composed of Boron Oxides (B_2O_3). They have good thermal and chemical stability with a lower melting point than that of silicate glasses which makes them easier to synthesize. Alkaline Earth Metal Oxides such as MgO, CaO, SrO, and BaO act as network modifiers which increase the fraction of four coordinated boron atom (BO_4) units within the network. This enhances the mechanical strength, chemical, and thermal resistance. This also increases the solubility of dopant ions in the host matrix.

The glasses are prepared for the compositions xRO - (100-x) B_2O_3 (x=30, 50, 70 mol%; R= Mg, Ca, Sr, Ba) using the melt-quenching technique at the temperature range of 900 - 1050^{o}C for 4 - 5 hrs followed by annealing at 300^{o}C. The glass samples were then finely polished using different grades of coated abrasives for refractive index measurement using a gem refractometer. The non-crystalline nature of the glass samples is confirmed using XRD. The density parameters are found using the Archimedes method. The physical properties of the glass samples are correlated with changing compositions. The glass samples are to be doped with rare earth ions

to check their suitability for optical applications.

Keywords: Alkaline Earth Borate Glasses, Physical Properties, Refractive index, Density parameters, XRD, Rare earth dopants

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PP- 21

Solar cell testing

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Solar cell is device that convert solar energy into electrical energy, they are also called “Photovoltaic cell”. The Indian government as planned for the solar cell capacity upto “230GWatts” I.e 1 solar cell generates upto “10Gwatts" In the context of solar cell “Fabrication” refers to the entire manufacturing process of creating a solar cell in this process some steps are involved they are Silicon wafer production, Texturing, Dopping, Metalisation Anti-Reflecting coating Encapsulation, Wiring. In the solar testing time is very fast because it should happen within milliseconds Importance of the solar cells are Voltage output current, short circuit current, Pmax i,e the maximum power output of a solar cell, series and shunt resistance. Important technologies of solar cells are PERC(Passsivated Emmitor and Rear Cell), TOPCON(Tunnel Oxide Passivated Contact), HJT(Heterojunction Solar cell) will be coming next year we cannot do the solar cell experiment overall in 24 hours has there will be no sunlight. Advantages of solar cells are It can be used in solar cell to act as a highly efficient light source for texting the cells performance . After testing it goes to binning in the solar plant A typical solar cell has efficiency ranging from 15% to 22% i,e 23(or)24watt efficiency.

Keywords

Solar cells, photovoltaic testing, environmental characterisation, performance evaluation, renewable energy.

PP- 22

PHYSICAL AND OPTICAL PROPERTIES OF IRON DOPED SODIUM BORATE GLASSES

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Fe^{+2} doped sodium borate glasses prepared by using melt-quenching method and analysed their density, molar volume, refractive index, functional groups and optical band gap using techniques such s UV-Vis spectroscopy, Raman spectroscopy and Fourier Transform Infrared (FTIR) spectroscopy. The results indicate as increases in density with higher Fe_2O_3 content, while molar volume decreases inversely. Optical absorption spectra show a gradual shift in absorption edges, and Tauc plot analysis reveals as increases in energy bans gap values with Fe_2O_3 concentration due to variation in non-bridging oxygen atoms. The X-ray diffraction (XRD) pattern was used to confirm the amorphous nature of the glass samples. We can conclude that the prepared borate glasses are strong candidate for display device applications.

PP- 23

Structural studies of thermally decomposed potassium chromate salts

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Thermal decomposition of transition metal oxides (T.M.O.s) is one of the simple and conventional methods to synthesize nanoparticles. This work highlights the structural variation of the precursors viz., potassium chromate and potassium dichromate when they were subjected to thermal decomposition at 800℃. The X-ray Diffraction studies of salts clearly indicate that there could have been agglomeration of particles due to thermal treatment, which is noticeable by the shift in XRD peaks. Interestingly, there was no significant variation noted in FTIR Spectra of chromate sample, whereas there had been some noticeable functional group changes in dichromate groups. These materials play a vital role in energy storage device applications.

Keywords: *Heat treatment, Structural variations, Potassium dichromate.*

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Engineering the Cerium Oxide Nanoparticles with enhanced hydrophobicity

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The synthesis and design of nanomaterials with distinctive physical and chemical properties provide novel opportunities for utilizing them for various applications. In general, the structures and surface characteristics of the nanomaterials have a major influence on their physicochemical properties. It is feasible to carefully modify the properties of the nanomaterials by tuning the reaction parameters. Here, we provide a simple and effective wet chemical method for the controlled synthesis of functionalized cerium oxide nanoparticles (CeO_2 Nps) by varying the capping agents (CA) i.e. citric acid and Cetrimonium bromide. The synthesized CeO_2 Nps are characterized using XRD, Raman spectroscopy, FESEM, TEM, and FTIR to study the crystal structure, morphology, and functional groups, respectively. The synthesized CeO_2 NPs are highly crystalline and belong to a cubic crystal system. We investigated surface wettability for various functionalized CeO_2 NPs by contact angle measurements. The CA is critical in achieving morphology and imparting hydrophobicity to the NPs. The functionalization of CeO_2 with CTAB resulted in maximum enhancement in the contact angle of 92.2°±3.3. This work provides valuable insights into the influence of surface functionalization of nanoparticles on controlling their sizes and wetting properties.

PP- 25

Utilizing AI to Optimize the Design of Aerodynamics Structures

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The integration of Artificial Intelligence (AI) in aerodynamics design has revolutionized traditional optimization methods by improving efficiency and reducing computational costs.This paper reviews existing research on how AI- driven techniques such as Machine Learning(ML), Deep Learning (DL), and Genetic Algorithms (GA) have been applied to optimizeaerodynamic structures, particularly in aerospace and automative industries. Studies indicatethat AI-assisted Computational Fluid Dynamics (CFD) simulations reduce computation timeby up to 40% while AI- optimized wing and vehicle designs achieve 7-10% improvementsin efficiency. Case studies from NASA, Airbus, Boeing, and MIT's drivAerNet++ projectdemonstrate that AI models can generate more aerodynamics shapes faster than conventionalmethods. The paper highlights the role of AI in reducing drag, enhancing lift, andstreamlining the aerodynamic design process. The review concludes that AI will play anincreasingly critical role in real-time aerodynamic adjustments, paving the way forintelligent, adaptive aerodynamic systems.

Keywords: Artificial intelligence, Aerodynamics, Machine learning, Computational Fluid Dynamics, Optimization

PP- 26

Characterization of O2 annealed RF sputtered undoped and Aluminium doped ZnO Thin Films

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Radio frequency (RF) sputtering was used to deposit 60 nm, 100 nm and 150 nm thick undoped and 2% aluminum doped zinc oxide (AZO) nanocomposite thin films on pre- cleaned substrates at room temperature. Structural, morphological, electrical, and optical characteristics were assessed for both as-deposited and annealed films. XRD analysis confirms the hexagonal wurtzite structure of the film. In the case of AZO thin films annealed in an oxygen atmosphere, α- Al2O3 phase peaks and ZnO peaks were observed. The direct and indirect energy band gaps of the samples were determined by optical analysis. The present work clearly shows the dependence of film thickness, isochronal annealing, aluminum doping on various film properties.

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PP- 27

"Quantum Computers and Artificial Intelligence – Futuristic Transformation"

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Physics, Chemistry and Mathematics has been contributing its best constantly even before the human race evolved on this earth and perhaps its presence in this entire universe. The race has embraced it to such an extent that we are witnessing the latest developments in the field of Science and Technology in this 21st century. Though we see a revolution in this regard right from the 15th century so called the Industrial Revolution, the 21st century developments out beat any of the technologies, since the technology is developing at the rate of one minute and with the induction of quantum computers there will be a huge difference in the computational speeds.

This paper explores how the quantum computers and artificial intelligence (AI) collaborate with each other and come up with solutions faster and with greater precision in- spite of the current challenges. The quantum computers leverage phenomena such as superposition, entanglement and quantum parallelism which can be utilized by the AI algorithms to speed up its operations at exponential rate and brings about complete transformation in the journey of computation field and this can give rise to new methodologies for machine learning, optimization and data analysis. This paper gives a bird view of the applications of quantum computers and AI. It also gives information about the various models of quantum computers and its functionalities with applications.

Finally, to conclude, it highlights on the challenges and limitations of quantum computers and recommends about future research in this

direction to bring about further transformation.

Keywords: Quantum computers, Artificial Intelligence, Superposition, Entanglement, Parallelism, Machine learning, optimization, Data Analysis

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"Time Travel: A Scientific and Fictional Perspective"

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Time travel has been a subject of fascination in both science fiction and theoretical physics, inspiring countless stories and scientific inquiries. This paper explores the historical origins of time travel, its depiction in literature and film, and the theoretical foundations established by Albert Einstein's theories of relativity. It delves into key scientific concepts such as time dilation, wormholes, and closed time like curves while addressing major paradoxes like the grandfather paradox. Furthermore, the paper examines whether time travel is theoretically possible based on current scientific understanding. While time dilation has been experimentally confirmed, traveling backward in time remains speculative due to paradoxes, energy constraints, and quantum limitations. Despite these challenges, time travel continues to capture human imagination and drive scientific exploration.

Keywords: Time travel, relativity, wormholes, time dilation, grandfather paradox, closed timelike curves, causality, science fiction, theoretical physics, quantum mechanics, Many-Worlds Interpretation, Novikov Self-Consistency Principle, spacetime, chronology protection.

PP- 29

Transport properties of samarium doped Boro-tellurite glasses

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Samarium doped boro-tellurite glasses with the composition of $60B_2O_3$-(30-x)TeO_2-10Na_2O-xSm_2O_3 (where x=0.0, 0.1, 0.2, 0.3, 0.4 & 0.5 mol%) were prepared using conventional melt-quenching method. The nature of the was confirmed by X-ray diffraction technique. DC and AC electrical conductivity of the prepared samples were measured using Impedance spectrometer at room temperature (300 K) in the frequency range of 10 kHz to 10 MHz. The obtained results were analysed with respect concentration of samarium oxide.

Keywords: Boro-tellurite glass; Samarium; Dielectric constant: Conductivity.