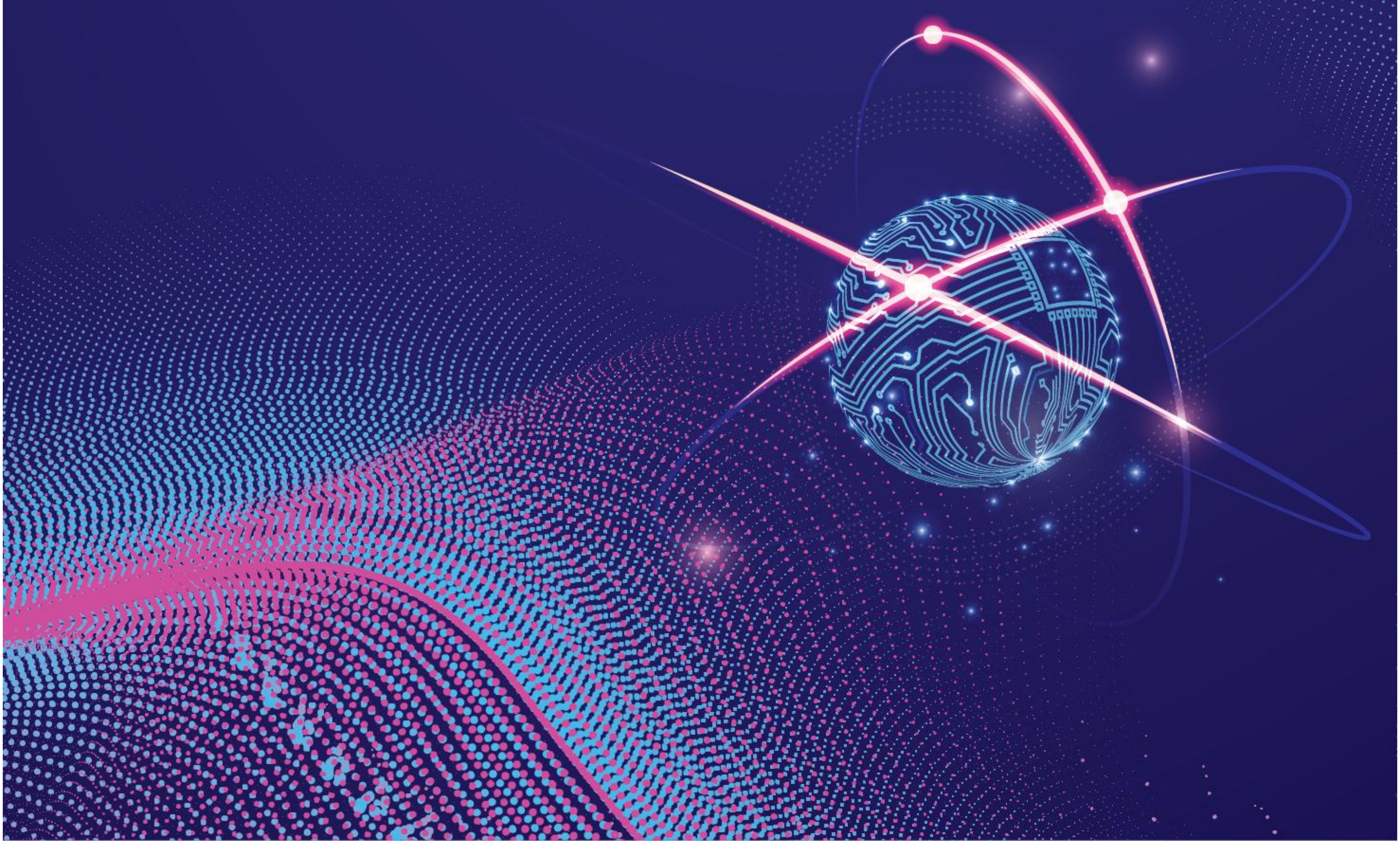
BOOK OF ABSTRACTS

PHENIKAA INTERNATIONAL PHYSICS CONFERENCE 2025

CELEBRATING 100 YEARS OF QUANTUM PHYSICS

Hanoi, 13th - 15th October 2025



Phenikaa International Physics Conference 2025: Celebrating 100 years of quantum physics

Phenikaa University, Hanoi, Vietnam

October 13th - 15th , 2025

CONFERENCE PROGRAM AND ABSTRACTS

CONTENTS

PIPC 2025 – The **Phenikaa International Physics Conference 2025** is held at Phenikaa University, Hanoi, Vietnam on October 13-15, 2025 to celebrate a century of groundbreaking discoveries in quantum physics. The event is hosted, sponsored and organized by:

Phenikaa University

With the scientific program established by:

Vietnam Physical Society

Phenikaa Institute for Advanced Study

NYCU Institute of Physics

ABOUT THE CONFERENCE

The Phenikaa International Physics Conference 2025 (PIPC2025) is scheduled to be held on October 13-15, 2025, at Phenikaa University, Hanoi, Vietnam. Organized by Phenikaa University, PIPC2025 aims to bring together global participants to share insights and experiences in the realm of physics. The conference provides a dynamic platform for researchers, professionals, and students to exchange ideas, establish collaborative connections, and foster partnerships across various disciplines. By facilitating interactions among delegates from various regions, this conference seeks to make a meaningful contribution to the current knowledge in physics and related scientific fields.

This year, as we celebrate a century of groundbreaking discoveries in quantum physics, PIPC2025 will highlight the latest research, emerging trends, and future directions in this transformative field that has revolutionized our understanding of the universe and continues to drive innovation.

We are delighted to invite contributions across theoretical, experimental, and applied physics, encouraging interdisciplinary dialogues and collaborations.

Join us in commemorating 100 years of quantum physics and exploring new horizons together.

The Topics

- High Energy Physics
- Astrophysics and Cosmology
- Condensed Matter Physics and Computational Physics
- Quantum Computation and Engineering
- Nuclear Science and Technology
- Materials Science and Semiconductor Technology
- Applied and Engineering Physics

International Steering Committee

- Assoc. Prof. Ho Xuan Nang, Phenikaa University
- Prof. Pham Thanh Huy, Phenikaa University
- Prof. Misao Sasaki, University of Tokyo, Japan
- Prof. Imre Pázsit, Chalmers University of Technology, Sweden
- Prof. Margarete Mühlleitner, Karlsruhe Institute of Technology, Germany
- Prof. Kuan-Neng Chen, International College of Semiconductor Technology, Institute of Electronics, and Institute of Physics, National Yang Ming Chiao Tung University, Taiwan

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- Prof. Nguyen Van Hieu, Phenikaa University
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- Prof. Nguyen Quang Liem, Vietnam Physical Society
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- Assoc. Prof. Dao Van Duong, Phenikaa University
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- Dr. Nguyen Viet Huong, Phenikaa University
- Dr. Bui Van Hao, Phenikaa University
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- Ms. Nguyen Thi Khanh Tra, Ho Chi Minh Communist Youth Union – Phenikaa University
- Dr. Dao Thi Nhung, PIAS – Phenikaa University
- Dr. Duong Van Loi, PIAS – Phenikaa University
- Dr. Tran Ngoc Hung, PIAS – Phenikaa University

Secretariat

- Ms. Pham Thu Hien, Science and Technology Office – Phenikaa University (hien.phamthu@phenikaa-uni.edu.vn)
- Mr. Tran Dinh Cuong, PIAS – Phenikaa University (cuong.trandinh@phenikaa-uni.edu.vn)

PIPC 2025 PROGRAM

Phenikaa International Physics Conference 2025 (PIPC2025):
Celebrating 100 years of quantum physics

Date: October 13-15, 2025
Venue: Phenikaa University, Nguyen Trac, Duong Noi, Ha Noi
Organizers: Phenikaa University, NYCU Institute of Physics and Vietnam Physical Society

13-Oct Time	**7:00 October 13, 2025, Phenikaa University, Hanoi, Vietnam**
7:00 – 8:30	**Registration and coffee**, *2nd floor A9-A10 grand hall*
8:30 – 8:50	**Opening ceremony,** *2nd floor A9-A10 grand hall*
8:30 – 8:40	Video introduction to Phenikaa University
8:40 – 8:45	Welcome speech by Phenikaa University's Representative
8:45 – 8:50	Speech by Distinguished Guest
8:50 – 10:20	**Plenary session (Chairperson: Prof. Phung Van Dong),** *2nd floor A9-A10 grand hall*
8:50 – 9:35	Plenary talk 1 by **Prof. Misao Sasaki**, Institute for the Physics and Mathematics of the Universe, The University of Tokyo, Japan ***"Inflationary Universe Known Knowns, Known Unknowns, and Unknown Unknowns"***
9:35 – 10:20	Plenary talk 2 by **Prof. Milada Margarete Mühlleitner**, Institute for Theoretical Physics, Karlsruhe Institute of Technology (KIT), Germany ***"High-Energy Physics from a Theoretical Perspective: Major Results, Recent Results and Near-Future Projects"***
10:20 – 10:45	**Photo session and Coffee break**

Time	**Parallel Sessions**									
10:45 – 11:45	**Room 1: 104 A8 (Session 1)**		**Room 2: 201 A8 (Session 2)**		**Room 3: 202 A8 (Session 3)**		**Room 4: Meeting Room 3-2nd Floor A10 (Session 5)**		**Room 5: Grand Hall-2nd Floor A10 (Session 6-7)**	
	Chairperson: Le Duc Ninh		**Chairperson: Nguyen Quynh Lan**		**Chairperson: Pham Tien Lam**		**Chairperson: Nguyen Ngoc Anh**		**Chairperson: Nguyen Huu Lam**	
	PID	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**
	S1.K1	Prof. Guey-Lin Lin	S2.K1	Prof. Shinji Miyoki	S3.K1	Prof. Massimo Boninsegni	S5.K1	Prof. Dao Tien Khoa	S6.K1	Prof. Yong Ill Lee
	S1.I1	Dr. Tran Hoai Nam (onl)	S2.K2	Prof. Alex Lazarian (onl)	S3.I1	Prof. Do Van Nam	S5.K2	Dr. Peng Hong Liem	S6.K2	Prof. Phan Manh Huong
11:45 – 13:30	**Luncheon at D6 building – 2nd Floor**									
	Parallel Sessions									

13:30 – 15:10	**Room 1: 104 A8 (Session 1)**		**Room 2: 201 A8 (Session 2)**		**Room 3: 202 A8 (Session 4)**		**Room 4: Meeting Room 3-2nd Floor A10 (Session 5)**		**Room 5: Grand Hall-2nd Floor A10 (Session 6-7)**	
	Chairperson: Eibun Senaha		**Chairperson: Do Quoc Tuan**		**Chairperson: Hung Nguyen**		**Chairperson: Le Ngoc Thiem**		**Chairperson: Nguyen Duc T.Kien**	
	PID	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**
	S1.I2	Prof. Do Thi Huong	S2.K3	Prof. Bum-Hoon Lee	S4.K1	Prof. Tran Nguyen Lan	S5.I1	Prof. Nguyen Quang Hung	S7.K1	Prof. Hsin-Fei Meng
	S1.I3	Dr. Pawin Ittisamai	S2.K4	Prof. Thiem Hoang (onl)	S4.K2	Prof. Areeya Chantasri	S5.I2	Dr. Le Xuan Chung	S7.K2	Prof. Le Anh Tuan
	S1.I4	Dr. Phan Hong Khiem	S2.K5	Prof. Sushant Ghosh	S4.I1	Prof. Pham Tan Thi	S5.O1	Dr. Nguyen Duy Quang	S6.I1	Prof. Sanghoon Kim
	S1.K2	Prof. Hoang Ngoc Long (onl)	S2.K6	Prof. Pham Ngoc Diep	S4.I2	Prof. Nguyen The Toan	S5.O2	Dr. Nguyen Huu Tiep	S7.I1	Prof. Dao Van Duong
15:10 – 15:25	**Coffee break**									
15:25 – 16:00	**Poster session 1:** (S1.P)1, 2, 3, 4, 5, 6; (S2.P)1, 2; (S3.P)1, 2, 3, 4, 5, 6, 7; (S4.P)1, 2, 3, 4, 5; (S5.P)1, 2, 3, 4, 5, 6, 7, 8, 9; (S6.P)1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22; (S7.P)1, 2, 3, 4;									
16:00 - 17:30	**Parallel Sessions**									
	Room 1: 104 A8 (Session 1)		**Room 2: 201 A8 (Session 2)**		**Room 3: 202 A8 (Session 3)**		**Room 4: Meeting Room 3-2nd Floor A10 (Session 5)**		**Room 5: Grand Hall-2nd Floor A10 (Session 6-7)**	
	Chairperson: Phan Hong Khiem		**Chairperson: Pham Ngoc Diep**		**Chairperson: Tran Hai Duc**		**Chairperson: Nguyen Huu Tiep**		**Chairperson: Dao Van Duong**	
	PID	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**
	S1.I5	Dr. Tran Chien Thang	S2.K7	Prof. Masahide Yamaguchi	S3.I2	Prof. Tran Hai Duc	S5.I3	Dr. Le Ngoc Thiem	S7.I2	Prof. David Riassetto
	S1.I6	Dr. Eibun Senaha	S2.I1	Prof. Quang Nguyen-Luong (onl)	S3.I3	Prof. Huynh Vinh Phuc	S5.O3	Ms. Do Thi Khanh Linh	S6.I2	Dr. Tran Ngoc Quang
	S1.I7	Dr. Vu Ngoc Khanh (onl)	S2.I2	Dr. Pham Tuan-Anh	S3.O1	Dr. Phan Duc Anh	S5.O4	Dr. Do Cong Cuong	S6.O1	Dr. Nguyen Thi Hue
			S2.I3	Dr. Peter Lott	S3.O2	Dr. Hoang Van Ngoc	S5.O5	Dr. Truong Hoai Bao Phi	S6.O2	Dr. Bui Van Hao
18:30 – 20:30	**Gala dinner at D6 building - 2nd Floor**									
14-Oct	**8:00 October 14, 2025, Phenikaa University, Hanoi, Vietnam**									
8:30 – 9:30	**Public lecture** (online) **by Prof. Dam Thanh Son,** University of Chicago, United States **(Chairperson: Prof. Le Duc Ninh)** ***"Quantum Tunneling: Fundamental Physics and Practical Applications"*** *, 2nd floor A9-A10 grand hall*									
9:30 – 10:00	**Coffee break**									
10:00 – 11:30	**Plenary session (Chairperson: Prof. Tran Hoai Nam),** *2nd floor A9-A10 grand hall*									
10:00 – 10:45	Plenary talk 3 by **Prof. Imre Pázsit**, Department of Physics, Chalmers University of Technology, Sweden ***"Symmetries and Asymmetries in Branching Processes"***									
10:45 – 11:30	Plenary talk 4 by **Prof. Kuan-Neng Chen**, National Yang Ming Chiao Tung University, Taiwan "***Enabling Semiconductor Innovation with 3D IC, Heterogeneous Integration, and Advanced Packaging*** "									
11:30 – 13:30	**Luncheon at D6 building – 2nd Floor**									

Time										
13:30 - 15:10	**Parallel Sessions**									
	Room 1: 104 A8 (Session 2)		**Room 2: 201 A8 (Session 3)**		**Room 3: 202 A8 (Session 4)**		**Room 4: Meeting Room 3-2nd Floor A10 (Session 6)**		**Room 5: Grand Hall-2nd Floor A10 (Session 7)**	
	Chairperson: Pham Tuan-Anh		**Chairperson: Dang The Hung**		**Chairperson: Phan Duc Anh**		**Chairperson: Nguyen Viet Huong**		**Chairperson: Tran Manh Trung**	
	PID	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**
	S2.O1	Prof. Yi-Zen Chu	S3.O3	Prof. Bach Huong Giang	S4.I3	Dr. Nguyen Van Duy	S6.K3	Prof. Yu Sheng Su	S7.I3	Prof. Nguyet Pham
	S2.O2	Dr. N. T. Thao	S3.O4	Dr. Nghiem Thi Minh Hoa	S4.I4	Dr. Mohammad Haidar	S6.I3	Prof. Nguyen Quang Hung	S7.K3	Prof. Hsiao-Wen Zan
	S2.O3	Dr. Tran Ngoc Hung	S3.O5	Dr. Nguyen Dung Chinh	S4.I5	Assistant Prof. Le Bin Ho	S6.I4	Dr. Nguyen Dang Tung	S7.I4	Dr. Vu Ngoc Hung
	S2.O4	Prof. Do Quoc Tuan	S3.O6	Mr. Lam Huu Minh	S4.I6	Dr. Nghiem Nguyen Viet Dung	S6.O3	Dr. Mai Thi Thu	S7.O1	Mr. Le Duc Tam
15:10 - 15:25	**Coffee break**									
15:25 – 16:00	**Poster session 2:** (S1.P)7, 8, 9, 10, 11, 12; (S3.P)8, 9, 10, 11, 12, 13, 14; (S4.P)6, 7, 8, 9, 10; (S5.P)10, 11, 12, 13, 14, 15, 16, 17, 18; (S6.P)23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44; (S7.P)5, 6, 7, 8, 9;									
16:00 - 17:00	**Parallel Sessions**									
	Room 1: 104 A8 (Session 1)		**Room 2: 201 A8 (Session 3)**		**Room 3: 202 A8 (Session 4)**		**Room 4: Meeting Room 3-2nd Floor A10 (Session 6)**		**Room 5: Grand Hall-2nd Floor A10 (Session 7)**	
	Chairperson: Tran Chien Thang		**Chairperson: Dang The Hung**		**Chairperson: Hung Nguyen**		**Chairperson: Bui Van Hao**		**Chairperson: Nguyen Van Du**	
	PID	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**	**PID**	**PRESENTER**
	S1.I8	Prof. Dang Van Soa	S3.O7	Prof. Young-Gwan Choi	S4.O1	Dr. Le Tan Phuc	S6.I5	Prof. Le Manh Tu	S7.I5	Dr. Tran Manh Trung
	S1.I9	Dr. Reinard Primulando	S3.O8	Dr. Nguyen Ngoc Linh	S4.O2	Mr. Doan Manh Duc	S6.O4	Mr. To Toan Thang	S7.O2	Dr. Vu Duy Linh
	S1.I10	Dr. Cao Van Son (onl)	S3.O9	Prof. Seok Joon Yun	S4.O3	Mr. Marc Andrie Bermundo (onl)	S6.O5	Dr. Tran Nguyen Minh Anh	S7.O3	Mr. Tran Vu Hung Anh
17:10 – 17:25	**Closing ceremony,** *2nd floor A9-A10 grand hall*									
	Closing speech by Conference chair & Best poster prize announcement									
17:25 – 18:45	**Film screen "*The Most Brilliant Human Mind*" on John von Neumann,** *2nd floor A9-A10 grand hall*									
15-Oct	**Post-conference Excursion**									

Session 1: High Energy Physics

Session 2: Astrophysics and cosmology

Session 3: Condensed Matter Physics and Computational Physics

Session 4: Quantum Computation and Engineering

Session 5: Nuclear Science and Technology

Session 6: Materials Science and Semiconductor Technology

Session 7: Applied and Engineering Physics

PLENARY TALKS
&
PUBLIC LECTURE

INFLATIONARY UNIVERSE - KNOWN KNOWNS, KNOWN UNKNOWNS, AND UNKNOWN UNKNOWNS

Misao Sasaki[1,2]

[1] *Institute for the Physics and Mathematics of the Universe, The University of Tokyo, Japan*

[2] *Asia-Pacific Center for Theoretical Physics, Korea*

*E-mail: misao.sasaki@ipmu.jp

Abstract:

Thanks to the rapid progress in observational cosmology, we have begun to understand the very early stage of the Universe, specifically an exponentially expanding era called inflation. However, our knowledge is still far from complete. I will first review what inflation is and what we currently know about it. Then I will discuss some recent topics that may improve our understanding of the early Universe, including recent developments in the blossoming field of gravitational wave cosmology.

Keywords: Cosmic inflation; Early universe; Gravitational waves.

Professor Misao Sasaki

Professor Misao Sasaki's research focuses on general relativity and cosmology, the theory of cosmic inflation, gravitational waves, and black hole perturbation theory. He is currently the Director of the Asia-Pacific Center for Theoretical Physics. Professor Sasaki has received many prestigious awards, including those from the International Society on General Relativity and Gravitation.

High-Energy Physics from a Theoretical Perspective Major Results, Recent Results and Near-Future Projects

Milada Margarete Mühlleitner[1]

[1]*Institute for Theoretical Physics, Karlsruhe Institute of Technology (KIT), Wolfgang-Gaede Str. 1, Karlsruhe, Germany*

[*]E-mail: milada.muehlleitner@kit.edu

Abstract:

High-energy physics stands at the crossroads of theory and experiment, continuing the century-long legacy of quantum physics. In this talk, I will provide a theoretical perspective on the major milestones achieved in high-energy physics, from the formulation of the Standard Model to the development of effective field theories and beyond. Recent advances in precision studies of the Higgs properties, neutrino physics, the ongoing search for Dark Matter, and the interplay between gravitational waves and collider physics, will be highlighted. I will discuss how collider experiments, especially the Large Hadron Collider (LHC), have both confirmed Standard Model predictions and motivated novel theoretical frameworks. Looking ahead, next-generation collider projects and dedicated neutrino and Dark Matter experiments promise to probe energy scales and phenomena beyond the current frontier. Together, these efforts will advance our understanding of the fundamental interactions and the true theory underlying nature.

Keywords: High-energy physics, neutrino physics, Dark Matter, gravitational waves

Professor Milada Margarete Mühlleitner

Professor Margarete Mühlleitner's research focuses on fundamental particle physics and high-energy physics. Her work is mainly in theory and phenomenology, developing new physics models beyond the Standard Model of particle physics. Recently, she has also conducted extensive research on dark matter.

Quantum Tunneling: Fundamental Physics and Practical Applications

Dam Thanh Son[1]

[1]*Kadanoff Center for Theoretical Physics, University of Chicago, Chicago, Illinois 60637, USA*

Abstract:

One phenomenon that distinguishes quantum behavior from classical behavior is quantum tunneling. We will trace the history of this phenomenon from its discovery to modern times, illustrating its importance on examples taken from nuclear physics, condensed matter physics, and particle physics/cosmology.

Keywords: High-energy physics, neutrino physics, Dark Matter, gravitational waves

Professor Dam Thanh Son

Professor Dam Thanh Son's research at the University of Chicago focuses on quantum chromodynamics, string theory applications, and many-body physics. He gained international recognition for applying string theory concepts to understand nuclear matter under extreme conditions. Professor Son received the Dirac Medal in 2018 and is a member of the U.S. National Academy of Sciences.

Symmetries and Asymmetries in Branching Processes

Imre Pázsit
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Department of Physics, Chalmers University of Technology
*E-mail: imre@chalmers.se

Abstract:

Most elementary processes in classical and quantum physics are invariant for time reversal. Such processes are associated with Hermitian or self-adjoint operators. However, many-particle systems, in particular those which obey statistical laws, show irreversibility, i.e. no invariance for time reversal. This is the case of neutron transport in a multiplying medium, or atomic collision cascades. As is known in stochastic particle theory, the same random process can be described by two different master equations for the evolution of the probability density, namely, by a forward or a backward master equation. These are the generalised analogues of the direct and adjoint equations of traditional neutron transport theory. At the level of the first moment, these two equations show considerable resemblance to each other, but they become increasingly different with increasing moment order. The largest difference is in the master equation (Chapman-Kolmogorov equation) for the evolution of the full probability density. The purpose of this presentation is to demonstrate this increasing asymmetry and to discuss the underlying reasons. It is argued that since the reason of the different forms of the forward and the backward equations lies in the lack of invariance of the process to time reversal, the reason for the increasing asymmetry between the two forms for higher-order moments or processes with several variables (particle types) can be related to the increasing level of the violation of the invariance to time reversal. This will be illustrated with some examples.
Keywords: branching processes; stochastic transport; master (Chapman–Kolmogorov) equations; forward - backward forms.

Professor Imre Pázsit

Professor Imre Pázsit's research focuses on transport theory of neutral and charged particles, particularly fluctuations in neutron transport processes and atomic collision chains; reactor dynamics theory, neutron noise, and diagnostics of nuclear reactor operation. He is a member of the Royal Swedish Academy of Engineering Sciences and the Royal Society of Arts and Sciences in Gothenburg. Professor Pázsit has received many prestigious awards from the American Nuclear Society and the Hungarian Nuclear Society, most notably the "Order of the Rising Sun, Gold Rays with Neck Ribbon" from the Government of Japan.

Enabling Semiconductor Innovation with 3D IC, Heterogeneous Integration, and Advanced Packaging

Kuan-Neng Chen
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E-mail: knchen@nycu.edu.tw

Abstract:

3D IC, advanced packaging, and heterogeneous integration have become increasingly significant in current electronic products and applications due to their flexibility and ability to integrate various substrates, functions, devices, and products into small form factors with low power consumption. These approaches are not only considered candidates for extending "Moore's Law" but also for realizing the concept of "More than Moore". Moreover, given the current semiconductor development focus on the potential and demands of AI and data center, these approaches provide solutions for fabricating various advanced electronic products. Ongoing technological development aims to achieve high-performance computing and compact dimensions by refining the pitch and size of vertical interconnections and exploring solutions to mitigate stress and warpage issues. Innovative platforms based on low-temperature bonding and ultra-thin device layer stacking show promising capabilities.

This presentation will begin with an introduction to the current status, including historical background and the current status of semiconductors, followed by discussions on 3D integration schemes such as 3D, 2.5D (interposer-based), and 2.1D (fanout-based). Key technologies will be described, including significant hybrid bonding technology. Finally, the presentation will delve into the challenges associated with the aforementioned goals and discuss possible solutions through industry efforts and research advances.

Keywords: 3D IC; advanced packaging; heterogeneous integration; semiconductor.

Professor Kuan-Neng Chen

Dr. Kuan-Neng Chen is Dean of International College of Semiconductor Technology and Chair Professor at Institute of Electronics at National Yang Ming Chiao Tung University (NYCU) in Taiwan. He received his Ph.D. degree in Electrical Engineering and Computer Science, as well as his M.S. degree in Materials Science and Engineering, both from Massachusetts Institute of Technology (MIT). Dr. Chen has held several prominent positions including Vice President for International Affairs, Associate Dean of International College of Semiconductor Technology at NYCU, Program Director of the Micro-Electronics Program at National Science and Technology Council in Taiwan, Adjunct R&D Director at Industrial Technology and Research Institute (ITRI), and Research Staff Member at IBM Thomas J. Watson Research Center.

PARALLEL SESSIONS

Program of Session S1
High Energy Physics

(other activities are mentioned in the conference's main program)

Date: October 13-15, 2025
Venue: Phenikaa University, Duong Noi, Hanoi
Organizers: Phenikaa University, NYCU Institute of Physics, and Vietnam Physical Society

No.	Time	Title	Presenter
October 13, 2025			
10:45 – 11:45		**Oral session** chaired by **Le Duc Ninh;** location: Room 1 (105 A8)	
S1.K1	10:45 – 11:15	Probing dark sectors with vector mediators using ANTARES and IceCube search data for neutrino fluxes from dark matter annihilation in the galactic halo	**Prof. Guey-Lin Lin** National Yang Ming Chiao Tung University
S1.I1	11:15 – 11:45	A Precision Test of the Standard Model: The Final Results from the Fermilab Muon g-2 Experiment *[ONLINE]*	**Dr. Tran Hoai Nam** Boston University
October 13, 2025 Afternoon			
13:30 – 15:10		**Oral session** chaired by **Eibun Senaha;** location: Room 1 (105 A8)	
S1.I2	13:30 – 13:55	Connecting Tiny Neutrino Masses and keV Dark Matter in a $U(1)_N$ Model	**Assoc. Prof. Do Thi Huong** Institute of Physics, VAST
S1.I3	13:55 – 14:0	Effect of Cosmic Neutrino Background on the Dark Matter Self-interaction	**Dr. Pawin Ittisamai** Chulalongkorn University
S1.I4	14:20 - 14:45	Phenomenological Studies of the Two-Higgs-Doublet Model: Parameter Space scanning, Collider Signatures, and Loop-Induced scalar Higgs Decays	**Dr. Phan Hong Khiem** Duy Tan University
S1.K2	14:45 – 15:10	The 3-3-1 model with $U(1)_{B-L}$ and Peccei-Quinn symmetries *[ONLINE]*	**Prof. Hoang Ngoc Long** Van Lang University
15:25 – 16:00		**Poster session 1**	
16:00 – 17:30		**Oral session** chaired by **Phan Hong Khiem;** location: Room 1 (105 A8)	
S1.I5	16:00 – 16:30	Probing the ATOMKI X17 vector boson using Dalitz decays $V \to Pe^+e^-$	**Dr. Tran Chien Thang**

No.	Time	Title	Presenter
			HCMC University of Technology and Education
S1.I6	16:30 – 17:00	Exploring CP Violation and Electron EDM Cancellation in a Scale-Invariant g2HDM	**Dr. Eibun Senaha** Van Lang University
S1.I7	17:00 – 17:30	Recent Dark Matter/Photon/Higgs search results from ATLAS *[ONLINE]*	**Dr. Vu Ngoc Khanh** Shanghai Jiao Tong University
October 14, 2025 Afternoon			
15:25 – 16:00		**Poster session 2**	
16:00 - 17:00		**Oral session** chaired by **Tran Chien Thang;** location: Room 1 (105 A8)	
S1.I8	16:00 - 16:20	The influence of the scalar unparticle and polarization on the exclusive W boson hadronic decays in the final state at muon colliders in the Randall-Sundrum model	**Prof. Dang Van Soa** University of Economics - Technology for Industries
S1.I9	16:20 - 16:40	Novel probes for electron-muon flavor violation from exotic Higgs decays	**Dr. Reinard Primulando** Parahyangan Catholic University, Indonesia
S1.I10	16:40 - 17:00	Physics Through the Lens of Neutrino Oscillations: Mass, Mixing, and CP Violation *[ONLINE]*	**Dr. Cao Van Son** Institute for Interdisciplinary Research in Science and Education, ICISE

Room 1 (Session 1)

S1.K1 – Keynote talk

Probing dark sectors with vector mediators using ANTARES and IceCube search data for neutrino fluxes from dark matter annihilation in the galactic halo

Van Thi Dieu Hien, Guey-Lin Lin*

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Vector boson mediation between visible and dark sectors is a popular theoretical proposal awaiting experimental test for different model parameter ranges. We take advantage of the enhancement on thermally averaged annihilation cross section $\langle\sigma v\rangle$ in the present day universe as compared to its early universe value from two parameter scenarios, namely the resonance enhancement scenario with $2m_\chi \cong m_V$ or Sommerfeld enhancement scenario with $m_\chi > m_V$ and $\alpha_\chi \gg v$. Here m_χ and m_V are masses of dark matter (DM) and vector boson mediator, respectively, while α_χ is defined as $g_\chi^2/4\pi$ with g_χ the coupling between DM and vector boson mediator. Using ANTARES and IceCube published upper bounds on $\langle\sigma(\chi\bar{\chi} \to \nu\bar{\nu})v\rangle$ from their searches for $\chi\bar{\chi} \to \nu\bar{\nu}$ in the galactic halo and the estimated sensitivities of these detectors to $\chi\underline{\chi} \to VV \to \nu\bar{\nu}\nu\bar{\nu}$, we derive (expected) constraints to dark sector parameters. For $m_\chi > m_V$, we found that the m_χ range would be tightly constrained by analyzing the annihilation channel $\chi\underline{\chi} \to VV \to \nu\bar{\nu}\nu\bar{\nu}$.

Keywords: Dark Matter, Dark Sector, Vector Boson Mediator.

S1.I1 – Invited talk

A Precision Test of the Standard Model: The Final Results from the Fermilab Muon g-2 Experiment

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The anomalous magnetic moment of the muon can be both measured and computed to an exceptionally high precision, making it a powerful probe to test the Standard Model and search for new physics. The preceding measurement by the Brookhaven

E821 experiment revealed a notable discrepancy from the Standard Model's predicted value of approximately three standard deviations. To resolve this, the Muon g-2 experiment at Fermilab was designed to improve the measurement precision to 140 parts per billion (ppb) compared to the 540 ppb of E821, by vastly increasing statistics and employing an upgraded apparatus.

This presentation summarizes the final results from the completed Fermilab experiment. After six years of data taking, the experiment has surpassed its design goal, achieving a final precision of 127 ppb. We will present this definitive experimental value and discuss its standing in relation to the evolving Standard Model prediction, where tensions between different theoretical approaches persist. This talk will detail the experimental achievement and examine the current status of the comparison between theory and experiment.

Keywords: Muon, g-2, Standard Model, BSM.

S1.I2 – Invited talk

Connecting Tiny Neutrino Masses and keV Dark Matter in a $U(1)_N$ Model

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Based on an extension of the Standard Model with a $U(1)_N$ symmetry, we study mechanisms for generating small masses of neutrinos and dark matter. Tiny neutrino masses arise via a radiative inverse seesaw, while a radiative type-II seesaw accounts for keV fermion dark matter. The residual Z_2 symmetry ensures dark matter stability and forbids its mixing with active neutrinos. keV dark matter is thermally produced in the early Universe through $U(1)_N$ portal interactions and decouples while still relativistic, but its abundance is thermally overproduced. The correct relic density is achieved through late entropy injection from the decay of long-lived particles. The viable parameter space simultaneously accommodates cosmic inflation and keV dark matter.

Keywords: neutrino masses, dark matter, radiative seesaw, $U(1)_N$.

S1.I3 – Invited talk

Effect of Cosmic Neutrino Background on the Dark Matter Self-interaction

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Neutrino–pair exchange induces a neutrino force that can drive dark matter (DM) self-interactions and influence small-scale structure formation. In this talk, we present the study how the cosmic neutrino background (CνB) modifies DM phenomenology through scalar and pseudoscalar interactions. We examine the impact of the background neutrino force within the scalar DM–neutrino portal model, focusing on both DM self-scattering and annihilation. Our results show CνB substantially reshapes the viable coupling range for DM self-interactions while remaining consistent with current constraints, thereby offering a potential resolution to small-scale structure problems.

Keywords: Dark Matter; Neutrino Force; Cosmic Neutrino Background.

S1.I4 – Invited talk

Phenomenological Studies of the Two-Higgs-Doublet Model: Parameter Space scanning, Collider Signatures, and Loop-Induced scalar Higgs Decays

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In this talk, we present a comprehensive exploration of the parameter space of the Two-Higgs-Doublet Model (THDM), incorporating theoretical constraints, experimental bounds from the LHC, and limits from flavor physics. The analysis is performed using 2HDMC 1.8.0 in combination with SuperISO 4.1. Based on the viable parameter regions, we investigate the phenomenology of charged Higgs bosons at prospective high-energy facilities, including muon colliders operating at the TeV scale and photon-photon colliders ($\mu^+\mu^- \to \gamma\gamma \to H^+H^-$). Furthermore, we examine the one-loop induced decays of CP-even and CP-odd Higgs states into three-body final states within the THDM framework. Illustrative phenomenological results are highlighted, such as $A^0 \to Z\gamma\gamma$, $H \to h\gamma\gamma$, etc.

Keywords: Higgs Physics, HEP phenomenology, Beyond the Standard Models.

S1.K2 – Keynote talk

The 3-3-1 model with $U(1)_{B-L}$ and Peccei-Quinn symmetries

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The 3-3-1 model with right-handed neutrino associated $U(1)_{B-L}$ and Peccei-Quinn (PQ) symmetries is proposed. Based on PQ charges of fields, the general formula of axion is constructed. This form of axion is consistent with the physical state of axion defined from the diagonalization of CP-odd mass mixing matrix of scalar sector. It is shown that axion contains four imaginary components and three mixing angles. Because these mixing angles are tiny, the Yukawa couplings of axion with two fermions depend on the ratio of electroweak scale and PQ symmetry breaking scale ($\sim 10^{-10}$). It is also shown that axion-photon-photon coupling exists not only in anomaly couplings of QCD but also in triple couplings of scalar field and two gauge bosons.

Keywords: Beyond Standard Model, Axion, Lepton family number.

S1.I5 – Invited talk

Probing the ATOMKI X17 vector boson using Dalitz decays V → Pe+e⁻

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Recent anomalies observed in e^+e^- nuclear transitions of ^{8}Be, ^{4}He, and ^{12}C by the ATOMKI collaboration may hint at the existence of a vector boson with a mass around 17 MeV, referred to as X17. If it exists, this boson would also affect similar processes in particle physics, including the Dalitz decays of vector mesons. Recently, the BESIII collaboration measured the Dalitz decay $D^{*+} \to D^0 e^+ e^-$ for the first time and reported a 3.5σ excess over the theoretical prediction based on the vector meson dominance (VMD) model. This excess may be another signal of the X17. In this study, we investigate the possible effects of the X17 on the Dalitz decays $D^*_{(s)} \to D_{(s)} e^+ e^-$, $B^*_{(s)} \to B_{(s)} e^+ e^-$, and $J/\Psi \to \eta_c e^+ e^-$. The required hadronic form factors are calculated within the framework of our Covariant Confined Quark Model, without relying on Heavy Quark Effective Theory or the VMD model. We present predictions for the Dalitz decay widths and the ratios $R_{ee}(V) \equiv \Gamma(V \to Pe^+e^-)/\Gamma(V \to P\gamma)$ within the Standard Model and in several new physics scenarios involving modifications due to the X17. Our results are compared with other theoretical calculations.

Keywords: Covariant Confined Quark Model; Dalitz decay; X17.

S1.I6 – Invited talk

Exploring CP Violation and Electron EDM Cancellation in a Scale-Invariant g2HDM

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Recent LHC data indicate that the discovered scalar particle with a mass of 125 GeV closely resembles the predictions of the Standard Model (SM). While the scale of new physics could lie well above the TeV range, current observations do not rule out scenarios in which new particle masses are below the TeV scale, provided their couplings to SM particles are "aligned" to mimic SM-like behavior. Another significant experimental development is the stringent limit on the electron electric dipole moment (EDM), which strongly constrains CP-violating effects in the Higgs sector.

In this talk, we explore a scale-invariant general two-Higgs-doublet model (SI-g2HDM) with explicit CP violation. Using the method of Gildener and Weinberg, we analyze the Higgs mass spectrum and couplings at the one-loop level, focusing on CP violation originating from both the scalar and Yukawa sectors. We demonstrate that tree-level CP mixing vanishes along a flat direction, resulting in SM-like Higgs couplings to gauge bosons and fermions that satisfy current LHC constraints. At the one-loop level, CP violation in the Higgs sector is entirely determined by the additional Yukawa couplings. In the case where only an additional top Yukawa coupling (ρ_{tt}) is present, the electron electric dipole moment is directly proportional to ($Im\ \rho_{tt}^2$). Furthermore, a nontrivial cancellation region can occur for a specific Higgs mass spectrum. We extend our analysis to scenarios with an additional complex electron Yukawa coupling, identifying the conditions under which the electron electric dipole moment is suppressed or vanishes.

Keywords: 2 Higgs Doublet Model; CP violation; electron electric dipole moment.

S1.I7 – Invited talk

Recent Dark Matter/Photon/Higgs search results from ATLAS

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The nature of dark matter (DM) remains one of the central open questions in particle physics, and models featuring a broader hidden dark sector (DS) are also gaining strong interest. Using 139 fb^{-1} of the LHC proton-proton collision data at a centre-of-mass energy $\sqrt{s} = 13$ TeV recorded between 2015-2018, the ATLAS experiment has carried out extensive searches for DM and DS signatures. In this talk, I will present an overview of three recent, major ATLAS DM/DS analyses to which the TDLI-SJTU group has made significant contributions: 1) combination and summary of DM searches interpreted in a Two-Higgs-Doublet-Model with a pseudo-scalar mediator (2HDM+a); 2) combination of searches for massless dark photon via exotic Higgs boson decays; 3) and search for dark Higgs boson.

Keywords: ATLAS; Dark Matter; Dark Photon; Dark Higgs.

S1.I8 – Invited talk

The influence of the scalar unparticle and polarization on the exclusive W boson hadronic decays in the final state at muon colliders in the Randall-Sundrum model

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An attempt is made to present the effect of unparticle physics and polarization on the exclusive decays of W boson at high energy colliders in the Randall-Sundrum (RS) model. By using Feynman diagram techniques we have evaluated the influence of the scalar unparticle and polarization on the exclusive W boson hadronic decays of $W^{\pm} \to \pi^{\pm}\gamma$, $W^{\pm} \to K^{\pm}\gamma$ and $W^{\pm} \to \rho^{\pm}\gamma$ at the high energy muon colliders in the RS model. The result shows that with fixed collision energies, the total cross-section for hadronic productions in the final state depends strongly on the parameters of the unparticle physics and muon beam polarizes. With a center-of-mass energy of 10 TeV, the total cross-sections achieve the maximum value when the benchmark background as $(\Lambda_U, d_U) = (1\,TeV, 1.9)$ and the polarization coefficient as $(P_{\mu^-}, P_{\mu^+}) = (1,1)$. The numerical evaluation of the statistical significance for the considered process is given in detail, which indicates that the effect can be detected in the future experiments with moderately high energy colliders.

Keywords: unparticle physics, polarization, hadronic decay, muon collider.

S1.I9 – Invited talk

Novel probes for electron-muon flavor violation from exotic Higgs decays

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In this talk, we propose two novel signatures of Higgs decays to search for electron-muon flavor violation. These signatures arise from the presence of a light pseudoscalar into which the 125-GeV Higgs boson decays. The pseudoscalar subsequently decays into an electron-muon pair, leading to multilepton final states, which are relatively clean signatures to search for at the LHC. As a benchmark, we consider the type-III Two-Higgs-doublet-model. We analyze both low-energy and collider constraints on the model and identify regions of parameter space where the light pseudoscalar is viable. Our proposed signatures yield stronger constraints on the lepton flavor violating couplings than current low-energy precision measurements. Taken together, our findings suggest that collider-based probes of exotic Higgs decays provide a powerful complement to precision experiments in the quest to uncover new physics.

Keywords: Lepton flavour Violation, Higgs Exotic Decay, Two Higgs Doublet Model.

S1.I10 – Invited talk

Physics Through the Lens of Neutrino Oscillations: Mass, Mixing, and CP Violation

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Neutrino oscillations provide one of the most compelling windows into physics beyond the Standard Model of elementary particles. The phenomenon, arising from the interplay of neutrino mass and leptonic mixing, reveals that neutrinos are not massless and leptons are mixed. This discovery has reshaped our understanding of flavor physics, opened questions about the nature of mass, and shed light on possible connections with the matter–antimatter asymmetry of the universe. In this talk, I will discuss the quantum aspect of neutrino oscillation, survey the present landscape of oscillation physics, highlighting results from neutrino experiments, and discuss the future prospects for probing the structure of the PMNS matrix and the search for CP violation in the lepton sector.

Keywords: neutrino physics; neutrino oscillation; flavor model; CP violation.

Program of Session S2
Astrophysics and Cosmology

(other activities are mentioned in the conference's main program)

Date: October 13-15, 2025
Venue: Phenikaa University, Duong Noi, Hanoi
Organizers: Phenikaa University, NYCU Institute of Physics, and Vietnam Physical Society

No.	Time	Title	Presenter
October 13, 2025 Morning			
10:45 – 11:45		**Oral session** chaired by **Nguyen Quynh Lan;** location: Room 2 (201 A8)	
S2.K1	10:45 – 11:15	KAGRA large-scale cryogenic gravitational wave telescope	**Prof. Shinji Miyoki** The University of Tokyo
S2.K2	11:15 – 11:45	Obtaining new tools for astrophysical magnetic field study through a better understanding of MHD turbulence *[ONLINE]*	**Prof. Alex Lazarian** University of Wisconsin - Madison
October 13, 2025 Afternoon			
13:30 – 15:10		**Oral session** chaired by **Do Quoc Tuan;** location: Room 2 (201 A8)	
S2.K3	13:30 – 13:55	Beyond Einstein gravity: Black holes and cosmology	**Prof. Bum-Hoon Lee** Sogang University
S2.K4	13:55 – 14:20	How quantum spins in cosmic dust illuminate galactic magnetic fields? *[ONLINE]*	**Prof. Thiem Hoang** Korea Astronomy and Space Science Institute and University of Science and Technology
S2.K5	14:20 – 14:45	Strong-field gravitational lensing by rotating black holes	**Prof. Sushant Ghosh** Jamia Millia Islamia
S2.K6	14:45 – 15:10	Astronomy and astrophysics worldwide and in Vietnam	**Assoc. Prof. Pham Ngoc Diep** Viet Nam National Space Center, Vietnam Academy of Science and Technology
15:25 – 16:00		**Poster session 1**	
16:00 – 17:30		**Oral session** chaired by **Pham Ngoc Diep;** location: Room 2 (201 A8)	

No.	Time	Title	Presenter
S2.K7	16:00 – 16:25	Cosmological collider physics	**Prof. Masahide Yamaguchi** Institute for Basic Science
S2.I1	16:25 – 16:50	BLADE: a broadband low-frequency array for detection and exploration of fast radio burst and transients *[ONLINE]*	**Prof. Quang Nguyen-Luong** CEA Saclay
S2.I2	16:50 – 17:10	Deriving the intrinsic properties of high-z galaxies from lensed ALMA and JWST images	**Dr. Pham Tuan-Anh** Viet Nam National Space Center, Vietnam Academy of Science and Technology
S2.I3	17:10 – 17:30	An algorithm for dark matter-admixed neutron stars in the era of gravitational-wave astronomy	**Dr. Peter Lott** Phenikaa University
October 14, 2025 Afternoon			
13:30 – 15:10		**Oral session** chaired by **Pham Tuan-Anh;** location: Room 1 (105 A8)	
S2.O1	13:30 – 13:55	What Constitutes a Gravitational Wave In An Expanding Universe?	**Prof. Yi-Zen Chu** National Central University
S2.O2	13:55 – 14:20	Performance assessment of the RC500 Ritchey–Chrétien telescope at Nha Trang observatory	**Dr. N. T. Thao** Vietnam National Space Center, Vietnam
S2.O3	14:20 – 14:45	Holographic principle: from black hole thermodynamics to superconducting matter	**Dr. Tran Ngoc Hung** Phenikaa University
S2.O4	14:45 – 15:10	Unstable de Sitter solutions in two novel fourth-order gravities with the Grisaru-Zanon correction	**Assoc. Prof. Tuan Q. Do** Phenikaa University

S2.K1 – Keynote talk

KAGRA large-scale cryogenic gravitational wave telescope

First Shinji MIYOKI[1,*], on behalf of KAGRA Collaboration.

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The KAGRA gravitational-wave telescope in Japan began its fourth international observation run (O4) with Advanced LIGO and Advanced Virgo in May 2023, following three years of repairs, upgrades, and commissioning since May 2020. Under the LIGO–Virgo–KAGRA (LVK) O4 plan, KAGRA resumed commissioning in July 2023 to further improve its sensitivity, aiming to rejoin O4 around spring 2024. However, the magnitude 7.4 Noto Peninsula earthquake severely damaged 10 of the 20 mirror suspension systems, along with other detector components. Recovery efforts began immediately after the earthquake and were completed in July 2024. Thanks to 11 months of dedicated commissioning - including suspension control modifications, recovery of the OMC stack, cooling of sapphire mirrors and suspensions to ~40 K, 10 W laser operation, and suppression of beam jitter noise originating from several mirrors - KAGRA achieved a binary neutron star (BNS) range of up to 7.5 Mpc and is officially rejoining O4 in June 2025. In this presentation, we report on KAGRA’s recovery process, upgrades, and commissioning efforts for O4, as well as its current observational status. We also introduce some of the quantum optics technologies employed in present gravitational-wave telescopes, such as squeezed light.

Keywords: Gravitational Waves; Underground; Cryogenics; Squeezed Light.

S2.K2 – Keynote talk

Obtaining new tools for astrophysical magnetic field study through a better understanding of MHD turbulence

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In this talk, I will explain the new advances in understanding MHD turbulence, including the sub-Alfvenic and super-Alfvenic turbulence, and show how these advancements enable us to measure astrophysical magnetic field properties. I will explain how to use archival data in an innovative way that allows significant advancing of our understanding of magnetized astrophysical media.

Keywords: Magnetic field; galaxy.

S2.K3 – Keynote talk

Beyond Einstein gravity: Black holes and cosmology

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Recent theoretical arguments and precise measurements, such as discrepancies in the Hubble constant, challenge the standard cosmological model and motivate exploration of gravity theories beyond Einstein. One of the simplest extension is the dilaton-Einstein-Gauss-Bonnet (dEGB) Gravity, which adds a quadratic curvature term of the so-called Gauss-Bonnet as well as the scalar coupling function in four-dimensional spacetimes. In the higher than 4-dimensional spacetimes, the Gauss-Bonnet term is dynamical and the additional scalar field is not needed. dEGB theory notably predicts a minimum black hole mass, unlike Einstein's gravity, as well as the possibility of the splitting of the black hole into smaller ones. Finally, we sketch the implication of this theory on cosmological evolution. The major message is that it opens new possible phases at higher temperatures, in addition to the well-accepted radiation, matter, and cosmological constant dominant phases of the standard cosmological model. With a concrete example of the gravitational waves from the plasma in early universe, we show that these new high-temperature phases could have profound implications for our understanding of the early universe, potentially altering predictions about cosmic evolution and observable phenomena.

Keywords: Gauss-Bonnet; Black Holes; Cosmology with Higher Curvatures.

S2.K4 – Keynote talk

How quantum spins in cosmic dust illuminate galactic magnetic fields?

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Magnetic fields are pervasive throughout galaxies and play a crucial role in governing the dynamics of interstellar matter, as well as the formation of stars and planets. Yet, observing these fields remains a significant challenge due to their rather low strength. One of the most powerful tools for probing galactic magnetic fields is the polarization of light, which arises from the alignment of dust grains with magnetic fields. In this talk, I will explore how quantum spins—both in electrons within dust grains and in photons—contribute to the grain alignment mechanism. I will then introduce our newly developed techniques for probing three-dimensional magnetic fields in galaxies using dust polarization. Finally, I will present a novel theory linking cosmic magnetic fields and quantum spin interactions in dust to a potential pathway for the extraterrestrial origin of life.

Keywords: Magnetic field; galaxy

S2.K5 – Keynote talk

Strong-field gravitational lensing by rotating black holes

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Black holes are among the most fascinating predictions of general relativity, and their study has entered a new era with the Event Horizon Telescope (EHT) providing the first images of supermassive black holes. Gravitational lensing in the strong-field regime offers a unique window into probing the geometry near black hole horizons and testing possible extensions of Einstein's theory. In this talk, we shall discuss strong-field gravitational lensing by a class of rotating black holes that, in addition to the mass parameter (M) and spin (a), possess an extra parameter ($0 \leq l/2M \leq 1$).

Our analysis shows that the deflection angle αD and the flux ratio of the first image to all other images, rmag, decrease with increasing l. Conversely, the angular position of the first image θ1 grows more slowly, the photon sphere radius xm decreases more rapidly, and the angular separation s increases more significantly, with qualitative behaviour similar to the Kerr case. We further apply this formalism to the supermassive black holes NGC 4649, NGC 1332, Sgr A*, and M87*, finding that such rotating black holes can, in principle, be distinguished from Kerr black holes through their lensing signatures. Indeed, the deviation of the lensing observables Δθ1 and Δs of such rotating black holes from the Kerr black hole for $0 < l/2M < 0.6$ ($a/2M = 0.45$), for supermassive black holes Sgr A* and M87, respectively, lies within the range 0.0422 − 0.11658 μas and 0.031709 − 0.08758 μas, while |Δrmag| ranges from 0.2037 − 0.95668. However, the deviations are of order O(μas), which remain beyond the reach of present EHT observations. Future experiments with the ngEHT may provide the required precision to constrain these effects.

Keywords: Rotating Black hole; Gravitational lensing.

S2.K6 – Keynote talk

Astronomy and astrophysics worldwide and in Vietnam

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Astronomy and astrophysics are advancing rapidly worldwide, with major progress in areas such as cosmology, galaxy evolution, and exoplanet research, driven by powerful observatories and global collaboration. Facilities like the James Webb Space Telescope and the Square Kilometre Array are opening new windows onto the Universe. In Vietnam, astronomy remains a young field but has grown significantly over the past two decades. Institutions such as the Vietnam National Space Center, universities, and observatories are building capacity through research, training, and international partnerships. This talk will provide an overview of global trends in astronomy and astrophysics, then highlight Vietnam's progress, challenges, and opportunities. It aims to position Vietnam's efforts within the broader international landscape and explore pathways for future contributions.

Keywords: Astronomy; Astrophysics; Vietnam.

S2.K7 – Keynote talk

Cosmological collider physics

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We will discuss cosmological collider physics, with a particular focus on how to extract information about physics beyond the Standard Model (BSM) of particle physics in the current Universe.

Keywords: Collider; Primordial Perturbations.

S2.I1 – Invited talk

BLADE: a broadband low-frequency array for detection and exploration of fast radio burst and transients

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We present the conceptual design, scientific motivation, and early development of the Broadband Low-frequency Astronomical Detection Experiment (BLADE) — a new radio array dedicated to the detection and characterization of transient radio phenomena in the 300–700 MHz band. BLADE is designed to operate as a high-throughput, low-frequency interferometric system optimized for time-domain astrophysics and atmospheric sciences: Fast Radio Bursts (FRBs), transients, ionospheres, lightning, ionospheric scintillation, while also serving as a testbed for advanced radio frequency and data infrastructure in Vietnam.Phase 1 of BLADE includes the construction of a 16-element Log-Periodic Dipole Array (LPDA) at a reasonably radio-quiet site in the Central Vietnam, with simulations demonstrating a boresight gain of ~10 dBi and wide field-of-view. The antennas will be paired with a digital backend based on RFSoC (Radio Frequency System-on-Chip) technology capable of real-time data acquisition and processing across 16 channels at 800 MHz bandwidth. To support this, we propose a scalable data center architecture capable

of ingesting >100 Gbps of radio data, performing beamforming and real-time triggering, and buffering petabyte-scale raw data streams for transient search and follow-up. BLADE will operate in coordination with international networks such as BURSTT (Taiwan), SKA (South Africa/Australia), and regional optical facilities, enabling real-time multi-messenger science in a global context. This paper outlines the system architecture, antenna design, backend performance benchmarks, and development roadmap, while highlighting BLADE's role in building research infrastructure and training capacity for radio astronomy, earth science and big data in Vietnam.

Keywords: Radio astronomy; Fast Radio Burst; Gravitational waves.

S2.I2 – Invited talk

Deriving the intrinsic properties of high-z galaxies from lensed ALMA and JWST images

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We study the physical properties of high-redshift galaxies, taking advantage of the magnification offered by strong gravitational lensing. Our approach involves the analysis of high-resolution data from leading observatories, including the Atacama Large Millimeter/submillimeter Array (ALMA) to probe the cold interstellar medium (gas and dust), and the James Webb Space Telescope (JWST) to characterize stellar populations. We demonstrate the versatility of our approach with three case studies. For the submillimeter galaxy J1344 at $z \sim 2$, we construct a gravitational lens model based solely on ALMA continuum data, enabling a characterization of its dust-emitting region. For P483, a lensed galaxy at $z \sim 3$, JWST and Hubble Space Telescope (HST) observations reveal a low-mass, clumpy system undergoing active star formation, offering a snapshot of galaxy assembly during the cosmic noon. For P109 at $z \sim 6$, JWST data uncover a multi-component starburst

galaxy whose clumpy morphology highlight the complex, rapid, and non-uniform nature of early galaxy growth during the epoch of reionization. These studies demonstrate the power of gravitational lensing, combined with ALMA and JWST, to reveal the diverse pathways of galaxy evolution in the early universe.

Keywords: Galaxy formation and evolution; Gravitational lensing; High-redshift galaxies.

S2.I3 – Invited talk

An algorithm for dark matter-admixed neutron stars in the era of gravitational-wave astronomy

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Gravitational-wave observations provide a unique window into the fundamental nature of massive objects. In particular, the neutron star equation of state has been constrained due to the success of ground-based laser interferometry. Recently, the possibility of detecting dark matter-admixed neutron stars via gravitational waves has been explored. Dark matter would impact the gravitational waveform of an inspiraling neutron star system through tidal parameters, namely the tidal deformability, incurring a phase shift to the time-frequency evolution of the signal. This phase shift would depend both on the percentage of dark matter within the star and its particle nature, e.g., bosonic or fermionic. Indirect detection of dark matter through admixture within neutron stars can provide insight into the neutron equation of state, as well as constraints on the density of dark matter in the universe. In this talk, I discuss Darksuite, an extension of the gravitational-wave data analysis software LALSuite, designed to model the gravitational wave signatures of dark-matter-admixed neutron stars. This framework employs simulations from the two-fluid, generally relativistic Tolman-Oppenheimer-Volkoff equations, wherein one fluid is ordinary nuclear matter and the other is dark matter. We demonstrate interpolation of values from a bank of simulations, enabling the study of binary systems where at least one component may be a dark-matter-admixed neutron star. By leveraging existing methodologies within LALSuite for tidal phase corrections and supplementing them with dark matter effects, Darksuite provides a means to generate and analyze gravitational waveforms for these exotic systems. I discuss this work within the broader context of gravitational-wave astronomy in light of the recent data release from the LIGO-Virgo-KAGRA collaboration's fourth observing run.

Keywords: Gravitational waves; Neutron stars; Dark matter.

S2.O1

What Constitutes a Gravitational Wave In An Expanding Universe?

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Our understanding of gravitational waves produced by isolated astrophysical systems is primarily based on gravitational perturbation theory off a flat spacetime background. This leads to the common identification of gravitational radiation with massless spin-2 waves. In this talk, I will argue that gravitational waves may no longer be solely "spin-2" in character once the background spacetime is our expanding universe instead. As a result of the mixing between gravitational and other degrees of freedom, scalar "spin-0" gravitational waves may exist during the radiation-dominated epoch of our universe; as well as during its current accelerated expansion phase -- provided the main driver is not the cosmological constant, but some extra "Dark Energy" field. Moreover, during the radiation-dominated era, spin-0 Cherenkov gravitational waves may even be generated if its material source were traveling faster than 1/3.

Keywords: Gravitational waves; Cosmology; Expanding Universe.

S2.O2

Performance assessment of the RC500 Ritchey–Chrétien telescope at Nha Trang observatory

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The RC500 telescope at the Nha Trang Observatory (NTO) is a 0.5 m Ritchey-Chrétien optical system well suited for both imaging and spectroscopic studies. This study evaluates the performance of the instrument, with particular attention to the impact of local atmospheric conditions on high precision photometry. As a performance benchmark, we conducted multiple transit observations of short period

exoplanets such as WASP-3b and HD 189733-b. Photometric data were acquired and modelled to derive transit depths and planetary radii, yielding results consistent with published values and confirming the instrument's capability to detect shallow transit signals. The analysis also revealed constraints imposed by the local environment, such as atmospheric extinction, elevated sky brightness from urban light pollution, and fluctuations in seeing. These factors introduce additional photometric noise and limit the detection threshold for fainter targets or shallower transits. The findings establish a baseline for characterizing NTO's site performance and provide guidance for optimizing its observational programs.

Keywords: Exoplanet transits; Nha Trang Observatory (NTO); Photometry; Medium aperture telescope.

S2.O3

Holographic principle: from black hole thermodynamics to superconducting matter

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The holographic principle, first proposed in the context of black hole thermodynamics, has emerged as one of the most profound ideas in modern theoretical physics. This concept, later formalized through the AdS/CFT correspondence, provides a powerful framework for studying strongly coupled quantum systems that are otherwise intractable by conventional methods. Beyond its foundational role in quantum gravity, the holographic principle has also found remarkable applications in condensed matter physics, particularly in the study of superconductivity. In this work, we summarize our recent results on black hole thermodynamics and superconductivity within the framework of holography.

Keywords: holographic principle; AdS/CFT correspondence; black hole thermodynamics; condensed matter.

S2.O4

Unstable de Sitter solutions in two novel fourth-order gravities with the Grisaru-Zanon correction

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In this talk, we will present main results of our recent studies on the stability of de Sitter solutions in two novel fourth-order gravities with the Grisaru-Zanon correction: Einstein-Grisaru-Zanon gravity and Starobinsky-Grisaru-Zanon gravity. First, we will show how to derive the corresponding field equations of the studied gravity models from the Euler-Lagrange equations. Then, we will show that these field equations do admit exact de Sitter solutions due to the existence of the Grisaru-Zanon correction. Finally, we will show, by performing the stability analysis using the dynamical system method, that the obtained de Sitter solutions are always unstable.

Keywords: de Sitter solution; fourth-order gravity; dynamical system; stability analysis.

Program of Session S3
Condensed Matter Physics and Computational Physics

(other activities are mentioned in the conference's main program)

Date: October 13-15, 2025
Venue: Phenikaa University, Duong Noi, Hanoi
Organizers: Phenikaa University, NYCU Institute of Physics, and Vietnam Physical Society

No.	Time	Title	Presenter
October 13, 2025 Morning			
10:45 - 11:45		**Oral session** chaired by **Pham Tien Lam;** location: Room 3 (202 A8)	
S3.K1	10:45 – 11:15	Quantum Mechanics on a macroscopic scale: The role and impact of computer simulations	**Prof. Massimo Boninsegni** University of Alberta, Canada
S3.I1	11:15 – 11:45	Real-Space Kernel Polynomial Method for Electronic properties of quantum materials	**Prof. Do Van Nam** Phenikaa University
October 13, 2025 Afternoon			
15:25 – 16:00		**Poster session 1**	
16:00 – 17:30		**Oral session** chaired by **Tran Hai Duc, Dang The Hung;** location: Room 3 (202 A8)	
S3.I2	16:00 – 16:25	Local structure and vortex phase diagram in Bi-Pb-Sr-Ca-Cu-O superconductor with additions of nanoparticles	**Assoc. Prof. Tran Hai Duc** VNU University of Science
S3.I3	16:25 – 16:50	Magneto-Optical Responses in Topological Semimetals: From Weyl and Dirac to Nodal-Line Systems	**Assoc. Prof. Huynh Vinh Phuc** Dong Thap University
S3.O1	16:50 – 17:10	Novel Advancements in Integrating Artificial Intelligence and Theoretical Models for Predicting Material Properties	**Dr. Phan Duc Anh** Phenikaa University
S3.O2	17:10 – 17:30	TM-BaO monolayers (TM = Co, Fe, Mn): A promising platform for spintronic and electronic applications	**Dr. Hoang Van Ngoc** Thu Dau Mot University
October 14, 2025 Afternoon			
13:30 – 15:10		**Oral session** chaired by **Dang The Hung;** location: Room 2 (201 A8)	

No.	Time	Title	Presenter
S3.O3	13:30 – 13:50	First-order phase transition and magneto-caloric effect in the disordered Blume-Capel models	**Assoc. Prof. Bach Huong Giang** VNU University of Science
S3.O4	13:50 – 14:10	Theory of light absorption and scattering by nanoparticles in an absorbing medium - modeling with experimental validation	**Dr. Nghiem Thi Minh Hoa** Phenikaa University
S3.O5	14:10 – 14:30	Resonance Energy Transfer Between Two Atoms Near a Finite-length dielectric cylindrical waveguide	**Dr. Nguyen Dung Chinh** Van Lang University
S3.O6	14:50 – 15:10	High-Chern-number topological phases in stacked atomic layers: influence of layer sliding and interlayer coupling	**Mr. Lam Huu Minh** Phenikaa University
15:25 – 16:00		**Poster session 2**	
16:00 – 17:00		**Oral session** chaired by **Dang The Hung;** location: Room 2 (201 A8)	
S3.O7	16:00 - 16:20	Quantum sensing with NV centers: nanoscale magnetometry	**Assistant Prof. Young-Gwan Choi** University of Ulsan
S3.O8	16:20 - 16:40	Computational Insights into Defect States in Wide Band Gap Semiconductors	**Dr. Nguyen Ngoc Linh** Phenikaa University
S3.O9	16:40 - 17:00	Bottom-up synthesis of 2D materials for future electronics	**Assistant Prof. Seok Joon Yun** University of Ulsan

Room 3 (Session 3)

S3.K1 – Keynote talk

Quantum Mechanics on a macroscopic scale: The role and impact of computer simulations

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In the pursuit of understanding the role of quantum mechanics in shaping the macroscopic behaviour of large assemblies of interacting particles, which is foundational to fields such as condensed matter physics, computer simulations are now widely regarded as an indispensable tool. In this talk, the transformative insights gained from the use of computer simulations in limits in which existing analytical approaches are unreliable will be illustrated. The focus of this presentation will be on first-principle Monte Carlo simulations of condensed matter systems in thermodynamic equilibrium. It will be shown how not only can one achieve a quantitative description of such remarkable phenomena as superfluidity and Bose-Einstein Condensation, allowing for a direct comparison with experiment, but also, and perhaps even more significantly, how original fundamental physical microscopic knowledge is gained from simulations.

Keywords: Superfluidity, Bose-Einstein Condensation, Quantum Monte Carlo.

S3.I1 – Invited talk

Real-Space Kernel Polynomial Method for Electronic properties of quantum materials

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This year marks the centennial of quantum mechanics, yet the computation of electronic spectra and related observables in quantum systems remains both technically challenging and conceptually rich. While conventional approaches often rely on full diagonalization of the Hamiltonian, alternative strategies focus on direct evaluation of target physical quantities. In this talk, I will present a real-space implementation of the Kernel Polynomial Method (KPM) as an efficient and scalable tool for studying the electronic properties of quantum materials. This formulation bypasses diagonalization, enabling the treatment of systems with millions of degrees of freedom. I will illustrate the approach with recent results for monolayer and twisted

bilayer graphene at arbitrary twist angles, including density of states, DC/AC conductivities, and Green's functions. The discussion will highlight both methodological insights and physical interpretations, with an emphasis on the versatility of the real-space KPM framework for exploring complex quantum systems.

Keywords: Quantum materials, Electronic spectrum, Kernel Polynomial Method.

S3.I2 – Invited talk

Local structure and vortex phase diagram in Bi-Pb-Sr-Ca-Cu-O superconductor with additions of nanoparticles

Duc Hai Tran[1,*], An The Pham[1], Nguyen Hoang Nam[1], Tien Le[2]

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A close correlation between local structure variation and superconductivity of Bi-Pb-Sr-Ca-Cu-O (BPSCCO) superconductors was investigated. To improve the application of the BPSCCO superconductor, the artificial pinning centers played an important role. The non-magnetic and magnetic nanoparticles were separately added to the BPSCCO ceramics. Results show that values of critical current density (J_c) and upper critical field (B_{c2}) deduced using the Bean and the Werthamer–Helfand–Hohenberg model, respectively, were significantly enhanced, while the critical temperature (T_c) was well maintained about the liquid nitrogen point. To quantitatively explore the local structure variation, the Xray absorption near edge (XANES) and Extended Xray absorption fine structure (EXAFS) spectra were examined. Values of valence state, hole concentration, bond length and Debye Waller factor were found to vary, which might be used as the solid evidence to explain the variations of T_c, J_c and B_{c2}. The excess conductivity of all samples was analyzed based on the Aslamazov– Larkin and Lawrence–Doniach models. For each addition, the c-axis coherence length at T = 0 K ($\xi_c(0)$) and the interlayer coupling strength were optimized. The activation energy (U_0) calculated using the Arrhenius model was also increased, and the maximum value of U_0 was reached, which again supported the enhancements of J_c and B_{c2}. More interestingly, the small bundle field (B_{sb}), large bundle field (B_{lb}), irreversibility field (B_{irr}), and B_{c2} were combined for the vortex phase (B-T) diagram of the samples. The extensions of all pinning regimes were clearly observed for nanoparticle added BPSCCO samples, clearly revealing the improvements in the flux pinning properties in that sample. Effects of magnetic properties of nanoparticles on the formation of 0-dimensional (0D) and 3-dimensional (3D) pinning centers were also discussed.

S3.I3 – Invited talk

Magneto-Optical Responses in Topological Semimetals: From Weyl and Dirac to Nodal-Line Systems

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Topological semimetals, including Weyl, Dirac, and nodal-line systems, exhibit unconventional magneto-optical properties arising from their nontrivial band structures and Landau quantization under magnetic fields. Our review synthesizes recent theoretical advances on three representative cases. In Weyl semimetals, non-uniform magnetic fields lead to finite Landau level spectra and tunable magneto-optical responses controlled by external electric fields, carrier density, and temperature. In Dirac semimetals, strong electron–photon–phonon coupling governs magneto-optical absorption and linewidth broadening, with clear deviations from the conventional square root of B scaling and the emergence of symmetry breaking at high fields; analysis of spectral widths further connects to carrier mobility. In nodal-line semimetals, spin–orbit coupling and doping strongly modify Landau levels and generate anisotropic optical susceptibilities, where intraband and interband transitions show distinct spectral fingerprints. Taken together, these studies reveal a unifying picture: magneto-optical responses in topological semimetals are highly sensitive to external perturbations, many-body interactions, and underlying band topology, thereby offering versatile control mechanisms for next-generation infrared and terahertz optoelectronic applications.

Keywords: Topological semimetals, Magneto-optical response, Infrared and terahertz optoelectronics.

S3.O1

Novel Advancements in Integrating Artificial Intelligence and Theoretical Models for Predicting Material Properties

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In this study, we integrate machine learning/deep learning models into theoretical and simulation frameworks to predict and analyze optical, thermal, magnetic, and molecular dynamics properties in metallic glasses, oxides, polymers, phosphors, perovskites, and thermoelectric materials. Machine learning models are constructed to predict the melting temperatures, glass transition temperatures (T_g), emission peak positions, phase transition energy levels, bandgap, Curie temperatures, thermoelectric figure of merit (ZT), and other properties from their chemical compositions. Our approach, despite its simplicity, provides predictions with higher accuracy compared to prior research. This approach proves particularly beneficial for predicting properties of novel materials not yet synthesized. The predicted-T_g values from simulations and AI are integrated into the Elastically Cooperative Nonlinear Langevin Equation theory to determine the temperature dependence of structural relaxation time of amorphous materials. All our calculations show good agreement with experimental data and prior simulations without any adjustable parameters. Beyond 'forward prediction' (predicting material properties based on chemical composition), our developed models can be developed to perform 'inverse design' (suggesting chemical compositions to achieve desired material properties).

Keywords: machine learning; glass transition; inverse design; chemical composition.

S3.O2

TM-BaO monolayers (TM = Co, Fe, Mn): A promising platform for spintronic and electronic applications

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In this work, we systematically investigate the structural, electronic, magnetic, optical, and thermomechanical properties of transition-metal-adsorbed BaO monolayers (TM-BaO, TM = Co, Fe, Mn) using density functional theory (DFT) calculations combined with machine learning techniques. Structural stability and adsorption characteristics are explored within the framework of Quantum Espresso, while electronic band structures and density of states reveal significant modifications induced by the adsorbed transition metals. Our results indicate that Co, Fe, and Mn adsorption can induce spin polarization, making TM-BaO monolayers promising candidates for spintronic applications. Optical analyses show enhanced absorption, suggesting potential in optoelectronic devices. Furthermore, the thermomechanical parameters, predicted via the crystal graph convolutional neural network (CGCNN), provide insight into the mechanical robustness and thermal stability of these systems. This study highlights TM-BaO monolayers as versatile two-dimensional materials with great potential for future electronic and spintronic technologies.

Keywords: BaO monolayers; Transition metal; Adsorption; DFT.

Room 2 (Session 3)

S3.O3

First-order phase transition and magneto-caloric effect in the disordered Blume-Capel models

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Magnetic phase transition was previously observed in the Blume-Capel models for different lattice types. Whether magnetic phase transition is the first or the second type following the Landau theory of phase transition really depends on intrinsic factors of models such as spin states, magnetic anisotropy, magnetic interactions etc., and external factors like magnetic fields, strain etc.. Since magnetic phase transition type directly involves magneto-caloric properties of magnetic materials, understanding the microscopic mechanism of those effects is essential for the application. Using analytical calculations and Monte Carlo simulations, we systematically examined magnetic phase transitions in disordered Blume-Capel models with random anisotropy for square lattices with and without external magnetic fields. We also connect our theoretical calculations with experimental observations to give physical insight for applications.

Keywords: magnetic phase transitions, Blume-Capel spin-1 model, Monte Carlo method, effective field theory, magneto-caloric effects.

S3.O4

Theory of light absorption and scattering by nanoparticles in an absorbing medium - modeling with experimental validation

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We develop a model of thin-film composites with nanoparticles, where Mie theory provides the absorption and scattering cross-sections of individual particles, and Kubelka–Munk theory (with Saunderson correction) serves as transfer equations to describe light propagation in the film. This framework enables calculation of transmittance and reflectance spectra from the optical constants of the nanoparticles and host medium, and in reverse, extraction of absorption (K) and scattering (S) coefficients from measured spectra. Theoretical coefficients (Ktheo, Stheo) are obtained from Mie cross-sections in an absorbing medium. Excellent agreement between experiment and theory for TiO2 nanoparticles in PMMA thin films validates the model. By bridging the mesoscopic optical scale of Mie scattering with microscopic scales, the approach offers a predictive tool for designing optical properties of nanoparticle-based thin-film composites [1].

[1] Thi Hong Pham, Kien Trung Nguyen, Viet Tuyen Nguyen, Hung Q. Nguyen, H. T. M. Nghiem, "Absorption and scattering properties of nanoparticles in an absorbing medium: modeling with experimental validation", accepted to be published in Journal of Quantitative Spectroscopy and Radiative Transfer.

S3.O5

Resonance Energy Transfer Between Two Atoms Near a Finite-length dielectric cylindrical waveguide

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Within the frame of macroscopic QED in linear, causal media, we derive a formula for computing the resonance energy transfer rate between two two-level atoms---one in the excited state (donor) and the other in the ground state (acceptor)---near a finite-length dielectric cylinder, which can be regarded as a finite optical fiber. By employing a truncated Born expansion of the homogeneous Green's tensor and using numerical solutions, we identify a range of parameters for which the finite cylinder can be well approximated by an infinite one, whose Green's tensor is known in closed form. Beyond the validity of the infinite-cylinder approximation, we find that the effect of the fiber tip on the resonance energy transfer rate becomes significant, particularly when the donor–acceptor pair is located above the top edge of the fiber.

Keywords: resonance energy transfer; cylindrical system; finite optical fiber.

S3.O6

High-Chern-number topological phases in stacked atomic layers: influence of layer sliding and interlayer coupling

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This study explores the feasibility of realizing large Chern number topological phases through the stacking of atomic-thickness material layers. Specifically, we focus on a model featuring two weakly coupled graphene layers, examining how relative displacement and inter-layer coupling influence the formation of such phases. Our investigation reveals rich diagrams illustrating nontrivial topological phases, with two bilayer configurations displaying Chern numbers of 3 and -3. Furthermore, electronic band structure calculations for corresponding ribbon configurations unveil the presence of three pairs of chiral modes along the ribbon edges. We attribute the emergence of these large Chern number phases to specific features of the energy surfaces dictated by lattice symmetries arising from the interaction between the two material layers.

Keywords: Chern insulator; honeycomb lattice; time-reversal symmetry; topological materials.

S3.O7

Quantum sensing with NV centers: nanoscale magnetometry

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Quantum sensing refers to the use of quantum systems as probes to detect physical quantities such as magnetic fields, electric fields, or temperature with extraordinary sensitivity. Unlike conventional sensors, quantum sensors exploit coherence and spin properties of qubits, enabling precision measurements at the nanoscale [1].

A prominent example of such a platform is the nitrogen-vacancy (NV) center in diamond, a point defect consisting of a nitrogen atom adjacent to a lattice vacancy. NV centers possess spin-triplet ground states that can be optically initialized and read out, making them robust quantum sensors operable even at room temperature [2].

In this talk, I will introduce NV-based magnetometry, focusing on two representative approaches. First, confocal scanning magnetometry, where individual NV centers are addressed optically in bulk diamond to map magnetic fields near the surface. Second, tip-based scanning magnetometry, where NV centers are fabricated at the apex of atomic force microscopy tips, allowing nanoscale spatial resolution while scanning across a sample surface.

As illustrative examples, I will briefly show how these techniques have been applied to visualize nanoscale magnetic textures in condensed matter systems, including skyrmion lattices, magnetic vortices, and domain walls. Through these demonstrations, the broader potential of NV-based quantum sensing, as a versatile tool for both fundamental quantum science and materials research, will be highlighted.

[1] Degen, C. L., Reinhard, F., & Cappellaro, P. (2017). Quantum sensing. Reviews of Modern Physics, 89(3), 035002. https://doi.org/10.1103/RevModPhys.89.035002

[2] Rondin, S., Tetienne, J.-P., Hingant, T., Roch, J.-F., Maletinsky, P., & Jacques, V. (2014).

[3] Magnetometry with nitrogen-vacancy defects in diamond. Reports on Progress in Physics, 77(5), 056503. https://doi.org/10.1088/0034-4885/77/5/056503

S3.O8

Computational Insights into Defect States in Wide Band Gap Semiconductors

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Defects in wide band gap semiconductors are emerging as a versatile platform for quantum technologies and defect-based optoelectronics. In this work, we present first-principles simulations of native and impurity-related defects in cubic boron nitride, focusing on their roles in photoluminescence and potential as solid-state quantum bits. By combining semi-local and hybrid density functional theory, we identify the defect origins of prominent emission peaks observed experimentally and evaluate key qubit parameters such as zero-phonon lines, zero-field splitting, and hyperfine interactions. Our results reveal that vacancy–impurity complexes, including boron vacancies coupled with oxygen, carbon, or silicon dopants, exhibit stable spin-triplet ground states and optical transitions suitable for quantum sensing and telecommunication-wavelength quantum networks. These findings provide insight into defect engineering strategies for next-generation quantum devices based on wide band gap materials.

Keywords: Solid state qubits, density functional theory, boron nitride.

S3.O9

Bottom-up synthesis of 2D materials for future electronics

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Two-dimensional (2D) semiconductors have been intensively studied because of their potential in overcoming the limitation of current Si semiconductor technology. The semiconductor industry necessitates the synthesis of high-quality 2D materials on a large scale for various applications. Engineering the physical properties of these 2D materials and seamlessly integrating them into electronic devices are equally critical objectives. To accomplish these goals, a bottom-up synthesis approach, such as chemical vapor deposition (CVD), is essential. CVD, being a versatile bottom-up synthesis technique, offers precise control over the growth process and allows for the fine-tuning of material properties to meet specific requirements. In this talk, I will introduce my research history about the synthesis and modification of 2D materials using chemical vapor deposition, aiming to promote realization of 2D material applications.

I. Various 2D semiconductors can be synthesized at a wafer-scale with reasonable uniformity and crystallographic quality. The key lies in engineering the absorption energy between substrate and precursor.

II. Reduction of point defects in 2D semiconductor transition metal dichalcogenides using high-pressure chemical vapor deposition.

III. Studying the growth mechanism and controlled synthesis of two-dimensional materials using in-situ diagnostics as feedback for artificial intelligent aided autonomous bottom-up synthesis.

Program of Session S4
Quantum computing

(other activities are mentioned in the conference's main program)

Date: October 13-15, 2025
Venue: Phenikaa University, Duong Noi, Hanoi
Organizers: Phenikaa University, NYCU Institute of Physics and Vietnam Physical Society

No.	Time	Title and authors	Presenter
October 13, 2025 Afternoon			
13:30 – 15:10		**Oral session** chaired by **Hung Nguyen;** location: Room 3(202 A8)	
S4.K1	13:30 – 13:55	Quantum many-body problems in the age of quantum computing	**Assoc. Prof. Tran Nguyen Lan** University of Science, Ho Chi Minh City
S4.K2	13:55 – 14:20	Parameter tracking for continuous quantum measurement via sequential Monte-Carlo estimation	**Assoc. Prof. Areeya Chantasri** Mahidol University, Bangkok, Thailand
S4.I1	14:20 – 14:45	Bridging Dimensions: Quantum Computing enhanced High-Dimensional Hyperspectral Data for Precision Agriculture	**Assoc. Prof. Pham Tan Thi** Ho Chi Minh City University of Tehcnology
S4.I2	14:45 – 15:10	Critical properties of conformal field theory at the boundary of the AdS/CFT correspondence and its relations in quantum information	**Prof. Nguyen The Toan** VNU University of Science
15:25 – 16:00		**Poster session 1**	
October 13, 2025 Afternoon			
13:30 – 15:10		**Oral session** chaired by **Phan Duc Anh;** location: Room 3 (202 A8)	

No.	Time	Title and authors	Presenter
S4.I3	13:30 – 13:55	Simulation of Neutrino Oscillations on a Quantum Compute	**Dr. Nguyen Van Duy** Phenikaa University
S4.I4	13:55 – 14:20	Bridging Education and Industry Through OpenVQA: A Global Platform for Variational Quantum Algorithms	**Dr. Mohammad Haidar** OpenVQA hub, Paris, France
S4.I5	14:20 – 14:45	Superconducting sensor network for dark matter detection	**Assistant Prof. Le Bin Ho** Tohoku University
S4.I6	14:45 – 15:10	Towards Quantum Utility for Haplotype Inference	**Dr. Nghiem Nguyen Viet Dung** VNU University of Engineering and Technology
15:25 – 16:00		**Poster session 2**	
16:00 – 17:00		**Oral session** chaired by **Hung Nguyen;** location: Room 3 (202 A8)	
S4.O1	16:00 – 16:20	Beyond Classical Probability: Quantum Approaches to Environmental Awareness Research	**Dr. Le Tan Phuc** Duy Tan University
S4.O2	16:20 – 16:45	Hardy's nonlocality for entangled pairs in a four-particle system	**Mr. Doan Manh Duc** VNU University of Science
S4.O3	16:45 – 17:10	Analysis of Man-in-the-Middle Attacks (MITM) on B92 Quantum Secret Sharing (QSS)	**Mr. Marc Andrie M. Bermundo** University of the Philippines Baguio

Room 3 (Session 4)

S4.K1 – Keynote talk

Quantum many-body problems in the age of quantum computing

Tran Nguyen Lan[1]

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For quantum many-body problems, it is crucial to have methods that strike a balance between accuracy and computational costs. Quantum computing is an emerging technology that is expected to tackle issues unsolvable by classical computing. Unfortunately, quantum computing is not yet fully practical due to the current limitations of quantum hardware, and the current state of quantum computing is referred to as the noisy intermediate-scale quantum (NISQ) era. Thus, quantum-classical hybrid approaches have been actively developed to bring quantum computing into realistic applications. In this talk, I will first provide an overview on the current development of quantum simulation. I will then discuss our current work on the development of novel methods, including correlated-mean-field theory and quantum downfolding framework, to facilitate quantum computing in solving quantum many-body problems.

Keywords: correlated mean-field; quantum downfolding; quantum computing solvers, quantum-classical hybrid

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S4.K2 – Keynote talk

Parameter tracking for continuous quantum measurement via sequential Monte-Carlo estimation

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Time evolutions of an open quantum system are of crucial interest in the field of quantum control. Such evolutions are governed by the system's parameters, dynamical equations, and measurement outcomes over time. For a system with unknown parameters, we can utilise records of continuous weak measurements to extract information about the parameters. Our work demonstrates a method of calibrating Hamiltonian parameters of transmon-qubit experiments using the Sequential Monte Carlo method. We start by generating random particles on the parameter space and allow them to evolve through time according to the Stochastic Master Equation. Given the measurement results, we can construct the probability weights of such random particles and then estimate the parameters using the Bayesian estimator. Our result agrees with the empirical values and enables us to gain insight into the stability of the parameters.

Keywords: Continuous quantum measurement; Parameter Estimation; Sequential Monte-Carlo.

S4.I1 – Invited talk

Bridging Dimensions: Quantum Computing enhanced High-Dimensional Hyperspectral Data for Precision Agriculture

Le Nhat Tan, Nguyen Le Dung, Dang Nguyen Chau, Phan Huynh Lam,

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Hyperspectral remote sensing has emerged as a transformative technology for precision agriculture, offering unprecedented detail on crop health, soil properties, and environmental conditions. By capturing hundreds of contiguous spectral bands, hyperspectral imagery enables fine-grained discrimination of vegetation stress, nutrient content, and disease outbreaks. However, the richness of this data comes at the cost of extreme dimensionality and computational complexity. Despite their success, classical machine learning techniques face challenges in processing high-dimensional spectral signatures, particularly under limited training data or time-critical conditions. These challenges present an ideal proving ground for Quantum Computing and Quantum Machine Learning (QML). Quantum algorithms provide natural advantages in processing high-dimensional vectors, performing feature selection, and accelerating optimization tasks. Early studies have demonstrated that quantum-enhanced classifiers and hybrid quantum-classical models can achieve competitive or superior accuracy on hyperspectral datasets with fewer training samples, making them highly relevant for agriculture where labeled data is limited. Such advances pave the way for upcoming agricultural breakthroughs, supporting

accurate crop type mapping, yield forecasting, and early identification of threats such as pests, drought, and nutrient shortages

This talk will highlight the convergence of hyperspectral remote sensing and quantum computing for precision agriculture. We will explore the state of the art in QML applications, discuss recent case studies using quantum support vector machines, variational circuits, and quantum annealers on agricultural hyperspectral imagery, and outline future directions. By bridging these two frontier technologies, we move closer to scalable, efficient, and timely analytics that can empower farmers, policymakers, and researchers to optimize agricultural productivity and sustainability in an era of global food security challenges.

Keywords: Quantum Machine Learning; Quantum-enhanced algorithm, Hyperspectral Image; Remote Sensing

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S4.I2 – Invited talk

Critical properties of conformal field theory at the boundary of the AdS/CFT correspondence and its relations in quantum information

Luu Duc Manh, Toan T Nguyen*

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The AdS/CFT correspondence is one of the most successful realizations of the holographic principle. More importantly, it provides an intriguing method (although limited) to investigate strongly coupled quantum field theory by using the dual weakly coupled quantum gravity, which is more mathematically tractable. As a result, it has been employed to investigate many strongly correlated condensed matter systems. This is especially useful in working with quantum information since this correspondence provides a geometric description of many abstract concepts in quantum information such as entanglement, quantum information entropy and complexity, quantum error correction. Vice versa, one can also build gravity from quantum information theory. In this work, various critical behaviors of the Conformal Field Theory living at the boundary of an AdS gravitational systems is investigated. The results show a conjectured quantum phase transition as the temperature approaches zero where all the excited states of the CFT are activated beyond a finite chemical potential value. We discussed their potential implications to the novel states in condensed matter systems, as well as through the lenses of quantum information.

S4.I3 – Invited talk

Simulation of Neutrino Oscillations on a Quantum Computer

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In this work, we build a quantum simulation framework for neutrino oscillations in three cases: vacuum, matter, and collective oscillations. In the two-flavor case, we use qubits to encode each neutrino, which represents the SU(2) flavor symmetry. In the three-flavor case, we use qutrits, quantum systems with three levels, to represent the SU(3) flavor symmetry. The time evolution in these cases is given by the corresponding Hamiltonians and is approximated with the Trotter–Suzuki decomposition. This method lets us design quantum circuits from qubit or qutrit gates that carry out the decomposed unitary operators.

Keywords: Neutrino oscillations, collective oscillations, Trotter–Suzuki decomposition, qubit and qutrit encoding.

S4.I4 – Invited talk

Bridging Education and Industry Through OpenVQA: A Global Platform for Variational Quantum Algorithms

Mohammad Haidar

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Quantum computing is **booming worldwide**, rapidly evolving from a theoretical concept to a transformative technology that promises to reshape industries such as pharmaceuticals, materials design, energy, logistics, and finance. By exploiting quantum mechanical principles such as superposition and entanglement, quantum algorithms provide new methods to tackle problems that are intractable for classical computing. In the current noisy intermediate-scale quantum (NISQ) era, **variational quantum algorithms (VQAs)** have emerged as one of the most promising approaches. These hybrid quantum–classical methods are particularly well-suited for molecular simulations, combinatorial optimization, and quantum machine learning. Recent advances in VQAs have demonstrated their relevance across multiple industrial domains, making them a central tool in extracting value from near-term devices.

The unique strength of VQAs lies in their ability to **scale with NISQ hardware while maintaining conceptual and implementational simplicity**. This positions them as a natural bridge between theoretical research and industrial applications, ensuring that progress in quantum algorithm development can be translated into tangible impact for companies and society.

In this context, **Dr. Mohammad Haidar**, co-founder and creator of the **OpenVQA initiative**, introduces an open-source platform dedicated to advancing VQA research and deployment. **OpenVQA unites over 40 engineers, PhD students, and postdoctoral researchers worldwide**, supported by **leading international professors and domain experts** in chemistry, materials science, digital twins, and AI. This diverse community collaborates to develop and benchmark multiple versions of VQAs, targeting applications in drug discovery, optimization, and machine learning.

OpenVQA directly addresses two key needs in the quantum ecosystem:

1. **Educational empowerment** – providing simplified modules, tutorials, and hands-on training resources to make quantum computing accessible to students, engineers, and early-career researchers.
2. **Industrial scalability** – offering companies and research groups the ability to prototype, evaluate, and deploy VQA-based solutions for real-world challenges.

By combining algorithmic innovation with an open-source, community-driven framework, OpenVQA fosters a **sustainable global ecosystem** for quantum computing. It enhances collaboration between academia and industry, accelerates knowledge transfer, and strengthens the role of education in building the next generation of quantum talent.

At this conference, **Dr. Haidar will present the latest advances in VQAs, their industrial applications, and how OpenVQA is driving education, innovation, and the wider adoption of quantum technologies in this booming field.**

Keywords: Quantum Computing; Variational Quantum Algorithms; Quantum Education; Industrial Applications

S4.I5 – Invited talk

Superconducting sensor network for dark matter detection

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Dark matter, the invisible component that holds galaxies together, remains one of the deepest mysteries in physics. Detecting it requires extraordinary sensitivity, well beyond the reach of conventional instruments. In this talk, I present a new approach that leverages superconducting qubits as highly sensitive quantum sensors. By linking these qubits into optimized network structures, such as ring, line, star, and fully connected graphs, we show that weak dark matter signals can be amplified and detected more reliably than with individual sensors. Our method combines variational quantum metrology, which adaptively trains sensor configurations much like a machine-learning model, with Bayesian estimation techniques to filter out noise and sharpen the signal. Numerical results using four- and nine-qubit systems demonstrate that optimized sensor networks consistently outperform traditional strategies, even in the presence of realistic noise, highlighting their feasibility on today's quantum devices. Beyond dark matter, this work points toward broader applications of quantum sensor networks in quantum radar, gravitational wave detection, timekeeping, and medical imaging.

Keywords: Quantum sensor network; Superconducting qubit; Variational quantum metrology; Dark matter detection.

S4.I6 – Invited talk

Towards Quantum Utility for Haplotype Inference

Nghiem Nguyen Viet Dung[*]

The quest for quantum advantage in real-world applications remains ongoing. Among available approaches, quantum annealing stands out as a promising framework for tackling large-scale optimization problems. In this talk, we focus on the NP-hard Haplotype Inference by Pure Parsimony (HIPP) problem, which plays a critical role in biomedical research. We present PrefixHI, a new quantum annealing method based on a compact prefix-sum encoding that simplifies the formulation and reduces auxiliary variables. This innovation achieves a 50% reduction in time-to-

solution compared to the current state-of-the-art under identical conditions. Furthermore, we show how fine-tuning annealer configurations leads to additional efficiency gains. Our experimental results demonstrate that PrefixHI performs competitively with classical simulated annealing while opening a path toward practical bioinformatics applications on quantum hardware. Beyond haplotype inference, this work highlights opportunities for applying quantum annealing to broader challenges such as genome assembly, gene regulatory network inference, and drug discovery.

S4.O1

Beyond Classical Probability: Quantum Approaches to Environmental Awareness Research

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Quantitative research on environmental awareness has traditionally relied on classical probability theory, particularly within psychology and sociology. While effective in many contexts, classical models fail to account for a range of well-documented cognitive phenomena, including conjunction and disjunction fallacies, order effects, and classification interferences. These limitations suggest that human judgment and decision-making often deviate from the assumptions of classical probability. Quantum probability, derived from the mathematical foundations of quantum mechanics, offers a powerful alternative framework. By representing cognitive states as vectors in Hilbert space, quantum models capture features such as superposition, incompatibility, entanglement, and contextuality - properties that more accurately reflect how individuals reason under uncertainty. Recent developments demonstrate that tools such as density matrices and state multipole analysis can address long-standing challenges in survey-based research, including the interpretation of ordinal Likert scale data and the measurement of ambivalence. Applying these methods to the study of environmental awareness provides a novel opportunity to reveal subtle structures of cognition that traditional statistical approaches cannot detect. This talk explores the potential of quantum approaches to advance our understanding of environmental attitudes and decision-making, highlighting how they may inform more effective strategies for addressing urgent ecological challenges.

Keywords: Environmental awareness, classical probability, quantum probability.

S4.O2

Hardy's nonlocality for entangled pairs in a four-particle system

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Nonlocality can be studied through different approaches, such as Bell's inequalities, and it can be found in numerous quantum states, such as GHZ states or graph states. Hardy's paradox, or Hardy-type nonlocality, is a way to investigate nonlocality for entangled states of particles without using inequalities. Previous studies have primarily focused on the configuration where all particles are entangled with each other. However, it is necessary to investigate this type of nonlocality in different configurations of entanglement. In our work, the system under investigation consists of four particles arranged in a cyclic entanglement configuration, where each particle forms entangled pairs with its two neighbors, while these two neighbors remain unentangled with each other. By using quantum circuits, particle correlations are observed, revealing that the measurement result of a particle only influences the result of its paired partners. Additionally, the success probability, which leads to the contradiction in Hardy's original work, is found to be approximately 9%. By performing an angle sweep in $R_y(\theta)$ rotation gates, the maximum value of this probability is found close to 9.09% with the corresponding $\theta \approx 0.439\pi$. The simulation results are sufficiently consistent with theoretical predictions. The quantum circuits are executed experimentally on the IBM Brisbane device as well. Experimental results show considerable deviations from theory due to the low fidelity of entangled gates. Notably, the state $|0000\rangle$ exhibits a discrepancy with the simulation of up to 30%.

Keywords: Hardy-type nonlocality; quantum circuit simulation; cyclic entanglement ; the success probability.

S4.O3

Eavesdropping on Entropy: Analysis of Man-in-the-Middle Attacks (MITM) on B92 Quantum Secret Sharing (QSS)

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Quantum secret sharing (QSS) is a foundational tool for secure multiparty communication, yet simplified protocols like B92 warrant closer scrutiny under active attack scenarios. This work presents a simulation-based analysis of man-in-the-middle (MITM) attacks on the B92 QSS protocol, focusing on how interception impacts fidelity, entropy, and bit-level agreement between participants. The simulation examines state fidelity, von Neumann entropy, and mistake rates for Alice, Bob, and an intercepting Eve. Bloch sphere projections and entropy maps are used to visualize how qubit states evolve under attack. Key indicators, such as Eve's basis guess rate and Hamming distances, measure the adversary's amount of information leakage and disruption. When MITM interference is introduced, the results demonstrate a substantial decrease in transmission integrity, as seen by increasing entropy and reduced fidelity across the shared key. The analysis also highlights a trade-off between Eve's measurement success and the noise injected into the system. This study establishes a replicable approach for evaluating QSS protocol resilience under realistic threat models. While B92's design remains straightforward, its vulnerability to active interception calls for prudence in practical deployment without higher authentication levels.

Keywords: Quantum Secret Sharing (QSS); Man-in-the-Middle (MITM) Attack; B92 Protocol.

Program of Session S5
Nuclear Science and Technology

(other activities are mentioned in the conference's main program)

Date: October 13-15, 2025
Venue: Phenikaa University, Duong Noi, Hanoi
Organizers: Phenikaa University, NYCU Institute of Physics, and Vietnam Physical Society

No.	Time	Title	Presenter
October 13, 2025 Morning			
10:45 – 11:45		**Oral session** chaired by **Nguyen Ngoc Anh;** location: Room 4 (Meeting Room 3 - 2nd Floor A10)	
S5.K1	10:45 – 11:15	**To be updated**	**Prof. Dao Tien Khoa** Vietnam Atomic Energy Institute
S5.K2	11:15 – 11:45	Present Status of a Molten Salt Reactor Nuclear Power Plant Development in Indonesia	**Dr. Peng Hong Liem** Nippon Advanced Information Services Ltd.
October 13, 2025 Afternoon			
13:30 – 15:10		**Oral session** chaired by **Le Ngoc Thiem, Nguyen Quang Hung;** location: Room 4 (Meeting Room 3 - 2nd Floor A10)	
S5.I1	13:30 – 13:55	Anomaly in the production of ^{60}Fe nucleus in massive stars: the role of nuclear physics inputs	**Prof. Nguyen Quang Hung** Duy Tan University
S5.I2	13:55 – 14:20	Nuclear reaction study with low-energy proton beams from the 5SDH2-pelletron accelerator at VNU-University of Science in Hanoi	**Dr. Le Xuan Chung** Vietnam Atomic Energy Institute
S5.O1	14:20 – 14:45	Fast neutron spectra: Unfolding and direct measurement with scintillation crystals	**Dr. Nguyen Duy Quang** Vietnam Atomic Energy Institute
S5.O2	14:45 – 15:10	Improving the ATWS analysis using data assimilation and machine learning	**Dr. Nguyen Huu Tiep** Vietnam Atomic Energy Institute

No.	Time	Title	Presenter
15:25 – 16:00		**Poster session 1**	
16:00 – 17:25		**Oral session** chaired by **Nguyen Huu Tiep, Le Xuan Chung;** location: Room 4 (Meeting Room 3 - 2nd Floor A10)	
S5.I3	16:00 – 16:25	Ionizing Radiation Metrology: Current Status and Future Development toward the National Strategy on Nuclear Application Promotion	**Dr. Le Ngoc Thiem** Vietnam Atomic Energy Institute
S5.O3	16:25 – 16:45	Unfolding method for overlapping peaks induced by light charged particles from p+^{6}Li reaction at low energies	**Ms. Do Thi Khanh Linh** Vietnam Atomic Energy Institute
S5.O4	16:45 – 17:05	Microscopic descriptions of the elastic proton scattering on light unstable nuclei based on the Brueckner-Hartree-Fock approach	**Dr. Do Cong Cuong** Vietnam Atomic Energy Institute
S5.O5	17:05 – 17:25	Development of a Tunable Monochromatic X-ray Source for Pixelated Semiconductor Detector Calibration	**Dr. Truong Hoai Bao Phi** Vietnam Atomic Energy Institute
October 14, 2025 Afternoon			
15:25 – 16:00		**Poster session 2**	

Room 4 (Session 5)

S5.K1 – Keynote talk

Neutron and Physics of Neutron Star

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Neutron star (NS) is a unique compact stellar object where four fundamental interactions were revealed from the astronomical observations, which is now widely studied by the astrophysics, nuclear physics, and high-energy physics communities. The present talk gives a brief story on the prediction and discovery of neutron and NS, followed by an elementary introduction to NS for nonspecialists and/or graduate students who are willing to learn about physics of NS, and how macroscopic stellar properties of NS are described within Einstein's general relativity (GR). The main physics input for the GR field equations of NS is the equation of state (EOS) of high-density nuclear matter. The interested readers can then learn about how the EOS of the β-equilibrated baryon and leptonic matter of NS is derived from the mean-field calculation, using a realistic in-medium baryon-baryon interaction. The obtained EOS of NS matter is further used as input for solving the GR field equations to determine the total mass, radius, and tidal deformability of NS, and the results are compared with the empirical constraints implied by the gravitational wave signals detected from the NS merger GW170817.

S5.K2 – Keynote talk

Present Status of a Molten Salt Reactor Nuclear Power Plant Development in Indonesia

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This paper reports on the present status of the plan to introduce the thorium molten salt reactor TMSR-500 (barge-type, electrical output 250,000 kWe × 2 units) to Indonesia by ThorCon, a US nuclear development technology developer, which began in 2015. It established a representative office in Jakarta in 2018 and established PT ThorCon Power Indonesia (PT TPI) as a foreign direct investment

company in 2021. PT TPI is headquartered in Jakarta and has also established a branch office (Pangkal Pinang City, the provincial capital) in Bangka Belitung province (off the eastern coast of Sumatra), which is a candidate site for the TMSR-500 demonstration reactor. The candidate site for this power plant is Kelasa Island, located between Bangka Island and Belitung Island. In 2019, ThorCon conducted a study on the development and introduction of the TMSR-500 in Indonesia in cooperation with a research institute under the Ministry of Energy and Mineral Resources, concluding that it is worth considering the construction of the TMSR-500 to meet Indonesia's future electricity demand. The study results showed that the construction of the TMSR-500 is economically feasible and can compete with coal-fired power plants at a sales price of US$0.069 per kWh, which is lower than the country's electricity supply cost. In addition, a safety evaluation showed that the TMSR-500 is highly safe. ThorCon's molten salt reactor plants are available in two types: land-based and barge-based, and the one planned for introduction in Indonesia is the latter. The TMSR-500 to be introduced will be built in the form of a large barge at a Korean shipyard, transported close to the coast and secured to the seabed at a depth of about 10 m, and then connected to the power grid. It is expected that this method of introduction will enable the introduction of quick and inexpensive power plants at sites/remote areas with minimum infrastructures throughout Indonesia. Domestic as well as international deployment activities are being conducted by the ThorCon and its subsidiary company PT TPI in Indonesia. TMSR-500 is expected to start its commercial operation around 2032-2035, after completing the non-fission tests and demo plant tests. TMSR-500 is a thermal-spectrum (graphite moderated) MSR, fueled with low enriched NaF-BeF_2-UF_4-ZrF_4 or thorium-based NaF-BeF_2-ThF_4-UF_4-ZrF_4. The design is based on the Oak Ridge National Laboratory’s Molten Salt Reactor Experiment, i.e. reducing the needs of lengthy and costly further research and development efforts, hence, shorten the period for deployment. The first application of permit for starting a site evaluation was rejected and now was being revised. This reactor is considered a next-generation reactor, so there is little experience or track record both domestically and internationally. In addition, Indonesia is on the Pacific Ring of Fire, and is prone to natural disasters such as earthquakes, eruptions, and tsunamis. International collaboration and assistance including Japan, which has a wealth of experience and track record in developing nuclear power plants and responding to accidents, is expected to enhance the feasibility to realize the introduction plan.

Keywords: Molten Salt Reactor; TMSR-500; barge-type; introduction plan.

S5.I1 – Invited talk

Anomaly in the production of ^{60}Fe nucleus in massive stars: the role of nuclear physics inputs

Samapti Lakshan[1], Le Tan Phuc[2,3], Deepak Pandit[4,5], Srijit Bhattacharya[6], Balaram Dey[1], Nguyen Ngoc Anh[7], and Nguyen Quang Hung[2,3,*]

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A number of experiments have detected the presence of two long-lived ^{26}Al and ^{60}Fe radioisotopes and their ratio in both interstellar environments and terrestrial archives [1,2]. Those experimental detections provide fundamental probes for the nucleosynthesis in stars. In particular, a recent experiment, based on the gamma-decay spectroscopy of ^{60}Fe produced via the beta-decay of ^{60}Mn, has reported the enhanced production of ^{60}Fe in massive stars, which is almost 2 times higher than previous studies [3]. Such an enhanced production strongly impacts the ^{60}Fe/^{60}Al ratio, a primary source of uncertainties between gamma-ray telescope observations and supernova models. In this work, we revisit the ^{60}Fe production problem by analyzing the influence of nuclear physics uncertainties, typically the nuclear level density (NLD) and gamma-rays strength function (gSF), on both the neutron-captured and Maxwellian averaged cross sections of (n,gamma)^{60}Fe reaction. We show that both the partial (angular-momentum dependent) NLDs and low-energy gSF, which have not been measured, are the main sources that affect the ^{60}Fe production.

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[1] W. A. Mahoney et al., Astrophys. J. 262, 742 (1982).
[2] W. R. Binns et al., Science 352, 677 (2016).
[3] A. Spyrou et al., Nat. Comm. 15, 9608 (2024).

Keywords: Nucleon synthesis; neutron-capture cross section; nuclear level density; gamma-rays strengh function.

S5.I2 – Invited talk

Nuclear reaction study with low-energy proton beams from the 5SDH2-pelletron accelerator at VNU-University of Science in Hanoi

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Low-energy proton induced reactions plays an important role not only in nuclear physics, nuclear astrophysics but also in application. For the first purpose, we present and summarize our recent results on nuclear reaction study with experiments induced by proton beams bombarding on ^{6}Li, ^{10,11}B, ^{12}C and ^{197}Au targets. These experiments were conducted at the 5SDH2-pelletron at VNU-University of Science in Hanoi (HUS). The main focuses are (p, p) and (p, α) reation channels. Afterwards, we will discuss further prospective studies utilizing proton and alpha beams from this accelerator.

Keywords: Pelletron, p+^{6}Li, p+^{10,11}B, p+^{12}C, p+^{197}Au

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S5.I3 – Invited talk

Ionizing Radiation Metrology: Current Status and Future Development toward the National Strategy on Nuclear Application Promotion

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Ionizing radiations such as alphas, betas, photons, and neutrons are commonly encountered in a wide range of applications in daily life.. To ensure precise measurements of radiations, the reference radiation fields have been established at several research institutes. Those reference fields of radiations (photons and neutrons) have been contributing vital roles in calibrations of radiation measuring devices, thereby ensuring the proper operations in radiation measurements and safety assessment. In recent years, Vietnam's national strategy has strongly promoted the application of radiation technologies across multiple sectors, including the national center for nuclear science and technology, the planned Ninh Thuan 1 and Ninh Thuan 2 nuclear power plants, and the development of Small Modular Reactors. With these facilities expected to become operational in the future, potential radiation hazards are anticipated to increase accordingly. As a result, the demand for enhanced national capabilities in radiation metrology, as well as the development of advanced radiation facilities, is becoming increasingly urgent. This paper presents the current status of ionizing radiation metrology in Vietnam and outlines future directions for development in alignment with the national strategy to promote radiation and nuclear applications.

Keywords: Radiometric, science, technology

S5.O1

Fast Neutron Spectra: Unfolding and Direct Measurement with Scintillation Crystals

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Accurate analysis of fast neutron spectra is critical for a wide range of applications such as nuclear security, radiation protection, astrophysics, and underground physics. This report presents two different potential approaches for analyzing fast neutron spectrum through unfolding and direct spectroscopy, using advanced scintillation crystals of trans-stilbene and $LaCl_3$, respectively. Fast neutrons from Cf-252 and AmBe sources were measured by scattering reactions $^{1}H(n,n)^{1}H$ in the trans-stilbene crystal. In this process, an incident neutron collides with a proton, transferring part or all of its energy. The resulting recoil proton is then detected and discriminated from the gamma background. Because the recoil proton energy depends on the scattering angle, an unfolding algorithm was applied to reconstruct the true neutron spectrum from the measured recoil proton spectrum. The unfolding was performed using the iterative Bayesian method without any constraints, smoothness, or assumption of prior knowledge of true spectra. In contrast, the $LaCl_3$ crystal was characterized for fast neutron spectroscopy via detecting protons from the $^{35}Cl(n,p)^{35}S$ capture reactions. This study presents the fast neutron spectrum of Cf-252 measured with a $LaCl_3$ crystal after investigating its proton response function. These results demonstrate the potential of $LaCl_3$ as a versatile scintillator for fast-neutron measurements, complementing the well-established capabilities of trans-stilbene.
Keywords: Neutron Spectrum; Stilbene; $LaCl_3$; Scintillation Crystal;

S5.O2

Improving the ATWS analysis using data assimilation and machine learning

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Anticipated Transients Without Scram (ATWS) pose significant safety risks in nuclear reactors due to the potential for core damage and the release of radioactive isotopes during operational transients when shutdown systems fail. This study evaluates ATWS mitigation by analyzing thermal hydraulic responses using the L9-3 experiment, conducted at the Loss of Fluid Test (LOFT) facility, as a benchmark. In this analysis, we applied a data assimilation technique to enhance the predictive capability of the MARS-KS code, enabling better agreement between simulation results and L9-3 experimental data. The results obtained from data assimilation outperform the nominal prediction by approximately 55% in the overall evaluation.

Additionally, by employing a machine learning technique, key physical models contributing to uncertainty and the effects of parameter variations on thermal hydraulic behavior in the ATWS analysis were examined.

Keywords: Data assimilation, ATWS, uncertainty quantification, LOFT, L9-3 test

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S5.O3

Unfolding method for overlapping peaks induced by light charged particles from p+^{6}Li reaction at low energies

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Unfolding method based on GEANT4 simulation is proposed to analyze data from p+^{6}Li experiment with E_p=0.8-3.2 MeV, performed on the 5SHD-2 pelletron at Hanoi University of Science. Firstly, the experimental configuration is described. The detector's energy resolutions of p, ^{3}He, and ^{4}He were experimentally determined and implemented as inputs for the simulation. Meanwhile, the available GEANT4 electromagnetic models, incorporating elastic/inelastic scattering processes and electromagnetic interactions, were fine-tuned to best reproduce the detector's experimental response functions induced by these particles. Afterwards, the optimal models were chosen to generate simulated spectra at given energies. The results together with a suitable background were applied to fit the experimental spectra obtained from p+^{6}Li experiment to unfold overlapping peaks. The method was validated by comparing extracted differential cross sections at selected energies for the p(^{6}Li, ^{6}Li)p and p(^{6}Li, ^{4}He)^{3}He reactions with those from the literature. Good agreement was obtained, demonstrating a reliable basis for further data analysis in the full 0.8-3.2 MeV energy range to study the aforementioned reactions.

Keywords: GEANT4, pelletron, p+^{6}Li

S5.O4

Microscopic descriptions of the elastic proton scattering on light unstable nuclei based on the Brueckner-Hartree-Fock approach

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The elastic proton scattering of beryllium and oxygen isotopes at intermediate energies is described in the optical model using microscopic optical potentials given by the folding model. The density-dependent parametrization of the complex nucleon-nucleon interaction by Jeukenne, Lejeune and Mahaux (JLM) based on Brueckner-Hartree-Fock approach as well as realistic nuclear densities were used as input of folding calculations. Our results have been shown to be very good description of both the elastic scattering and total reaction cross section data for the stable isotopes. For unstable nuclei, the calculated results using various densities indicated that the elastic proton scattering cross section is sensitive density of colliding nuclei. Therefore, we can discuss that the microscopic calculation of the elastic scattering is good tool to probe nuclear structure of unstable nuclei.

Keywords: The elastic proton scattering; folding model; The nuclear radii of neutron-rich isotopes.

S5.O5

Development of a Tunable Monochromatic X-ray Source for Pixelated Semiconductor Detector Calibration

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Semiconductor pixelated detectors are emerging as a cornerstone technology for next-generation computed tomography (CT) systems due to their high-speed photon-counting capability [1]. To achieve optimal energy resolution, precise pixel-by-pixel energy calibration is essential, requiring monochromatic X-ray sources with both

high flux and broad energy tunability - a combination currently unattainable with conventional sources.
In this study, we develop a X-ray source based on graphite-crystal diffraction, enabling continuous energy tuning across 15–100 keV with monochromaticity < 9%. This solution is projected to significantly reduce calibration time while improving accuracy compared to traditional methods.

Keywords: Photon-Counting Detector Computed Tomography (PCD CT), semiconductor pixelated detectors, per-pixel energy calibration, tunable monochromatic X-ray source.

Program of Session S6
Materials & Semiconductor

(other activities are mentioned in the conference's main program)

Date: October 13-15, 2025
Venue: Phenikaa University, Duong Noi, Hanoi
Organizers: Phenikaa University, NYCU Institute of Physics, and Vietnam Physical Society

No.	Time	Title	Presenter
October 13, 2025 Morning			
10:45 – 11:45		**Oral sessions** chaired by **Nguyen Huu Lam;** location: Room 5	
S6.K1	10:45 - 11:15	Synergistic Plasmonics and Molecular Recognition: Towards Next-Generation Paper-Based SERS Devices	**Prof. Yong-Ill Lee** Changwon National University
S6.K2	11:15 - 11:45	Emergence Spin-Dependent Phenomena in 2D Quantum Magnetic Materials	**Prof. Phan Manh Huong** VinUniversity, University of South Florida
October 13, 2025 Afternoon			
13:30 – 15:10		**Oral sessions** chaired by **Nguyen Duc T. Kien;** location: Room 5	
S6.I1	14:20 - 14:45	Giant Modulation of Longitudinal Magnetoresistance of the Fe5-xGeTe2 with In-Plane Bias	**Prof. Sanghoon Kim** University of Ulsan
15:25 – 16:00		**Poster session 1**	
16:00 – 17:30		**Oral sessions** chaired by **Dao Van Duong;** location: Room 5	
S6.I2	16:25 - 16:45	Oxide-Phosphide Heterostructure Interfaces for Green Hydrogen Production via Seawater Electrolysis	**Dr. Tran Ngoc Quang** Viet Nam National University
S6.O1	16:45 - 17:05	Numerical Study of an integrated fibre optic platform with an achromatic nanostructured vortex phase element for the visible spectral range	**Dr. Nguyen Thi Hue** Hong Duc University
S6.O2	17:05 - 17:25	Scalable atomic layer deposition for tailoring powder-based materials	**Dr. Bui Van Hao** Phenikaa University
October 14, 2025 Afternoon			
13:30 - 15:10		**Oral sessions** chaired by **Nguyen Viet Huong;** location: Room 4	

No.	Time	Title	Presenter
S6.K3	13:30 - 13:55	Process-Integrated Silicon Architectures for High-Efficiency and Long-Life Lithium-Ion Batteries	**Prof. Yu Sheng Su** National Yang Ming Chiao Tung University
S6.I3	13:55 - 14:20	Electron-beam irradiation: An alternative strategy for modifying the structure of nanomaterials	**Assoc. Prof. Nguyen Quang Hung** Duy Tan University
S6.I4	14:20 - 14:45	Advanced in Organic Electrochemical Devices using Self-Doped Polyelectrolytes	**Dr. Nguyen Dang Tung** VinUniversity
S6.O3	14:45 - 15:10	Advanced Layer-by-Layer Stress Mapping in GaN High Electron Mobility Transistor (HEMT) Structures for High-Performance Power Devices	**Dr. Mai Thi Thu** University of Science and Technology of Hanoi
15:25 – 16:00		**Poster session 2**	
16:00 - 17:00		**Oral sessions** chaired by **Bui Van Hao;** location: Room 4	
S6.I5	16:00 - 16:25	Barkhausen effect: Applications in materials science and engineering	**Prof. Le Manh Tu** Phenikaa University
S6.O4	16:25 - 16:45	First-principles study on electromechanical and thermoelectric properties of SnSb monolayer	**Mr. To Toan Thang** Hanoi University of Science and Technology
S6.O5	16:45 - 17:05	Se flux-induced structural phase transition and transport modulation in epitaxial $FeSe/Al_2O_3(0001)$ films	**Dr. Tran Nguyen Minh Anh** Phenikaa University

Room 5 (Session 6)

S6.K1 – Keynote talk

Synergistic Plasmonics and Molecular Recognition: Towards Next-Generation Paper-Based SERS Devices

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The pursuit of ultra-sensitive, low-cost, and portable optical sensing platforms remains a central challenge at the intersection of physics, chemistry, and materials science. Surface-enhanced Raman spectroscopy (SERS), by exploiting localized surface plasmon resonances, offers orders-of-magnitude signal amplification through electromagnetic "hot spots." However, achieving simultaneous molecular selectivity and reproducible enhancement on inexpensive substrates is non-trivial. In this work, we report a microfluidic paper-based SERS platform where molecularly imprinted nanogels decorated with silver nanoparticles serve as selective receptors and plasmonic amplifiers. The nanogels provide binding cavities for target molecules while their wrinkled morphology supports dense, uniformly distributed hot spots, yielding detection limits down to the sub-picomolar range (0.38 pM for bisphenol A and 0.37 pM for bisphenol S). We also introduce a self-assembled plasmonic paper substrate prepared by interfacial assembly of poly(styrene-b-2-vinylpyridine) block copolymers, followed by in situ silver nanoparticle growth. The copolymer concentration governs droplet stability, nanoparticle formation, and plasmon coupling, thereby controlling the SERS response. Electron microscopy reveals well-dispersed ~47 nm AgNPs on thin polymer films, achieving enhancement factors of $\sim 10^7$ and nanomolar detection of pharmaceutical pollutants such as sildenafil and flibanserin. Recently, we achieved remarkably low detection limits —1.0×10^{-20} M for rhodamine B, 1.0×10^{-17} M for thiabendazole, and 1.0×10^{-12} M for melamine— with corresponding SERS enhancement factors (EFs) of 4.5×10^{17}, 7.7×10^{13}, and 6.3×10^{9}, respectively, using an array of silica nanospheres (SNs) as a templating framework. These results highlight how plasmonic physics and supramolecular recognition can be synergistically integrated on paper to yield robust, inexpensive, and highly sensitive analytical devices, further extending the role of light–matter interactions in next-generation biomedical technologies.

Keywords: MIP nanogel; SERS; Plasmonic paper substrate; Ultrasensitive sensing.

S6.K2 – Keynote talk

Emergent Spin-Dependent Phenomena in 2D Quantum Magnetic Materials

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Two-dimensional (2D) van der Waals magnets are emerging as compelling candidates for ultralow-power, ultra-compact electronic and spintronic devices. However, most known 2D magnetic materials currently operate only under cryogenic conditions or other specialized environments, limiting their practical applicability. Achieving reliable control of their atomic-scale magnetism at or near room temperature, where real-world devices typically operate, is therefore a critical challenge. Recent breakthroughs in electrically and optically tunable room-temperature ferromagnetism, particularly in atomically thin transition metal dichalcogenides and their heterostructures, offer transformative potential across a range of cutting-edge technologies. These include spintronics, opto-spintronics, opto-spin-caloritronics, valleytronics, and quantum information science [1–7]. In this talk, I will present recent advances in 2D quantum magnetism, highlighting both the persistent challenges and the promising opportunities that are driving this rapidly evolving field forward.

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S6.I1 – Invited talk

Giant Modulation of Longitudinal Magnetoresistance of the $Fe_{5-x}GeTe_2$ with In-Plane Bias

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In this presentation, microscopic structures and magnetic properties of the $Fe_{5-x}GeTe_2$ single crystal, recently discovered as a promising van der Waals (vdW) ferromagnet, are introduced. Our study demonstrates a new way of the magnetization control of the vdW magnets via the electrical control of the interlayer coupling from ferromagnetic (FM)-to-antiferromagnetic (AFM). The current-induced phase transition results in drastically enhanced magnetoresistance from 5% to 170% with current in-plane geometry. This observation is fundamentally different from other conventional ways such as spin torque effects and gate voltage effects. This study will provide essential information to understand the complex magnetic properties and the origin of the new vdW ferromagnet, $Fe_{5-x}GeTe_2$ for future topology-based spin devices [1].

[1] K. Kim, et al. Giant Modulation of Magnetoresistance in a Van Der Waals Magnet by In-Plane Current Injection, *Advanced Materials* **37**, 2414917 (2025).

Keywords: van der Waals ferromagnet; Magnetic phase transition; Magnetoresistance

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S6.I2 – Invited talk

Oxide–Phosphide Heterostructure Interfaces for Green Hydrogen Production via Seawater Electrolysis

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Green hydrogen, produced via electrochemical water splitting, has emerged as an energy source capable of replacing fossil fuels due to its remarkable properties, such as high energy density (ca. 282 kJ mol–1) and carbon-free emission. Direct natural seawater electrolysis is an emerging technology that is effective for grid-scale green hydrogen mass production, however, its practical applications face extremely challenges, especially anode corrosion by side product Cl- at high current density and the blockage of active sites by insoluble precipitates at the cathode site. This talk will present a straightforward strategy to suppress chlorine evolution during natural seawater electrolysis by replacing the OER with the UOR at the anode. Specifically, a well-defined three-dimensional F-doped Ni2P-MoO2 heterostructure microrod array, rationally designed via an interfacial engineering strategy, exhibits eminently active and durable bifunctional catalysts for both HER, UOR, and OER in acid, alkaline, and alkaline seawater-based electrolytes. The electrochemical in-situ Raman spectroscopy and operando EIS reveal that a thin amorphous NiOOH layer, which is evolved from the Ni2P during anodic reaction, is real catalytic active sites. Density functional theory (DFT) calculation was also conducted to explore a catalytic mechanism.

Keywords: Seawater electrolysis, metal-organic frameworks, interfacial engineering, corrosion-resistant.

S6.O1

Numerical Study of an integrated fibre optic platform with an achromatic nanostructured vortex phase element for the visible spectral range

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In this study, we propose a novel micro-optical fibre-based device system that integrates an achromatic nanostructured gradient refractive index vortex phase element (nVPE) with a single-mode optical fibre. The developed element is composed of thousands of sub-wavelength constituents with high and low refractive indices, corresponding to two types of selected commercial glasses. Their dispersion properties satisfy the conditions for the achromatic function and feasible geometrical dimensions of the designed nVPE, making it suitable for fabrication using the conventional stack-and-draw technique commonly

employed in photonic crystal fibre production. Theoretical calculations and numerical results indicate that a model of a fibre-based device with 20-μm-long nVPE at the end can effectively generate fundamental optical vortices with an efficiency of more than 90% ($\Delta l = \pm 0.1$) across a 407 nm wavelength bandwidth, from 466 nm to 873 nm. Interestingly, this developed fibre-based device allows the mode-conversion efficiency of 100 % at two wavelengths 497 nm and 742 nm. This proves the simplification of vortex generator systems, easing the manipulation of the generated optical vortex beam in three-dimensional space.

Keywords: Nanostructured micro-optical element; fiber-based optics, optical vortices; broadband.

S6.O2

Scalable atomic layer deposition for tailoring powder-based materials

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Powder-based materials play a fundamental role in a wide range of technologies, from catalysis and energy storage to pharmaceuticals and protective coatings, owing to their large surface area and tunable physicochemical properties. Maximizing their performance, however, requires precise control over particle surfaces to ensure stability, prevent agglomeration, and introduce functional features that enable targeted applications. Surface engineering therefore plays a critical role in improving durability, reactivity, and overall material efficiency. In this presentation, I will introduce a scalable approach to surface modification of powders using atomic layer deposition (ALD) in custom-built fluidized bed reactors (FBRs) operating at atmospheric pressure. This system allows uniform deposition of ultrathin films and nanoparticles and is capable of processing material quantities ranging from grams to kilograms. I will highlight the versatility of FBR-ALD in tailoring surface properties and demonstrate its potential in fabricating high-performance catalysts for fuel cells, batteries, and other catalytic reactions, along with opportunities in additional industrial applications.

Keywords: Atomic layer deposition; Fluidized bed reactor; Surface engineering; Functional materials.

Room 4 (Session 6)

S6.K3 – Keynote talk

Process-Integrated Silicon Architectures for High-Efficiency and Long-Life Lithium-Ion Batteries

Yu-Sheng Su[1*], Thao Nguyen[1], Asif Latief Bhat[1], Yun-Zhen Liang[1], Kuo-Cheng Chang[1], Chun-Wei Huang[1] and Yu-Kang Chung[1]

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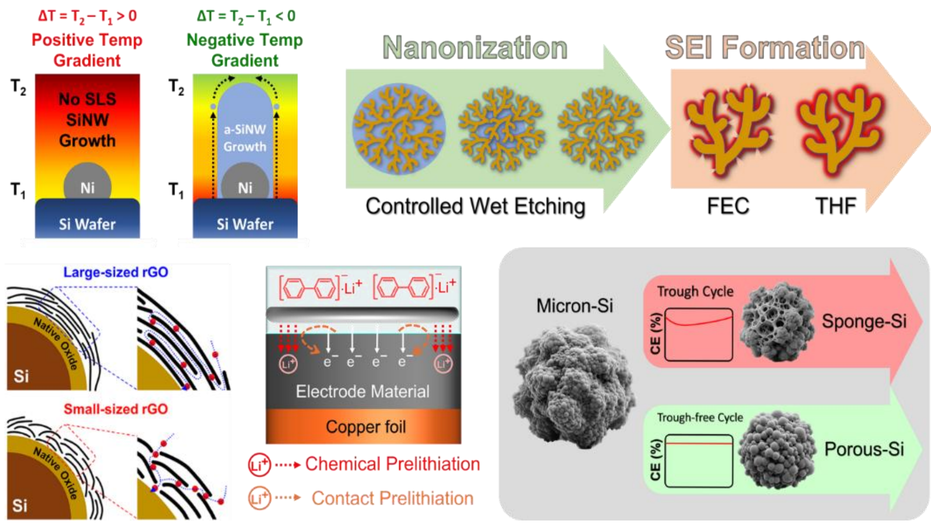
Silicon (Si) has emerged as a leading candidate for next-generation lithium-ion battery (LIB) anodes due to its ultrahigh theoretical capacity. However, its implementation is hindered by severe volume expansion, unstable solid–electrolyte interphase (SEI) formation, and low initial Coulombic efficiency (ICE). This work presents a process-integrated approach that combines hierarchical structural design, scalable fabrication, and electrochemical engineering to address these long-standing challenges.

We demonstrate scalable silicon nanowire growth through a cooling-controlled solid–liquid–solid (SLS) process and embed Si into conductive 3D scaffolds (CNTs, rGO, Ni foam) to enhance mechanical robustness and electronic/ionic transport. Complementary surface engineering—graphene encapsulation, hierarchical double-shell coatings, and coral-like Si derived from Al–Si alloys—improves SEI stability and cycling durability. Beyond structural design, electrolyte optimization (e.g., THF-based systems), controlled graphene oxide lateral dimensions, and sustainable transfer methods further boost electrochemical performance.

Prelithiation strategies, including stabilized lithium powder thermal treatment and biphenyl-based chemical contact, significantly elevate ICE without compromising electrode integrity. In parallel, process-tuned cycling protocols (voltage windows, state-of-charge management) mitigate efficiency loss and extend cycle life.

By integrating materials architecture with scalable process routes and electrochemical protocols, this study highlights a viable path toward high-efficiency, durable silicon anodes, bridging fundamental materials advances with manufacturable battery technologies.



Keywords: Silicon anodes; Lithium-ion batteries; Graphene; Prelithiation

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S6.I3 – Invited talk

Electron-beam irradiation: An alternative strategy for modifying the structure of nanomaterials

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Modifying the structure of nanomaterials is crucial for enhancing their properties for various applications. Most conventional methods rely on wet-chemical synthesis techniques such as elemental doping or co-doping, which often limit their scalability and industrial applicability. Recently, ionizing radiation has emerged as a powerful tool for altering the structure, morphology and chemical properties of nanomaterials in a controllable manner that is usually inaccessible by traditional chemical approaches.

Among different ionizing radiations, electron beam (EB) offers several advantages, including high directivity and processing efficiency; excellent high-energy utilization efficiency; easy to control, operate and maintain the reaction; low-operation cost; etc. As a result, the EB irradiation technology has gained attention as a promising economically and environmentally sustainable alternative to conventional chemical treatment. Herein, we report the application of EB irradiation to modify the structure of several nanomaterials and evaluate their performance in comparison to un-irradiated samples.

Keywords: Nanomaterials; electron beam irradiation; electron acceletator; industrial applicability.

S6.I4 – Invited talk

Advanced in Organic Electrochemcial Devices using Self-Doped Polyelectrolytes

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Organic electrochemical devices (OEDs) have emerged as promising platforms for bioelectronics, energy storage, and wearable technologies due to their inherent softness, biocompatibility, and mixed ionic-electronic conductivity. Self-doped polyelectrolytes are a special class of polymers that possess both electronic and ionic conductivity without requiring external dopants. Unlike traditional conductive polymers that need added salts or acids to conduct ions, self-doped polyelectrolytes have built-in ionic groups (e.g., sulfonate, carboxylate) that allow ion transport naturally. In this talk, I will present recent advances in OEDs enabled by self-doped polyelectrolytes in electronics and batteries devices. In particular, I will focus on the operation of organic electrochemical transistors, and show that, using self-doped polyelectrolytes, we can fabricate dual-mode transistors: the transistor that acts both in accumulation mode and in depletion mode. Building on our previous development of dual-mode organic transistors, we demonstrate a new generation of OEDs that combine high stability, reconfigurability, and scalable fabrication.

Keywords: Organic Electrochemical Devices; Organic Electronics; Mixed Ionic-Electronic Conductors

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S6.O3

Advanced Layer-by-Layer Stress Mapping in GaN High Electron Mobility Transistor (HEMT) Structures for High-Performance Power Devices

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Semiconductors are crucial in modern society, driving advances in high-performance computing, artificial intelligence, communication, transportation, healthcare, and the Internet of Things. Among them, AlGaN/GaN high-electron-mobility transistors (HEMTs) stand out in high-power and high-frequency electronics thanks to their high-voltage operation, rapid switching, and excellent thermal stability. To meet industrial demands, GaN power devices must achieve high breakdown voltages (650–900 V), low vertical leakage currents, and cost-effective scalability. However, their performance is limited by two major challenges: (1) poor crystal quality caused by lattice and thermal expansion coefficient mismatches between GaN and silicon, resulting in residual stress and high threading dislocation densities, and (2) current collapse due to buffer and surface traps from residual impurities and point defects. Introducing SiN interlayers into GaN stacks effectively modulates stress, reduces threading dislocation densities, and mitigates wafer bowing—critical steps toward improving device reliability. This study employed Laue X-ray nanodiffraction (XND) to characterize layer-by-layer stress and dislocation distributions in multilayer GaN HEMT systems, providing insights that surpass the capabilities of conventional methods. The investigation uncovered a novel discovery: three distinct columnar stress regions coexisted in GaN structures, exhibiting opposing in-plane stress magnitudes that effectively inhibit threading dislocation propagation. Notably, tensile stress domains were found to promote dislocation bending and annihilation, key mechanisms for improving crystal quality.These results underscore the importance of engineering a uniform distribution of tensile stress domains to suppress dislocations and wafer bowing, paving the way for high-performance, reliable, and cost-efficient GaN power devices. This work provides a valuable pathway for advancing Vietnam's semiconductor capabilities and fostering innovation in wide-bandgap power electronics.

Keywords: Power devices, HEMT, dislocation, residual stress

S6.I5 – Invited talk

Barkhausen effect: Applications in materials science and engineering

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Barkhausen effect, discovered by German physicist Heinrich Barkhausen in 1919, refers to the jerky noise produced in a ferromagnetic material when its magnetization is slowly driven by a varying magnetic field. This effect is also known as the first experimental proof of magnetic domains, which were previously proposed by Pierre-Ernest Weiss in 1906, for ferromagnetics. The measured magnetic output signal of the ferromagnet is known as Barkhausen noise, which is very sensitive to the microstructure of the material, it can provide insights into microstructural parameters such as grain size, residual/applied stress, stress anisotropy, plastic deformation, hardness, and magnetic anisotropy. Based on these properties, Barkhausen noise has been used as a nondestructive technique in different engineering applications such as stress measurement, defect detection, and grinding burn inspection, among others. Due to the complex nature of the phenomenon, the knowledge of Barkhausen noise is still not completed. Therefore, this work will explain to the readers some interesting physical aspects about the Barkhausen effect, from its origin to its application as a nondestructive testing method and material's characterization. Suggestions for future research and development of technique is also provided.

Keywords: Magnetic domains; stress measurements; nondestructive testing.

S6.O4

First-principles study on electromechanical and thermoelectric properties of SnSb monolayer

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We report a comprehensive investigation of the electromechanical and thermoelectric properties of the SnSb monolayer using density functional theory (DFT). The structural stability of the monolayer is confirmed through both dynamic and static criteria. Mechanical analysis reveals a fracture strain of $\varepsilon_{bia} = 0.18$ and a critical stress of 5.7 N/m, indicating considerable mechanical flexibility. The electronic band structure, computed using the HSE functional, yields a band gap of approximately 1.37 eV. The distribution of the conduction band minimum (CBM) and valence band maximum (VBM) points suggests that the SnSb monolayer exhibits high sensitivity to mechanical strain, making it a strain-tunable semiconductor. Furthermore, its thermoelectric properties - characterizing the material's capability for electric-to-heat conversion - are evaluated via the Boltzmann transport equation. The results demonstrate a high Seebeck coefficient and a superior power factor of 1200 µV/K and 46×10^{10} W/cmsK^2 , respectively. Our findings not only provide insight into the electromechanical and thermoelectric behaviors of SnSb monolayer but also highlight its potential for applications in next-generation nanoelectronic and energy conversion technologies.

Keywords: Electromechanical properties, thermoelectric properties, SnSb monolayer and density functional theory

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S6.O5

Se flux-induced structural phase transition and transport modulation in epitaxial FeSe/Al_2O_3(0001) films

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We report the modulation of phase structure and electronic transport properties of FeSe thin films through Se stoichiometry. The epitaxial FeSe thin films were grown on Al2O3(0001) substrates via molecular beam epitaxy, with systematic variation of the Se/Fe flux ratio from 1 to 10. A clear phase transition was observed from pure tetragonal β–FeSe (Se/Fe ≤ 3) to hexagonal δ–FeSe at higher Se content. The β–FeSe films exhibit metallic-like conduction, whereas δ–FeSe-rich films display semiconducting-like behavior. Moreover, we reveal a shift from hole-dominated metallic transport in tetragonal films to electron-type conduction in hexagonal samples. This behavior suggests reduced carrier mobility and possible carrier localization or multi-band effects. These results offer valuable insights into phase-selective growth and carrier dynamics in chalcogenide-based thin films.

Keywords: superconductivity, FeSe, phase transition, thin films, MBE

Program of Session S7
Engineering/Applied Physics

(other activities are mentioned in the conference's main program)

Date: October 13-15, 2025
Venue: Phenikaa University, Duong Noi, Hanoi
Organizers: Phenikaa University, NYCU Institute of Physics and Vietnam Physical Society

No.	Time	Title	Presenter
October 13, 2025 Afternoon			
13:30 – 15:10		**Oral session** chaired by **Nguyen Duc Trung Kien;** location: Room 5(Grand Hall - 2nd Floor A10)	
S7.K1	13:30 – 13:55	Solar cells and gas sensors based on organic semiconductors	**Prof. Hsin-Fei Meng** National Yang Ming Chiao Tung University
S7.K2	13:55 – 14:20	Advanced Functional Nanocomposites: From Large-scale Electrosynthesis to Smart Sensing and Industrial Applications	**Prof. Le Anh Tuan** Phenikaa University Nano Institute
S7.I1	14:45 – 15:10	Closing the plastic cycle for clean water: Melamine-supported PET-derived photothermal carbon evaporator for interfacial solar steam generation	**Assoc. Prof. Van Duong Dao** Phenikaa University
15:25 – 16:00		**Poster session 1**	
16:00 – 17:20		**Oral session** chaired by **Dao Van Duong;** location: Room 5 (Grand Hall - 2nd Floor A10)	
S5.I2	16:00 – 16:25	CO_2 Valorization by Photocatalysis	**Prof. David Riassetto** Grenoble Institute of Technology, France
October 14, 2025 Afternoon			
13:30 – 15:10		**Oral session** chaired by **Tran Manh Trung;** location: Room 5(Grand Hall - 2nd Floor A10)	

No.	Time	Title	Presenter
S7.K3	13:30 – 13:55	Low Power Gas Sensor for Environmental Applications	**Prof. Hsiao-Wen Zan** College of Electrical and Computer Engineering
S7.I3	13:55 – 14:20	Many-Body Quantum Methods for Predicting Optical Properties of NIR-II Organic Semiconductors	**Prof. Nguyet Pham** NYCU Taiwan
S7.I4	14:20 – 14:45	Surface modification of Ni-rich cathode for Li-ion batteries and Solid polymer electrolytes for Solid-state batteries	**Dr. Vu Ngoc Hung** Phenikaa University
S7.O1	14:45 – 15:10	Hydrothermal Synthesis of Erbium-Doped TiO_2 Photocatalyst toward Water Treatment Applications	**Assoc. Prof. Le Duc Tam** Phenikaa University
15:25 – 16:00		**Poster session 2**	
16:00 – 17:00		**Oral session** chaired by **Nguyen Van Du;** location: Room 5(Grand Hall - 2nd Floor A10)	
S7.I5	16:00 – 16:20	From cyan to far-red: spectrum-tailored phosphors for high-CRI WLEDs and plant growth lighting	**Dr. Tran Manh Trung** Phenikaa University
S7.O2	16:20 – 16:40	High-current triboelectric nanogenerator based on TiO_2 decorated PVDF porous fiber membrane via vapor phase deposition	**Dr. Vu Duy Linh** Phenikaa University
S7.O3	16:40 – 17:00	Atomic Layer Deposition and Vapor Phase Infiltration to Enhance the Weathering Resistance of Polymer Composite Materials	**MSc. Tran Vu Hung Anh** Phenikaa University

Room 5 (Session 7)

S7.K1 – Keynote talk

Solar cells and gas sensors based on organic semiconductors

Hsin-Fei Meng*[1], Yu-Chiang Chao[2], Hsiao-Wen Zan[3]

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Organic solar cells have the advantages of being semi-transparent, thin, light weight, and easy in fabrication. We achieved leading efficiencies in organic solar panels on large glass substrate [1]. Because of the photochemical reactions of organic materials and the metal oxide materials, the solar cells usually decay rapidly under the solar light due to the ultraviolet irradiation. Through the ternary semiconductor blends and the low-cost UV filter, the sunlight lifetime is raised to more than 4000 hours [2]. Furthermore, through the design of the external connection and sealing, the lifetime of the solar cell module is raised to be similar to the small device [3]. Solar cell fabrication without any costly vacuum deposition is demonstrated using cylinder blade coating and spray coating. Greenhouse projects using transparent organic solar modules are demonstrated. The stable module is an important step for the real world testing and evaluations of organic solar cells.

For gas sensor we designed a unique sensor structure with vertical conduction channel relative to the substrate. In the way the channel length can be reduced to about 300 nm without complicated lithography. Such sensors are highly sensitive and reproducible. The sensors were successfully used to monitor the breath of kidney diseases patients. It is also used to monitor the gas emission due to the bacteria or fertilizer pollution [4]. Conventionally it is slow to detect such pollutions in the water. Using the gas emission, it is much faster to obtain the pollution level in the rivers or drinking water. It was demonstrated for the rice field. Such system is helpful to monitor and control the eutrophication of rivers and oceans.

[1] ACS Applied Materials & Interfaces, 15, 7911 (2023)

[2] Solar RRL, 2200712 (2022)

[3] Solar RRL, 2400101 (2024)

[4] Analytica Chimica Acta, 1206, 339729 (2022)

S7. K2 – Keynote talk

Advanced Functional Nanocomposites: From Large-scale Electrosynthesis to Smart Sensing and Industrial Applications

Anh-Tuan Le[1,2]

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[2] *Nanomaterials for Environmental and Biomedical Applications (NEB Lab), Key Research Group at the Phenikaa University*

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This proposed talk aims to present about recent advances in ultralarge-scale green synthesis of high-performance advanced functional inorganic nanocomposites as well as polymer nanocomposites based on the Unsaturated Polyester Resin-UPR, Acrylic & Epoxy resins for smart sensing devices, outdoor artificial quartz stones manufacturing and industrial coatings applications. The talk will focus on main goals such as:(i) Mastering the production technology of advanced functional nanomaterials based on 0D nanoparticles, 2D nanosheets, 3D-metal-organic frameworks, and/or advanced nanocomposites (inorganic nanocomposites, polymer nanocomposites), (ii) Developing smart nanosensors for rapid alert systems integrated with novel nanomaterials, and (iii) Enhancing the UV resistance and weather durability of unsaturated polyester resin by applying functional nanocomposites for long-term outdoor applications and (iv) Building a strong interdisciplinary research group at the Phenikaa University on Smart Nanomaterials and Rapid Alert Systems (RAS) utilizing advanced sensing devices/systems for monitoring food safety and quality as well as nanotech-based healthcare or manufacturing industries, i.e., outdoor artificial quartz stones, smart coatings.

Keywords: Electrosynthesis, Advanced Functional Nanocomposites, Smart Sensing Materials/Devices, Outdoor Artificial Quartz Stones, Industrial Nano-Coatings.

S7.I1 – Invited talk

Closing the plastic cycle for clean water: Melamine-supported PET-derived photothermal carbon evaporator for interfacial solar steam generation

Nguyen Thi Hien, Ta Quynh Mai, Hoang Minh Hong, Tran Nam Anh, Van-Duong Dao*

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Transforming plastic waste into high-value carbon materials for energy and environmental applications represents a promising research direction that directly addresses the challenge of recycling urban and industrial plastics. In this work, post-consumer PET waste was converted into activated carbon via ionothermal pyrolysis assisted by a choline chloride–urea deep eutectic salt (CU-DES). Notably, the use of CU-DES eliminates the need for post-synthesis washing, thereby simplifying the fabrication process, while simultaneously producing activated carbons (ACs) with unique features such as relatively low surface area, enhanced graphitization/structural ordering, and high nitrogen doping. The as-synthesized ACs were subsequently coated onto melamine foam to construct solar-absorbing membranes for solar-driven water evaporation. The resulting system achieved an evaporation rate of 1.374 kg m^{-2} h^{-1} under 0.6 Sun illumination at 25°C and 50% relative humidity. These findings demonstrate, for the first time, that high-density carbons derived from waste PET can be effectively exploited as efficient photothermal materials, paving the way for practical applications in clean water production, seawater desalination, and oil-spill remediation.

Keywords: Solar energy; Solar driven steam generation; PET; activated carbon; Waste-to-energy.

S7.I2 – Invited talk

CO2 Valorization by Photocatalysis

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In today's world, the prospects for a sustainable future are facing a series of environmental, energy, and economic issues. One of the significant challenges is the increase in CO2 emissions, which has prompted scientists to find ways to reduce and recover it using renewable resources. Light-driven photocatalytic reduction of CO2 into solar fuels has gained significant potential as a sustainable solution. To enhance the activity, selectivity, and stability of photocatalysts, the use of nanostructures

materials and heterojunctions have shown great promise. Nanowires offer higher optical, surface, and transport properties. Combination of materials help decrease the recombination of charge carriers. In recent years, the direct Z-scheme has emerged as the most effective method for charge separation and maximizing the redox potential. Therefore, the synthesis of high-efficiency, cost-effective, and sustainable systems remain a challenge.This research work presents the development of a photocatalytic membrane composed of oxides nanowires. Subsequently, these membranes are decorated with various compounds in order to maximize the photocatalytic activity. Our results demonstrate that the constructed heterojunctions contribute to enhance charge separation and reduce self-photoreduction, as evidenced by photodegradation analyses.

S7.I3 – Invited talk

Many-Body Quantum Methods for Predicting Optical Properties of NIR-II Organic Semiconductors

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The second near-infrared (NIR-II, 1000–1700 nm) window has emerged as a powerful platform for biomedical imaging owing to its deeper tissue penetration, higher spatial resolution, and negligible autofluorescence compared with visible or NIR-I imaging. Organic fluorophores operating in this region are especially attractive because of their biocompatibility, biodegradability, and structural tunability. Similar to semiconductor nanomaterials used in optoelectronic devices, these fluorophores rely on extended π-conjugation and terminal group engineering to modulate electronic bandgaps and optical transitions. In this work, we apply many-body perturbation theory within the GW approximation combined with the Bethe–Salpeter equation (GW-BSE) to investigate a series of polymethine-based NIR-II dyes. This approach rigorously accounts for quasiparticle energies and excitonic effects that are not adequately captured by conventional time-dependent density functional theory (TDDFT). By employing the Tamm–Dancoff approximation and incorporating a space-dependent Coulomb attenuation parameter, we achieve substantial reductions in computational cost while maintaining predictive accuracy. Our results demonstrate that GW-BSE accurately reproduces experimental absorption spectra and excitation energies, highlighting strong analogies between organic fluorophores and semiconductor-based emitters. These findings position

GW-BSE as a reliable benchmark for excited-state modeling and establish polymethine dyes as promising organic "molecular semiconductors" for next-generation NIR-II fluorescence imaging applications.

Keywords: NIR-II Fluorescence Imaging; Organic Semiconductors; GW-BSE Theory; Quantum Excited States

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S7.I4 – Invited talk

Surface modification of Ni-rich cathode for Li-ion batteries and Solid polymer electrolytes for Solid-state batteries

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Ni-rich layered oxides are promising cathode for high-energy Lithium-ion batteries (LIBs) but are susceptible to degradation due to undesirable phase transitions and parasitic side reactions. To address these issues, coating design is one of the approaches to create a protective barrier between the surface of the Ni-rich layered cathode and the electrolyte, leading to diminished side reactions. This work employed spatial atomic layer deposition (SALD) technology to apply an amorphous ZnO coating directly onto the cathode with precise control over its thickness (15 nm) at the atomic level to improve electrochemical performance.
Solid-State Lithium Batteries using solid electrolytes are emerging as a safer, higher energy density alternative to traditional LIBs. Herein, we present two methods for fabricating solid polymer electrolytes for solid-state lithium batteries. The first method is based on the solution casting of Polyethylene oxide and silane-modified TiO2, and the second method is based on the in situ polymerization of methyl methacrylate and butyl acrylate.

Keywords: Ni-rich cathode; solid polymer electrolyte; solid-state batteries; PEO; Li-ion batteries.

S7.O1

Hydrothermal Synthesis of Erbium-Doped TiO_2 Photocatalyst toward Water Treatment Applications

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The development of efficient photocatalysts for environmental remediation has attracted increasing attention in recent years. In this study, we successfully synthesized Erbium-doped TiO_2 (Er-TiO_2) photocatalyst using hydrothermal method, aiming at practical applications in textile water treatment. Structural and surface properties of the as-prepared materials were investigated by X-ray diffraction (XRD), scanning electron microscopy (SEM), UV–visible–NIR spectroscopy, and transient photocurrent spectroscopy. The incorporation of Er ions into the TiO_2 lattice significantly modified the surface characteristics and electronic band structure, resulting in improved charge carrier separation and extended light absorption into the visible region. The results revealed that Er-doped TiO_2 exhibits superior properties, which are expected to significantly enhance photocatalytic performance compared to pristine TiO_2. This enhancement can be attributed to the role of Er doping in reducing the bandgap and extending visible-light absorption, while also suppressing electron–hole recombination. The hydrothermal method enabled simple and scalable synthesis, highlighting its potential for large-scale production. These findings confirm Er-doped TiO_2 as a promising photocatalyst for efficient wastewater remediation, offering valuable insights into the design of advanced functional materials for sustainable environmental solutions.

Keywords: Erbium-doped TiO_2; Hydrothermal method; Water treatment;

S7.O2

High-current triboelectric nanogenerator based on TiO_2 decorated PVDF porous fiber membrane via vapor phase deposition

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This study reports a high-performance direct-current triboelectric nanogenerator (DC-TENG) based on a TiO_2-decorated polyvinylidene fluoride (PVDF) porous fiber membrane, fabricated through a combined electrospinning, vapor-phase infiltration (VPI), and atomic layer deposition (ALD) approach. Initially, a PVDF nanofiber membrane with high porosity and large specific surface area was prepared via electrospinning, providing an ideal scaffold for subsequent modifications. The membrane was then internally reinforced by a conformal SiO_2 network via VPI and externally functionalized with a precisely controlled TiO_2 nanolayer through ALD. The synergistic effect of the hydrogen-bonded water network and the engineered Schottky barrier at the PVDF/TiO_2-metal interface facilitates efficient proton-assisted charge transport, yielding a stable direct-current output. This strategically designed membrane functions as an effective active layer for a DC-TENG, improving output performance and ensuring dependable operation in high humidity conditions.

Keywords: atomic layer deposition (ALD), vapor-phase infiltration (VPI), electrospinning, Schottky junction, triboelectric nanogenerator

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S7.O3

Atomic Layer Deposition and Vapor Phase Infiltration to Enhance the Weathering Resistance of Polymer Composite Materials

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Polymer composites are increasingly used in various industries due to their exceptional strength-to-weight ratio and design versatility. However, their susceptibility to weathering degradation and dust accumulation poses significant challenges to their long-term performance, particularly in outdoor environments. This study investigates the application of atomic layer deposition (ALD) and vapor phase infiltration (VPI) methods to enhance weathering protection and dust resistance in polymer composite materials. VPI drives inorganic precursors into the polymer to form a hybrid organic–inorganic structure that suppresses moisture/oxygen penetration and stabilizes the matrix, while ALD deposits nanometric, conformal metal oxide topcoats tailored to mitigate UV-induced degradation. Comprehensive characterization revealed that the coatings enhanced weathering resistance while creating a hydrophobic surface that is easy to clean. The coatings maintained good adhesion and durability under harsh environmental conditions, extending the lifespan and functionality of the composites. These findings demonstrate the potential of ALD-VPI technologies for improving the performance of polymer composites in demanding applications.

Keywords: *Atomic Layer Deposition, Vapor Phase Infiltration, Polymer Composite, Anti-UV Coatings* 4

POSTER SESSION 1

TIME: 15:25 16:00, October 13th

PID. No: (S1.P)1, 2, 3, 4, 5, 6, 7; (S2.P)1, 2; (S3.P)1, 2, 3, 4, 5, 6, 7; (S4.P)1, 2, 3, 4, 5; (S5.P)1, 2, 3, 4, 5, 6, 7, 8, 9; (S6.P)1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22; (S7.P)1, 2, 3, 4;

S1.P1

The new $(g\text{-}2)_{e,\mu}$ data and LFV decays in a left-right model

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In our recent work studying an extension of the left-right (LR) symmetry model with inverse seesaw (ISS) neutrinos, we will show numerically that the lepton flavor violating (LFV) decays of the standard model-like Higgs and neutral gauge bosons h, $Z \to e_b^+ e_a^-$ are still promoting significants of new physics in light of the 2025 results of the muon $(g-2)$ anomaly. Although this new experimental result is consistent with the standard model prediction and differs significantly from previous discussions, the LFV decay rates still reach the near-future experimental sensitivities. Numerically interesting relationships between them will be presented in this work.

Keywords: Beyond Standard Model; Lepton flavor violating; Neutrinos; Higgs boson.

S1.P2

A minimal complete model for flavor physics, neutrino mass, and dark matter

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We propose a minimal and ultraviolet-complete extension of the Standard Model that unifies the explanation of flavor hierarchies, neutrino masses, and dark matter.

In this framework, family-dependent gauge charges and a residual dark symmetry naturally generate a hybrid scotoseesaw mechanism for tiny neutrino masses and a stable dark matter candidate. Charged fermion mass hierarchies and suppressed quark mixing arise via higher-dimensional operators with scalar singlets and vector-like fermions. We outline the main phenomenological implications for neutrino physics, flavor observables, and dark matter searches.

Keywords: Flavor, Neutrino, DM, BSM.

S1.P3

On dark matter fermions production in e^+e^- collisions

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In this paper, we have studied the production of dark matter fermions in the annihilation of the electron-positron pair via a radion or a vector unparticle. We have obtained that the cross-section for the scattering should be detectable. Furthermore, we have found the lower bound on the radion mass and constraints on the parameters of Randall- Sundrum models.

Keywords: Dark matter fermion; Radion; Randall-Sundrum model.

S1.P4

Effects of (s)neutrinos on the Higgs masses and trilinear Higgs self-couplings

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The extended (s)neutrino sector in the inverse seesaw mechanism may induce large corrections to the Higgs boson masses and the trilinear Higgs self-couplings. We

investigate these effects at the full one-loop level and incorporate them with the available dominant two-loop corrections from the (s)top sector. We show that the effects can be up to 10% for the effective SM-like trilinear Higgs self-couplings, and up to 4.5% for the SM-like Higgs boson mass. Constraints from the Higgs data, the neutrino data, the charged lepton flavor-violating decays, and new physics constraints from the oblique parameters S, T, and U are taken into account for a reliable analysis.

Keywords: Supersymmetry; Higgs physics; Higher order corrections.

S1.P5

General Formulas for Loop-Induced Decays of $A \rightarrow Z\gamma\gamma$ and Their Applications

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Within the framework of the Standard Model Higgs extensions, including the Two-Higgs-Doublet Model with vector-like fermions and the Triplet-Higgs Model, we derive general one-loop contributions to the rare decay process $A \rightarrow Z\gamma\gamma$. The analytical expressions are formulated with Passarino-Veltman scalar functions, which represent the scalar coefficients of one-loop Lorentz-covariant tensor integrals. These functions are written in accordance with the input conventions of the LoopTools and Collier packages, facilitating the efficient numerical generation of decay rates and their distributions using these computational tools. As part of our phenomenological study, we examine the branching ratios of this decay channel within the viable parameter space of the considered models. Our results indicate that the branching ratio can reach $O(10^{-4})$ in the Two-Higgs-Doublet Model and $O(10^{-2})$ in the Triplet-Higgs Model at specific points within the allowed parameter regions. Furthermore, the inclusion of vector-like fermions in the loop leads to a significant modification of the partial decay rates, with an observed variation of approximately 10%. Additionally, we explore the dependence of the branching ratios on key model parameters, including the charged Higgs mass, mixing angles, and the soft-breaking scale, providing deeper insights into the phenomenological implications of these Higgs-extended frameworks.

Keywords: One-loop corrections, Higgs phenomenology, Physics beyond the Standard Model, Physics at present and future colliders.

S1.P6

The Hierarchical Symmetry Breaking Chain $E_8 \supset E_7 \supset E_6 \supset SO(10) \supset SU(5) \supset SM$: A Comprehensive Review

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The exceptional Lie group E_8, with its maximal rank and dimension, offers a profound framework for unifying fundamental interactions. This paper reviews the hierarchical symmetry-breaking chain $E_8 \supset E_7 \supset E_6 \supset SO(10) \supset SU(5) \supset SM$, emphasising its mathematical elegance and physical implications. We analyse the group-theoretic structure, symmetry-breaking mechanisms, and phenomenological consequences, including dark matter, neutrino masses, and proton decay.
Keywords: Grand unification, exceptional groups, symmetry breaking, dark matter.

S1.P7

Study light Higgs particles in the $SU(3)_C \otimes SU(3)_L \otimes U(1)_X \otimes U(1)_N$ model

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We study the $SU(3)_C \otimes SU(3)_L \otimes U(1)_X \otimes U(1)_N$ gauge symmetry (3-3-1-1 Model) and consider how the model fits to experiment data. We identified the 3-3-1-1 model Higgs with the standard model Higgs in $1.25 < \delta < 1.4$, $-0.9 < \gamma < 0.9$ or $0.17 < \delta < 0.3$, $-0.9 < \gamma < 0.9$. Moreover, we consider the 95 GeV-Higgs particle in experiment with light particle in the 3-3-1-1 model. The identification is very important in applying to study Higgs and dark matter. It is also confirmed that the 3-3-1-1 model will be an extended model to hunt for new physics in the future.
Keywords: Beyond Standard Model; Higgs Physics.

S2.P1

The perturbative *f (R)* theory: non-static charged black hole and embedding in the background of the FLRW cosmology, uniqueness of solutions

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We employ the perturbative f(R) theory to investigate a non-static charged black hole. Our results indicate that it does not emit electromagnetic waves but can emit gravitational waves. The metric tensors $g_{\mu\nu}$ are analyzed both inside and outside the gravitational source. The obtained results not only refine the solutions to Einstein's equations in terms of magnitude, thereby describing astronomical and cosmological quantities more accurately, but also reveal novel effects. Outside the gravitational source, the metric tensors may exhibit time dependence, enabling a spherically symmetric gravitational source to emit gravitational waves (an effect not predicted by Einstein's equations). However, a spherically symmetric field still does not emit electromagnetic waves. Additionally, we propose a new method for embedding the spherically symmetric metrics of a star (or black hole) within the FLRW cosmological background. Finally, we discuss the uniqueness of the solutions derived from the f(R) theory.

References: Pham Van Ky, *"Nonstatic Reissner–Nordström metric in the perturbative f(R) theory: embedding in the background of the FLRW cosmology, uniqueness of solutions, the TOV equation,"* Eur. Phys. J. C **85**, no.2, 170 (2025).

Keywords: Gravitational waves; cosmology; black holes; *f(R)* theories of gravity.

S2.P2

Inflationary power-law Bianchi type I universe with multiple vector fields

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We seek inflationary power-law solutions of the Bianchi type I universe in the most general form, with three different scale factors. To be consistent with the metric, we consider a model containing one homogeneous scalar field and three homogeneous vector fields, each oriented along one spatial axis. Furthermore, we assume the presence of non-minimal couplings between the scalar field and vector fields. In this setting, we find four types of solutions: cases in which all three vector fields persist, only two persist, only one persists, and none persist. The first two types of solutions correspond to the general Bianchi type I metric, the third to the rotationally symmetric Bianchi type I metric, and the last to the Friedmann–Lemaître–Robertson–Walker (FLRW) metric.

Keywords: Anisotropic inflation; Bianchi type I metric; Cosmic no-hair conjecture.

S3.P1

Thermoelectric properties in a jacutingaite monolayer under static and dynamic fields

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We investigate the impact of static and dynamic electric fields on the charge and heat transport properties of monolayer jacutingaite Pt_2HgSe_3–a quantum spin Hall insulator. By systematically analyzing the temperature dependence of electrical and thermal conductivity, we identify distinct roles played by static and dynamic fields. Our results reveal that electrical conductivity is significantly suppressed by increasing electric fields, with the static field exerting a dominant influence over charge transport. In contrast, thermal conductivity remains largely unaffected by external fields, indicating that phonon-mediated heat transport is insensitive to field-driven modifications. Selective field control enables the decoupling of electrical and thermal transport, offering insights into fundamental mechanisms and potential applications in tunable thermoelectric devices.

Keywords: Thermoelectric transport; Quantum spin Hall insulator; Jacutingaite; External fields.

S3.P2

Structural properties of densified boron silicon nitride under high pressure: insights from molecular dynamics simulation

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The molecular dynamics (MD) simulations were used to study the structural properties of boron silicon nitride (B-Si-B) under the high pressure. We cooled down the B-Si-N model from the high temperature of 5000 K to 300 K under the high pressure of 60 Gpa. The B-Si-N model exhibits disordered structure at 4000 K and 3500 K. The local entropy analysis indicated that the B-Si-N model has a heterogeneous structure at high temperatures of 4000 K and 3500 K. The more ordered atoms aggregate together to form more ordered clusters and the less ordered atoms also aggregate together to form clusters. With decreasing temperature, the phase occurs in the temperature range of 3400 K to 3100 K. The common neighbour analysis (CNA) indicated that face-centered cubic (fcc) and hexagonal close packed (hcp) crystals of N atoms are initially formed in the silicon nitride region. The crystal clusters have mainly fcc structure of N atoms and a small amount of hcp structure of N atoms. The crystallization mechanism will be discussed in detail in this paper.

Keywords: Boron silicon nitride; Molecular dynamics; Crystals; Structural properties.

S3.P3

EXAFS Debye-Waller factor and melting temperature of fcc-structured metals under extreme conditions with non-ideal c/a axial ratio

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In this work, the EXAFS Debye-Waller factor of fcc-structured metals under high temperature and pressure was studied. We also took into account the effect of the non-ideal c/a axis ratio using a semi-empirical method. The correlation shift function in the X-ray absorption fine structure spectrum was determined on the basis of the Debye-Waller factor. The effective interaction potential was approximately determined by considering the contributions of the neighboring atoms surrounding the absorbing and back-scattering atoms. The analytical expression of the EXAFS Debye-Waller factor, dependent on volume (pressure) and the c/a axis ratio, was derived based on the application of the Debye model. Numerical calculations were performed for copper, nickel, and indium up to temperature of 700 K and pressure of 300 GPa. In addition, the melting temperatures of copper, nickel, and indium under high pressure were calculated by combining the Debye model and Lindemann's melting law. The obtained melting curves of these metals are in good agreement with the experimental data. This suggests that the present theoretical model can be applied to other metals and alloys under extreme conditions.

Keywords: EXAFS Debye-Waller factor; Melting temperature; Metals; High temperature; High pressure.

S3.P4

Anharmonic high-order EXAFS cumulants of cadmium metal affected by thermal and structural disorders

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The anharmonic high-order extended X-ray absorption fine structure (EXAFS) cumulants of cadmium metal (Cd) have been theoretically analyzed with explicit treatment of both thermal and structural disorders. The proposed model is formulated using a first-order perturbation approach within the framework of quantum statistical theory. It incorporates the correlated Einstein model together with an anharmonic effective potential that characterizes atomic interactions. The resulting thermodynamic EXAFS parameters account for both correlational and anharmonic effects, explicitly considering the influence of nearest-neighbor atoms on the

absorber and backscatter. Temperature-dependent analytical expressions are derived in explicit form, accurately describing the physical behavior in both low- and high-temperature regimes. Numerical calculations for Cd show good agreement with available experimental data and other theoretical models in the temperature range of 0–500 K. These results confirm that the present theoretical framework is effective for analyzing anharmonic high-order EXAFS cumulants in thermally disordered metals, and provide a reliable tool for studying structurally disordered systems with complex thermal dynamics.

Keywords: Anharmonic high-order EXAFS cumulants; Cadmium metal; Quantum-statistical perturbation theory; Structurally disordered system.

S3.P5

Electronic origin of pressure-induced isostructural modifications in $Ca_3Co_2O_6$

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Structural peculiarities of $Ca_3Co_2O_6$, including its low dimensionality and inherent geometric frustrations, are main resources of the exotic physical properties observed for this material. Exploring the interplay between the lattice and other electronic degrees of freedom is crucial for understanding the mechanism governing its physical

behavior. In this study, we present a comprehensive analysis of the structural features of $Ca_3Co_2O_6$ in a large pressure range of 0 to 30 GPa, utilizing a combination of X-ray diffraction and Raman spectroscopy, complemented by density functional theory calculations. Notably, we observed several isostructural modifications at 3, 10, and 22 GPa, which have not been detected elsewhere. These phase transitions are accompanied by anomalies in the pressure-dependent variations of Ca and O atomic positions and Co-O interatomic bonds. Bader charge analysis also reveals changes in charge redistribution trend among Co, Ca, and O across the phase transitions, suggesting an electronic origin for the pressure-induced isostructural transitions in $Ca_3Co_2O_6$.

Keywords: Isostructural transformations; High pressures; Raman spectroscopy; X-ray diffraction.

S3.P6

Slater–Koster Tight-Binding Model of Twisted Bilayer Graphene at the Magic Angle with Hopping Parameter Adjustment

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We construct a full-atom tight-binding model (TBM) for twisted bilayer graphene that is applicable to arbitrary twist angles, including the magic angle 1.05°. The model fully incorporates the p_z orbitals and is refined through the decay parameter delta and an interaction distance cutoff, optimizing computational cost while accurately reproducing the flat bands. From this model, we obtain the energy spectrum and atomic-scale wavefunctions, enabling the verification of topological indicators such as Berry connection, Berry curvature, and Chern number. Furthermore, the model can serve as an input for Wannier90 or be extended to non-periodic systems.

Keywords: Flat bands; Slater-Koster model; Tight-binding model; Twisted bilayer graphene.

S3.P7

Correlated mechanical and electronic anisotropies in 2D Janus auxetic materials: First-principles insights into Si_2XY (X/Y = S, Se, Te)

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In this study, we systematically investigate the structural, mechanical, electronic, and transport properties of two-dimensional (2D) ternary Janus Si_2XY (X/Y = S, Se, Te) monolayers using first-principles density functional theory (DFT) calculations. Our results reveal that all three monolayers are direct semiconductors with moderate band gap energies and exhibit good thermodynamic and dynamic stabilities, suggesting their feasibility for experimental synthesis. The charge transport properties are further explored through carrier mobility calculations. Remarkably, all three Si_2XY monolayers display pronounced anisotropic carrier mobilities, not only between electrons and holes but also between the two in-plane transport directions. Among them, the Si_2SSe monolayer demonstrates the highest electron mobility, reaching 897.66 $cm^2\ V^{-1}\ s^{-1}$ along the x-axis. Even more intriguingly, our mechanical analysis uncovers that these Janus monolayers exhibit auxetic behavior, characterized by a negative Poisson's ratio along both x and y directions. In particular, the Si_2SSe monolayer shows the largest negative Poisson's ratio, with a value of –0.131 along the x-axis. These findings highlight the exceptional combination of anisotropic electronic transport and auxetic mechanical response in Si_2XY monolayers, opening promising opportunities for their potential applications in future electronic, optoelectronic, and nanomechanical devices.

Keywords: 2D Janus materials; Negative Poisson's ratio; Carrier mobility; First-principles calculations.

S4.P1

Quantum Simulation of Collective Neutrino Oscillations

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In this work, we present a quantum simulation framework for modeling the collective oscillations of neutrinos in both two-flavor and three-flavor cases. For the two-flavor scenario, each neutrino is encoded as a qubit, providing a natural representation of the SU(2) flavor symmetry. For the three-flavor case, we extend the encoding to qutrits—quantum systems with three energy levels—that capture the full SU(3) flavor structure. The time evolution governed by the collective Hamiltonian is approximated using the Trotter–Suzuki decomposition, which enables the construction of quantum circuits composed of qubit or qutrit gates corresponding to the decomposed unitary operators.
Keywords: Collective neutrino oscillations, Quantum simulation, Qubit and qutrit encoding.

S4.P2

Reflection coefficient of a superconducting qubit coupled to a transmission line

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Qubit readout is a fundamental task in quantum research, providing access to key properties such as operating frequency and coherence time through the analysis of reflected and transmitted signals. For superconducting qubits, we consider the Cooper Pair Box model, treated as an artificial atom coupled to a transmission line. One end of the line is open to infinity, while the other terminates at a capacitor acting as a mirror that reflects electromagnetic waves. To calculate the reflection coefficient of this system, we employ tools from circuit quantum electrodynamics, transmission-line theory, and the theory of open quantum systems. The analysis is carried out in two regimes: when the artificial atom behaves as a harmonic oscillator and when it exhibits genuine two-level qubit behavior. This framework enables us to study how the position of the artificial atom along the transmission line influences the reflection spectrum.

Keywords: Superconducting qubit, open quantum system, qubit readout.

S4.P3

Excited-State Quantum Simulation via Folded-Spectrum Variational Quantum Eigensolver with Quantum Natural Gradient Optimization

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We propose a hybrid quantum-classical approach that integrates the Folded-Spectrum Variational Quantum Eigensolver (FS-VQE) with Quantum Natural Gradient (QNG) optimization. The FS-VQE reformulates the eigenvalue problem by minimizing the expectation value of the squared shifted Hamiltonian, allowing selective targeting of excited states. The QNG method leverages the quantum Fisher information matrix to provide geometry-aware parameter updates, resulting in improved convergence and robustness against barren plateaus. Numerical experiments on the benchmark Ising model show that this combined strategy achieves higher accuracy and faster convergence than conventional gradient-based optimizers.

Keywords: Folded-Spectrum method, Variational Quantum Eigensolver, Quantum Natural Gradient.

S4.P4

Shaped Control Pulses for High-Fidelity Single-Qubit Gates in Superconducting Circuits

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Precise control of qubit dynamics is essential for realizing high-fidelity gate operations in superconducting quantum computing. A major challenge stems from the multilevel structure of transmon qubits, which induces leakage outside the computational subspace. To mitigate this effect, the derivative removal by adiabatic gate (DRAG) technique has been widely developed. In this work, we present a theoretical overview of the DRAG method and its application to the construction of single-qubit gates. We demonstrate that properly engineered control pulses, incorporating derivative components, can effectively suppress both leakage and phase errors during gate implementation.

Keywords: Superconducting qubit, quantum optimal control.

S4.P5

Determining the Shape of Paper Sheets with Quantum Physics-Informed Neural Networks

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In this study, we employ Physics-Informed Neural Networks (PINNs) to determine the shape of paper sheets governed by elasticity and deformation equations. PINNs provide a natural framework by embedding physical laws into the learning process, allowing accurate reconstruction from limited boundary information. To extend this framework, we investigate a Quantum Physics-Informed Neural Network (QPINN) to test the feasibility of quantum-enhanced optimization. We then compare the performance of PINNs and QPINNs in capturing nonlinear deformation patterns of paper sheets.

Keywords: The shape of paper sheets, Physics-Informed Neural Networks, Quantum Neural Networks.

S5.P1

Integrated Correction Factor for Ionization Chamber Electrodes in Measurement of Absorbed Dose to Water from a Medical Linear Accelerator: Geant4 Simulation

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An ionization chamber (IC) is commonly used for measuring absorbed dose to water (D_w) in medical linear accelerator (Linac) radiotherapy facilities. However, the physical structure of an IC (i.e., air cavity and electrodes) introduces a disturbance in D_w measurement – due to the difference between the chamber cells' materials and water. Consequently, an integrated correction factor (IcF) specific to IC electrodes is required. In this work, Geant4 Monte Carlo code was employed to determine the IcF values for 02 different ICs used in D_w measurements (at 10 cm depth in a water tank), irradiated with Linac X-ray beams with the maximum energy of 6 MeV – hereafter, referred to as the 6 MV Linac spectrum (obtained from Geant4 simulation of corresponding Linac phase space). This 6 MV Linac spectrum was then used as the input for further Geant4 simulations to determine energies deposited under 02 conditions: (i) in the active volume (with material of water) of the real IC (electrodes' materials are as manufacturer's specifications) – denoted as D_w^{IC-vol} and (ii) in the active volume of a dummy IC (same geometry as the real IC but all of its cells filled with water) – denoted as D_w^{d-vol}. The IcF values in D_w measurement using the IC is defined as the ratio of $\frac{D_w^{d-vol}}{D_w^{IC-vol}}$. As results, the simulated values of IcF were found to be for 1.0112 (PTW31010) and 1.0116 (PTW31013), with the associated statistical standard uncertainties as 0.63% and 0.62%, respectively.

Keywords: Standard uncertainty, ratio, radiotherapy, spectrum

S5.P2

Determination of the Conventional True Value of Ambient Dose Equivalent Rate Induced by Gamma Radiation from Reference ^{137}Cs Sources

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This paper presents the determination of the conventional true value of the ambient dose equivalent rate – denoted as $\dot{H}^*(10)$, at different distances, induced by gamma radiation from two ^{137}Cs sources (with different activities). The determination of $\dot{H}^*(10)$ was carried out using gamma radiation dose measurement systems that were calibrated at a secondary standard dosimetry laboratory (SSDL) for ionizing radiation dose. The combined standard measurement uncertainty of the obtained $\dot{H}^*(10)$ values was evaluated to be approximately 4.0%.

Keywords: Ambient dose equivalent rate $\dot{H}^*(10)$, Air kerma, gamma radiation, uncertainty

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S5.P3

Evaluation of proton energy and target thickness in cyclotron-based ^{18}F production using ISOTOPIA simulations

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Positron Emission Tomography is a key imaging technique in modern nuclear medicine, particularly for cancer diagnosis and monitoring. Among available radionuclides, ^{18}F is widely used due to its favorable half-life, low positron energy, and ability to label diverse biomolecules. Typically, ^{18}F is produced via the ^{18}O(p,n) ^{18}F reaction occurring when ^{18}O-enriched water target is bombarded by proton accelerated by using a cyclotron. The production yield increases with target thickness but at the expense of higher ^{18}O consumption; therefore, for a given target yield, the optimal combination of proton energy and thickness must be carefully selected. In this study, we define R as the ^{18}F activity per 1 μA current obtained after 2 hours of irradiation and investigate optimal proton energy (E) and target thickness

(t) ranges required to achieve a given R value. Simulations were performed with ISOTOPIA software for E between 3 and 20 MeV (in 0.5 MeV steps) and t from 0.5 to 10 mm (in 0.2 mm steps). The results reveal that for each target R, there exists an optimal energy window, with which target thickness is minimized. For example, to achieve R = 0.02 $\mathrm{Ci}/\mu A$, the optimal energy range is $E = 5.5 - 12$ MeV with target thickness (t) of 0.5 mm; for R = 0.1 $\mathrm{Ci}/\mu A$, $E = 10 - 11.5$ MeV at $t = 1.5$ mm; and for R = 0.16 $\mathrm{Ci}/\mu A$, $E = 16$ MeV at $t = 3.7$ mm. These findings highlight the critical role of proton energy selection in optimizing ^{18}F production, improving efficiency, and reducing unnecessary target volume.

Keywords: Fluorine-18 production; proton energy; target thickness; cyclotron

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S5.P4

Assessment of radon concentration in domestic water in Long Khanh area, Dong Nai province

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This study employs an electronic radon meter (RAD7) to quantify radon concentration levels in water. We analyzed 18 residential water samples from various locations in the Long Khanh area to evaluate radon levels. The findings revealed that radon concentrations in the residential water samples varied from 0.17 ± 0.33 Bq/l to 0.86 ± 0.50 Bq/l, with a mean concentration of 0.38 ± 0.30 Bq/l. The radon content in all analyzed samples is within the World Health Organization (WHO) limit. The average yearly effective doses from radon consumption and inhalation from water for adults, children, and newborns are 1.7 mSv/y, 1.97 mSv/y, and 2.97 mSv/y, respectively. The readings were below the acceptable thresholds established by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the International Commission on Radiological Protection (ICRP).

Keywords: RAD7, annual effective doses, domestic water, radon, Dong Nai

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S5.P5

Determining Activity Ratios of Radionuclides in Soil and Rock Samples with Different Geological Backgrounds

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This study presents a method for determining the activity ratios of the radionuclides ^{137}Cs, ^{40}K, ^{238}U, ^{226}Ra, ^{228}Ac, and ^{208}Tl in soil, rock, and sediment samples using a wide-range gamma spectrometry system with a relative efficiency calibration curve. The activity ratio between two radionuclides in a sample (A_1/A_2) is determined according to the formula $A_1/A_2 = (n_1/I_{\gamma,1})/f(E_{\gamma,1})$, where n_1 and $I\gamma,1$ are the count rate at the full-energy peak and the relative intensity of the characteristic gamma ray with energy $E_{\gamma,1}$ emitted by radionuclide (1), respectively, and $f(E_{\gamma,1})$ is the relative detection efficiency at energy $E_{\gamma,1}$, established from the characteristic gamma rays emitted by radionuclide (2) present in the sample. Based on the IAEA reference materials RGU-1, RGTh-1, RGK-1, and IAEA-375, secondary standard materials were prepared with varying matrix compositions but constant activity ratios. Experimental results demonstrate that, with a confidence level of 95%, the activity ratios of the radionuclides remain unaffected by wide variations in the sample matrix composition, confirming the robustness and high accuracy of the proposed method.
Keywords: Activity concentration, acitivity ratio, relative efficiency.

S5.P6

STUDY ON THE POTENTIAL USE OF THE RIGAKU 200-EGM X-RAY GENERATOR FOR INSPECTING THE INTEGRITY AND INTERNAL STRUCTURE OF FUEL RODS IN THE ĐA LAT NUCLEAR REACTOR

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In this study, we investigate the feasibility of using the RIGAKU200-EGM X-ray generator to inspect the integrity and structure of the fuel rods in the Đa Lat nuclear reactor. A model of the VVR-M2 fuel rod from the Russian Federation was fabricated. X-ray images of the fuel rod model were taken using the RIGAKU200-EGM X-ray generator at the Training Center of the Nuclear Research Institute. The captured images exhibit high sharpness and can detect cracks of approximately 0,25mm in size. The obtained results indicate that the RIGAKU200-EGM X-ray generator can be used to examine the integrity and internal structure of VVR-M2 fuel rods, which are scheduled to be loaded into the core of the Đa Lat nuclear reactor by the end of 2025. This study also serves as a foundation for improving, expanding, and supplementing the system of practical exercises at the Training Center of the Nuclear Research Institute.

Keywords: Non-destructive testing, X-ray imaging, VVR-M2 fuel.

S5.P7

Greenhouse gas mitigation in climate-smart agriculture need smart irrigation technologies: A critical review and application potential in Vietnam

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Climate change is increasing pressure on global agriculture, including in Vietnam. Irrigation accounts for about 70% of worldwide freshwater use and nearly 15% of total greenhouse gas emissions. In particular, rice cultivation is the major source of methane (CH_4) emissions, the second most important greenhouse gas, which has a global warming potential roughly 25 times greater than that of CO_2. To promote climate-smart farming, adopting innovative irrigation technologies is essential for conserving water and reducing emissions. This review covers modern irrigation methods such as alternate wetting and drying (AWD) for rice; drip and subsurface irrigation combined with fertigation for fruit trees, vegetables, and industrial crops; variable rate irrigation (VRI) for large farms; and the use of the Internet of Things (IoT), artificial intelligence (AI), renewable energy, and cosmic-ray neutron sensing (CRNS) for large-scale soil moisture monitoring. Findings show that: (i) AWD can cut CH_4 emissions by 20-50% and save 15-30% of water in rice systems; (ii) drip and subsurface irrigation can boost water efficiency by 25-60%, lower nutrient losses, and decrease N_2O emissions in upland crops; (iii) VRI and IoT/AI systems allow precise water management in space and time; and (iv) CRNS offers continuous, field-scale soil moisture data, supporting precision irrigation for

different crops. The application potential is especially notable in Vietnam's Mekong River Delta and Red River Delta for rice; the Central Highlands for industrial crops like coffee and pepper; the Southern region for fruit orchards; and key vegetable areas. Major barriers include high costs, fragmented landholdings, limited extension services, and a lack of monitoring, reporting, and verification (MRV) systems for carbon markets. Proposed solutions include standardizing AWD practices at the cooperative level; developing green credit packages for drip, subsurface irrigation, and CRNS sensors; expanding extension services and technical training; creating an integrated data platform combining sensor and satellite data for diverse crops; and establishing MRV frameworks locally. These strategies will support the growth of climate-smart agriculture, helping reduce emissions and foster sustainable climate adaptation in Vietnam.

Keywords: Irrigation technologies; Greenhouse gas emissions; Smart agriculture; Mitigation.

S5.P8

Evaluation of kinetic parameters of the Dalat Nuclear Research Reactor with fuel burnup using a Continuous-Energy Monte Carlo method

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Kinetic parameters of the Dalat Nuclear Research Reactor (DNRR) loaded with low-enriched uranium (LEU) fuel under burnup condition were evaluated using a continuous-energy Monte Carlo method and the ENDF/B-VIII.0 nuclear data library. The kinetic parameters, including the effective delayed neutron fraction (β_{eff}), the neutron generation time (Λ), and the prompt neutron lifetime (l_p), were calculated as functions of fuel burnup and analysed for reactor dynamics and safety implications. The results indicate that β_{eff} initially increases from 735 pcm to 750 pcm during the first 50 days of operation. During this period, Λ increases from 81.08 µs to 82.03 µs, whereas l_p decreases from 81.0 µs to 80.07 µs. Understanding these behaviours of the kinetic parameters would contribute to an improved safety assessment and effective core management strategies for the DNRR.

Keywords: Kinetic parameters, DNRR, LEU, ENDF/B-VIII.0.

S5.P9

Conceptual design of a 240 kWth micro nuclear reactor using potassium heat pipe

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Micro reactors are among the most attractive options for space applications, including planetary missions and deep-space exploration. A micro nuclear reactor cooled by heat pipes offers a compact structure, high power density, potential cost advantages, and enhanced safety and reliability, making it a cost-effective source of electrical power. In this work, we present the design analysis of a 240 kWth micro nuclear reactor core using uranium dioxide (UO_2) fuel and a potassium heat pipe cooling system. Monolith materials are stainless steel and alumina for the core structure and side reflector. Reactivity is controlled by six B_4C neutron-absorber control drums. A Monte Carlo analysis was performed to evaluate core performance, including criticality parameters, power peaking factors, power distribution, flux distribution, neutron fluence, and fuel burnup. The results indicate that the reactor could operate safely for 10 years, delivering 240 kW of thermal power. This work provides a reference for the design and application of micro nuclear power sources in space environments.

Keywords: Micro nuclear reactor; Serpent.

S6.P1

Synthesis and luminescent properties of $BaSiO_3$: Bi^{3+} phosphors prepared by solid-state reaction

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$BaSiO_3$: Bi^{3+} is considered a promising phosphor material for white light-emitting diode (WLED) applications due to the strong near-UV absorption and broad visible emission of Bi^{3+} ions, particularly in the blue–yellow region. In this study, $BaSiO_3$: Bi^{3+} phosphor powders were synthesized via a solid-state reaction. X-ray diffraction (XRD) analysis of $BaSiO_3$: 4% Bi^{3+} samples calcined at 1200 and 1250 °C confirmed the formation of the orthorhombic $BaSiO_3$ phase as the main crystalline structure. Photoluminescence measurements revealed that the sample doped with 4% Bi^{3+} and calcined at 1200 °C, when excited at 273 nm, exhibited a broad emission band spanning 350–650 nm, with the highest luminescence intensity observed in this study.
Keywords: $BaSiO_3$: Bi^{3+}; solid-state reaction method; WLEDs.

S6.P2

Abnormal-reduction of Eu^{3+} doped Al_2O_3-SiO_2 glass in the air atmosphere

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The aluminosilicate $20Al_2O_3$-$80SiO_2$:5wt%Eu_2O_3 glasses were fabricated using the melting method at 1550°C. The crystal structure and surfaces of the fabricated glasses were investigated in detail through X-ray diffraction and SEM images. The XRD patterns and SEM images indicate that the prepared glasses have an amorphous-like structure and high homogeneity of the glass formation. The results in the photoluminescence (PL) and photoluminescence excitation (PLE) spectra confirm that Eu^{3+} ions doped in Al_2O_3-SiO_2 glasses can be well reduced to Eu^{2+} in both an air atmosphere and an H_2 gas. In both cases, the PL spectra of Eu^{2+} emission have a broad band due to the 5d-4f transitions of Eu^{2+} ions in the host lattice. Eu^{2+} emission increases in H_2 gas and its peak shifts to a long wavelength of 20 nm compared to that in air, indicating that the crystal field of the annealed H_2 sample become stronger. The emission of Eu^{2+}/Eu^{3+} from red light to pure blue light was obtained in Eu-doped sodium aluminosilicate glasses as displayed in the CIE coordinates, suggesting that the sample may be a potential candidate for blue-emitting light material.
Keywords: Abnormal-reduction; Al_2O_3-SiO_2 glass; Eu^{2+}/Eu^{3+}.

S6.P3

A CNT/MoO3 nanohybrid for ultra-sensitive ethanol sensing at room temperature

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In this study, one-dimensional carbon nanotube (CNT) and zero-dimensional MoO3 nanohybrids were synthesized using a simple arc-discharge method for ethanol gas sensor applications. MoO3 nanoparticles were uniformly distributed on the surface of mesoporous CNTs, which increased the specific surface area and the availability of active sites for charge carriers within the nanohybrid. MoO3 functions as the receptor, while the CNTs serve as the transducer, leading to the modification in the depletion region at the hybrid surface followed by enhancement of the sensing performance. The CNT/MoO3 sensor exhibited the highest response of 76.5 % to 1 ppm ethanol even at room temperature operation (30 °C), significantly outperforming CNT (12.5 %) and MoO3 (2.5 %). Additionally, the CNT/MoO3 sensor revealed rapid response and recovery time, excellent selectivity, and minimal humidity dependence. SEM, TEM, XRD, XPS, and BET analyses confirmed that the improved gas sensitivity of the CNT/MoO3 nanohybrid is attributed to the increased active sites for charge carriers, abundant surface vacancies, and modification in the depletion region.

Keywords: Nanohybrid, Room temperature gas sensor, Ethanol, CNT/MoO3

S6.P4

Overcoming the solubility challenges of antidiabetic gliclazide via atomic layer deposition

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Diabetes mellitus is a rapidly growing global health challenge, with type 2 diabetes accounting for the majority of cases. An effective treatment often relies on oral antidiabetic drugs; however, the poor water solubility of many active compounds limits their bioavailability and therapeutic outcomes. Gliclazide (GLZ), a sulfonylurea widely prescribed for type 2 diabetes, exemplifies this issue due to its low aqueous solubility. In this study, we demonstrate the use of atomic layer deposition (ALD) as a novel surface engineering strategy to address this challenge. Ultra-thin SiO2 coatings deposited on GLZ particles transformed their wettability from hydrophobic to highly hydrophilic, enabling an improved dispersion in aqueous media and a substantially faster dissolution. Furthermore, by tuning the coating thickness, we achieved controlled modulation of the dissolution rate, providing flexibility in designing drug release profiles. Our results reveal the potential of ALD-derived coatings to overcome solubility limitations, enhance bioavailability, and enable advanced controlled-release formulations for GLZ and other poorly soluble drugs in diabetes therapy.

Keywords: Poorly soluble drugs; Type 2 diabetes; Gliclazide; Atomic layer deposition; Fluidized bed reactor; Surface engineering.

S6.P5

Electrodeposition of Sn-Zn alloys on copper electrodes from a non-aqueous solvent

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In this study, the electrochemical behavior, electrodeposition, and anti-corrosion properties of Tin-Zinc (Sn-Zn) alloys on a copper (Cu) electrode were examined in non-aqueous ethylene glycol (EG) solutions using cyclic voltammetry, chronoamperometry (CA), and Tafel corrosion measurements at room temperature. CVs have shown the a peak corresponding to the transition fom Sn(II)-Zn(II) to Sn-Zn solid phase, indicating that this process occurs through a single reduction step.

The CAs analyzed the initial phase of Sn-Zn electrodeposition, demonstrating its successful electrosynthesis onto the Cu substrate. Scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDS and EDS mapping) confirmed the presence of Sn-Zn deposits on the Cu substrate produced via a potentiostatic method, revealing a morphology consisting of thin film Sn-Zn alloys with uniform distribution. Finally, the anti-corrosion properties of the fabricated Sn-Zn alloy electrodeposited onto a Cu electrode were examined by the Tafel corrosion technique in both acidic (0.5M H_2SO_4) and alkaline (0.5M KOH) environments. They show an enhancement in the anti-corrosion properties of Sn-Zn/Cu coating when compared to the original Cu electrode. This method expands a potential approach from the electrochemistry study to the synthesis and examination of corrosion properties on a direct standard Cu electrode, which is suitable for large-scale applications such as gas sensors and fuel cells.

Keywords: Tin-Zinc alloys, electronucleation, non-aqueous solvent, ethylene glycol

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S6.P6

Synthesis and Optical Properties of Eu^{3+}/Bi^{3+} Co-Doped $SrMoO_4$ Red-Emitting Phosphors for WLED Applications

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In this study, red-emitting $SrMoO_4$ phosphors co-doped with Eu^{3+} and Bi^{3+} were successfully synthesized via a solid-state reaction method. The optimized sample was obtained after annealing at 1200 °C for 5 hours with doping concentrations of 3% Eu^{3+} and 4% Bi^{3+}. X-ray diffraction (XRD) analysis revealed that the synthesized material exhibited a single-phase crystalline structure with no detectable secondary phases, belonging to the tetragonal space group $I4_1/a$. Field-emission scanning electron microscopy (FESEM) images showed relatively large average particle sizes ranging from 5 to 10 μm. Energy-dispersive spectroscopy (EDS) further confirmed the absence of impurities in the material. Under blue-light excitation, the phosphors displayed strong red emission in the wavelength range of 590–710 nm with characteristic peaks at 590 nm, (611, 615) nm, and 700 nm, corresponding to the $^5D_0 \rightarrow {}^7F_j$ (j = 1, 2, 4) transitions of Eu^{3+} ions. Compared with Eu^{3+} single-doped samples,

the Eu^{3+}/Bi^{3+} co-doped phosphors exhibited enhanced photoluminescence intensity, which can be attributed to the energy transfer from Bi^{3+} ions to Eu^{3+} ions. Therefore, $SrMoO_4:Eu^{3+}/Bi^{3+}$ demonstrates great potential as a red-light source for high-power white LEDs (WLEDs) under blue-light excitation.
Keywords: $SrMoO_4:Eu^{3+}$ co-doped with Bi^{3+};; WLEDs; red-emitting phosphors.

S6.P7

ZnO/Ag Nanocomposite-Modified Electrode for the Development of a Non-Enzymatic Glucose Biosensor

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In this study, an electrochemical non-enzymatic glucose sensor based on zinc oxide/silver (ZnO/Ag) nanocomposites was successfully fabricated. The structural and morphological characteristics of the synthesized ZnO/Ag nanocomposites were examined using field-emission scanning electron microscopy (FE-SEM), energy-dispersive X-ray spectroscopy (EDX), and X-ray diffraction (XRD). The fabricated ZnO/Ag-based glucose sensor exhibited a high sensitivity of 10.811 $mA/mM \cdot cm^2$ and a low detection limit of 0.19 µM. Moreover, the sensor demonstrated a rapid amperometric response time of 5 s, indicating excellent electrocatalytic performance toward glucose oxidation. These findings highlight the potential of the proposed ZnO/Ag nanocomposite electrode for practical applications in biomedical diagnostics and environmental monitoring.
Keywords: Biosensor, Electrochemical sensor, ZnO/Ag, Non-enzymatic.

S6.P8

Synthesis and enhancement of red luminescence properties of Eu^{3+} ion-doped ZnMoO4

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In recent years, the development of red-emitting phosphor materials has received growing attention due to their suitability for phosphor-converted white light-emitting diodes (pc-WLEDs). In this study, we report the synthesis and optimization of red-emitting Eu^{3+}-doped $ZnMoO_4$ (ZMO: Eu^{3+}) phosphors via a solid-state reaction method. Analyses of the XRD, Raman, and XPS confirmed the formation of a single-phase triclinic $ZnMoO_4$ structure, and the Eu^{3+} ions successfully substituted at Zn^{2+} sites in the crystal structure. FESEM and EDS analyses reveal that the prepared ZMO: Eu^{3+} phosphors have a high purity with formed angular particles in a few μm size range. The photoluminescence excitation (PLE) spectrum of ZMO: Eu^{3+} exhibit multiple narrow peaks with the strongest peak at 394 nm, along with weaker absorption peaking at 464 nm. Under excitation of 394 nm, the optimized ZMO: 4% Eu^{3+} sample annealed at 900 °C for 3 hours emits an intense red emission peaking at 615 nm, originating from the $^5D_0 \rightarrow {}^7F_2$ transition of Eu^{3+} ions. The temperature-dependent emission reveals a good thermal stability of the ZMO: Eu^{3+}, where the PL intensity remains at 76.6% when operate at 130°C compared to its value at room temperature. These results showed promising potential for ZMO: Eu^{3+} phosphor as a red component, which can be used in high-quality pc-WLED applications.

Keywords: ZMO :Eu^{3+}; Red emission; pc-WLEDs; solid-state reaction.

S6.P9

Towards Accurate Formation Energy Prediction in Battery Materials: A Study of Multi-Layer Perceptrons, and Kolmogorov-Arnold Networks

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Formation energy is a critical descriptor for assessing the thermodynamic stability of crystalline structures, and its accurate prediction has become an essential step in the materials discovery pipeline. In this study, we introduce a Kolmogorov-Arnold Network (KAN) architecture specifically designed to predict the formation energy of crystals from structural descriptors with high accuracy. We systematically benchmarked conventional artificial neural networks against KAN, and the results demonstrate that KAN achieves superior predictive performance (R2 = 0.89, RMSE = 0.06) in estimating formation energies. Our findings provide new insights into the potential of Kolmogorov-Arnold Networks as a robust alternative to standard Multi-Layer Perceptrons (MLPs) for property prediction in materials science

Keywords: Kolmogorov-Arnold Network, Multi-Layer Perceptrons, Formation Energy.

S6.P10

A ZnO/ZnTe nanorod based hybrid for light irradiation enhanced room temperature NO_2 gas sensor

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This study focuses on fabricating a hybrid structure consisting of ZnO nanorods and ZnTe nanoparticles for NO_2 gas detection, particularly exploring the impact of light irradiation at room temperature (RT). The morphology, physical characteristics, and chemical properties of the ZnO/ZnTe hybrid structure are carefully studied under diversified analytical methods such as X-ray diffraction (XRD), Transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS), and other measurements. The ZnO/ZnTe composite displayed an improved response toward 500 ppb NO_2 under the blue light radiation effect. It claimed higher response (more than 2500 %), response time (faster than 3000 %), and recovery time (faster than 1000%) at RT comparing with pure ZnO. Hence, blue light irradiation revealed a more promising sensing performance than UV irradiation's case (200% response). The depletion theory, the oxygen vacancy, the catalytic effect of zinc telluride, and the absorption coefficient modulation of the gas sensor based on different materials explained the overall performance of the nanohybrid structured sensor.

Keywords: Light irradiation effect, Room temperature gas sensor, NO_2, ZnO/ZnTe

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S6.P11

Effect of $SrZrO_3$ doping on the structural and electrical properties of $BaTiO_3$-based piezoelectric ceramics.

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In this study, lead-free piezoelectric ceramic of (1-x)$BaTiO_3$ - $x$$SrZrO_3$ + 1 wt. % Li_2CO_3 with x = 0, 0.03, 0.06, 0.09. 0.12 and 0.15 (abbreviated BTSZ) was synthesized by solid state reaction method. The sinterability of BTSZ was enhanced by using 1 wt. % of Li_2CO_3 as a sintering aid, the sintering temperature was reduced from 1300 ºC to 1100 ºC. X-ray diffraction results showed that the crystal structure was changed from tetragonal to cubic when $SrZrO_3$ concentration reached 0.06. The residual polarization P_r decreased sharply from 6 to 1.14 μC/cm^2 and the energy consumption decreased as the SZ content increased. The material begins to change phase from ferroelectric to relaxor ferroelectric when x = 0.06, completely transitioning to relaxor ferroelectric when x = 0.12, which lowered the piezoelectric properties but significantly increased the storage energy ability. Specifically, at x = 0.12, dielectric constant up to 2100, recoverable energy density reached 0.092 J/cm^3 and energy efficiency value was 54.68%.
Keywords: BaTiO3, Lead-free, Piezoelectric ceramic, Dielectric, Energy storage.

S6.P12

Optical Properties of One-Dimensional ZnS/MoS$_2$ Hybrid Materials Synthesized by Thermal Evaporation and Hydrothermal Methods

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One-dimensional ZnS/MoS_2 hybrid nanostructures were prepared using a combined thermal evaporation and hydrothermal method. Structural and morphological analyses (SEM, EDS, and TEM) confirmed the successful integration of ZnS and MoS_2, while Rietveld-refined XRD patterns revealed strong crystal phase interactions and defect formation dependent on hydrothermal conditions. Photoluminescence studies showed defect-related emissions in the 400–600 nm range for ZnS at low precursor concentrations, with higher concentrations effectively reducing defect density. These results highlight the tunability of defect states in ZnS/MoS_2 hybrids and their promise for advanced sensor and electrochemical applications.
Keywords: ZnS/MoS_2, Optical properties, Hybrid materials.

S6.P13

Strain-Engineered Phase Switching in 8-8 ZnS Nanosheets: From Flattened Porous to Cage-Like Architectures.

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The rise of two-dimensional (2D) materials, especially in nanosheet form, has generated considerable interest due to properties that diverge markedly from their bulk counterparts. Among these materials, zinc sulfite (ZnS) exhibits highly tunable electronic, optical, and mechanical characteristics.Yet, elucidating strain-driven phase transitions in ultrathin nanosheet systems remains a fundamental challenge, particularly for nanoporous ZnS architectures. In this work, we explore a novel flattened nanosheet-hereafter termed the 8-8 ZnS-based nanosheet-and its derived cage-like porous phase variant, demonstrating a first-order phase transition between a cage-like (8-8-C) and a flattened (8-8-F) phase under tensile strain. Using the semi-empirical DFTB+ method, we show that this transformation is accompanied by abrupt changes in volume, as well as in electronic and mechanical structure, enabling reversible modulation of both the bandgap and pore geometry. Minimum Energy Path (MEP) analyses indicate that the activation energy barrier can be tuned by strain, supporting strain-engineered phase transitions. Additionally, we assess the structural stability, strain energy, and electronic properties of the 8-8 nanosheets, providing design principles for strain-engineered ZnS-based materials. These findings lay the groundwork for adaptive materials with potential applications in flexible electronics, strain-tunable optoelectronics, and molecular encapsulation technologies.

Keywords: DFTB+, Porou nanosheets, Structure design, Phase transition.

S6.P14

Electrochemical phase formation and growth of copper from Cu(I) in deep eutectic solvent

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Electrodeposition of copper from deep eutectic solvents (DES) has attracted considerable interest as an environmentally friendly alternative to conventional aqueous systems. In this study, the electrochemical phase formation and growth of copper on a glassy carbon electrode from Cu(I) precursor dissolved in deep eutectic solvents (DES) (a molar ratio of 1:2 eutectic mixture of choline and ethylene glycol) was systematically investigated using electrochemical techniques. Cyclic voltammetry (CV) was employed to determine the potential range over which copper crystallization occurred, verifying the capability of depositing copper in the studied system. Meanwhile, the formation and growth mechanism and kinetics of copper nanoparticles was investigated using chronoamperometry (CA) technique. From CA analysis, it was found that the electrochemical deposition process of copper followed a three-dimensional nucleation and diffusion-controlled growth process. The nondimensional analysis suggests that the nucleation type of copper from DES should be progressive nucleation. The formation of Cu nuclei and their structural characteristics were revealed by scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX), and X-ray diffraction (XRD), which helped to confirm the results observed from the CA analysis. This study contributes to the rational design of sustainable copper electrodeposition processes for diverse applications in electronics, energy, and surface engineering.

Keywords: Copper electrodeposition; deep eutectic solvents; 3D nucleation and growth.

S6.P15

Suppression of Thermal Conductivity in Black Phosphorus Polycrystals via Ball-Milling-Induced Multiscale Defects

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Pristine Black phosphorus (BP) possesses a relatively high lattice thermal conductivity of approximately 15 $W \cdot m^{-1} \cdot K^{-1}$ at 300 K, limiting its thermoelectric performance despite its favorable electronic properties. To overcome this obstacle, we employed repeated high-energy ball milling (HEBM) to induce microstructural modifications that enhance phonon scattering. As a result, the thermal conductivity of BP was effectively reduced to 6.9 $W \cdot m^{-1} \cdot K^{-1}$ at 300 K. Structural and microstructural analyses were performed to clarify the reduction mechanisms. XRD and HRTEM confirmed lattice expansion, crystallinity degradation, and the presence of amorphous regions within the polycrystalline matrix. These observations indicate that multiscale structural defects were successfully introduced during the milling process. Thermal transport behavior was further examined using Debye–Callaway modeling, which revealed that phonon scattering at multiple defects, including point defects, dislocations, grain boundaries, and amorphous phases - plays a dominant role in suppressing lattice thermal conductivity. These findings underscore that the multiscale defects introduced through ball milling are essential for optimizing thermal transport in thermoelectric materials.

Keywords: Thermoelectric; Black phosphorus; Ball milling; Structural defects

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S6.P16

Synthesis and properties of Bi_2MoO_6: Er/Yb/Ho phosphors

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In this study, intense upconversion emission of Bi_2MoO_6: Er/Yb/Ho phosphors was successfully synthesized via a solution combustion method. The X-ray diffraction (XRD) results confirmed the formation of the single γ-Bi_2MoO_6 phase with orthorhombic structure. The X-ray photoelectron spectroscopy (XPS) results indicate the presence of chemical elements of the host lattice (Bi, Mo, and O) and dopant elements (Er, Yb, and Ho), which confirms the successful synthesis of high-purity phosphors. Under 975 nm excitation, the Bi_2MoO_6: Er/Yb/Ho phosphor emitted intense green and red upconversion (UC) at the 520-560 nm region and red region at

630-690 nm. Significantly, the red/green emission ratios increase with increasing Ho^{3+} contents. These results indicated that the presence of the Ho^{3+} ion in the phosphors could control their emission band. This finding suggests that phosphor is a promising candidate for various solid-state lighting and solar cell applications.

Keywords: Bi_2MoO_6: Er/Yb/Ho phosphor; Combustion method, Upconversion emission

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S6.P17

Synthesis and Optical properties of novel far-red-emitting $GdAlO_3:Cr^{3+}$ phosphors for plant-growth LEDs

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Red and far-red emitting Cr^{3+}-doped $GdAlO_3$ phosphors were successfully synthesized via a solid-state reaction. At the optimal Cr^{3+} concentration, calcination at 1300 °C for 5 hours produced particles with average sizes of several hundred nanometers. Structural analysis confirmed a perovskite phase with orthorhombic Pbnm symmetry, where Cr^{3+} ions substituted for Al^{3+} at octahedral sites. Under 412 nm excitation from a Xenon lamp, $GdAlO_3:Cr^{3+}$ exhibited strong emissions in the 660–760 nm range, with dominant peaks at 694 and 725 nm, corresponding to the $^2E \rightarrow {}^4A_2$ and $^4T_2 \rightarrow {}^4A_2$ transitions of Cr^{3+}, respectively. These findings highlight $GdAlO_3:Cr^{3+}$ as a promising red and far-red phosphor for plant-growth LED applications.

Keywords: $GdAlO_3$ perovskite; Cr^{3+} luminescence; indoor plant growth LEDs; far-red-emitting

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S6.P18

A STATE-OF-THE-ART REVIEW ON MoS_2 PREPARATIONS AND APPLICATIONS

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Molybdenum disulfide (MoS_2) nanomaterials have been widely studied and applied in various fields such as optoelectroninic, battery (lithium-ion and sodium-ion batteries), catalytic, energy storage, electrode materials in the supercapacitor owing to their unique properties. MoS_2 exhibits excellent ionic conductivity, large specific capacity, and thickness-dependent adjustable bandgap. This review presents the synthesis methods, properties and applications of MoS_2 nanostructures.

Keywords: Molybdenum disulfide (MoS_2); Preparation; Application; Property.

S6.P19

Synthesis and Optical Properties of Ce^{3+}-Doped YAG Phosphors for High-Efficiency White LEDs

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Ce^{3+}-doped Yttrium Aluminum Garnet phosphors ($Y_3Al_5O_{12}:Ce^{3+}$, YAG:Ce) were synthesized via a solid-state reaction to investigate the effects of dopant concentration and calcination temperature on structural and optical properties. A series of YAG:x%Ce samples (x = 0, 2, 4, 6, 8, 10) were annealed at temperatures ranging from 1000 to 1600 °C. The optimized YAG:6%Ce sample exhibited a broad

yellow emission band (520 – 560 nm) under 450 nm excitation, with dominant peaks assigned to the allowed 5d → $^2F_{5/2}$ and 5d → $^2F_{7/2}$ transitions of Ce^{3+}. X-ray diffraction confirmed the formation of a highly crystalline cubic garnet phase (Ia3d), with grain sizes increasing from several hundred nanometers to a few micrometers at higher temperatures. These results demonstrate that optimizing Ce^{3+} concentration and thermal treatment is crucial for enhancing the structural and luminescent performance of YAG:Ce, highlighting its potential as an efficient yellow-emitting phosphor for high-performance white LEDs (WLEDs).

Keywords: YAG:Ce phosphors; Luminescence; Solid-state reaction; WLED.

S6.P20

SiP Monolayer as a Promising 2D Material for Optoelectronic and Piezoelectric Nanoscale Devices: A DFT Study

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The two-dimensional (2D) SiP monolayer has recently emerged as a promising candidate for future nanoelectronic and optoelectronic devices. In this work, we comprehensively investigate the structural stability, mechanical response, optoelectronic, and piezoelectric properties of SiP monolayer using first-principles density functional theory (DFT) calculations. The dynamic and mechanical stability are confirmed by the Born criteria based on elastic constants and by the absence of imaginary frequencies in the phonon spectrum. Under biaxial strain, the material exhibits remarkable mechanical resilience with a maximum stress of 13.36 N/m at εbia= 0.20. The electronic band structure reveals a semiconducting nature with a band gap of 1.48 eV within the PBE functional, which increases to 2.17 eV when corrected by the HSE hybrid functional. Optical analysis demonstrates a strong absorption coefficient in the ultraviolet region, highlighting the potential of SiP for UV optoelectronic applications. Furthermore, significant piezoelectric responses are

obtained, with the stress coefficient e = 3.66×10−10 C/m and the strain coefficient d = 3.42 pm/V, suggesting excellent potential in piezoelectric nanodevices. These findings provide critical insights into the multifunctional characteristics of the SiP monolayer and point towards its potential applications in next-generation nanoelectronic, optoelectronic, and energy conversion devices.

Keywords: SiP monolayer, Density functional theory (DFT), Mechanical stability, optoelectronic properties and piezoelectricity

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S6.P21

Atmospheric pressure atomic layer deposition for advanced drug delivery systems

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Designing effective drug delivery systems remains a major challenge in the pharmaceutical field, particularly when balancing the need for controlled release, stable dispersion in liquid formulations, and improved bioavailability of poorly soluble compounds. Conventional approaches often rely on multistep or harsh processing methods that risk altering the stability of active pharmaceutical ingredients (APIs). In this work, we present atmospheric pressure atomic layer deposition (AP-ALD) as a versatile surface engineering strategy to overcome these limitations. Using a fluidized bed reactor operating at room temperature, ultra-thin AP-ALD coatings were applied to pharmaceutical powders with precise nanoscale control. This method enables multiple functionalities: extending drug dissolution, stabilizing drugs against sedimentation in aqueous suspensions, and accelerating dissolution of poorly soluble drugs, thereby enhancing bioavailability. These results establish AP-ALD as a scalable and chemically mild platform for tailoring API surface properties, opening new opportunities for advanced, patient-centered drug delivery systems.

Keywords: Atomic layer deposition; Fluidized bed reactor; Surface engineering; Drug release control.

S6.P22

Enhancement in purity of LTP MnBi synthesized by ball milling method through optimizing its composition

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Low-temperature phase (LTP) MnBi has emerged as a particularly promising candidate for rare-earth-free permanent magnets, with intriguing magnetic properties that make it suitable for diverse applications. However, LTP-MnBi is formed through a peritectic reaction between Mn and Bi elements, and the large difference in their melting points hinders the formation of high-purity LTP-MnBi. Therefore, enhancing the purity of LTP-MnBi is critical for improving both its magnetic properties and overall performance. This study investigates the optimization of the MnBi composition synthesized via the ball milling method. A nominal composition of MnxBi100-x (x = 59, 61, 63, 65, 67) was arc-melted three times for homogeneity. The melted samples were then milled at 300 rpm for 10 hours, followed by annealing at 300°C for 24 hours and cooling in air. It was found that the optimal composition was Mn65Bi35, which possessed the highest purity of LTP-MnBi, exceeding 90%. The microstructural and magnetic properties of the synthesized MnBi alloy were analyzed using X-ray diffraction (XRD) and a Vibrating Sample Magnetometer (VSM) for various compositions, and the results will be presented at the conference. This work demonstrates that fine-tuning the composition can significantly enhance the purity of LTP MnBi, paving the way for its application in advanced magnetic devices and other technological sectors.

Keywords: LTP-MnBi; Magnetic materials; Optimization, Ball milling

S7.P1

Adsorption - photocatalytic properties of SnO_2/g-C_3N_4 nanocomposites synthesized by a simple hydrothermal method

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In this work, SnO_2/g-C_3N_4 nanocomposites (SnO_2/g-C_3N_4 NPCs) were successfully synthesized via a simple hydrothermal method. X-ray diffraction (XRD) patterns indicate strong interaction between SnO_2 and g-C_3N_4 phases. FESEM images and EDS spectra conrfrm that the high-purity SnO_2/g-C_3N_4 NPCs possess a granular morphology with particle sizes ranging from tens to several hundred nanometers. Under visible-light irradiation, the SnO_2/g-C_3N_4 NPCs achieve 100% removal efficiency of DB 71 dye – 6.3 times higher than that of pure SnO_2 - after 120 minutes, through the efficient combined process of adsorption with photocatalytic degradation. The enhanced performance originates from synergistic adsorption of both components and efficient energy transfer from g-C_3N_4 and SnO_2, which effectively suppresses charge-carrier recombination. These results demonstrate that SnO_2/g-C_3N_4 NPCs could serve as effecient adsorbent-photocatalysts for dye removal in aqueous environments.
Keywords: Nanocomposites, Hydrothermal method, Adsorption – photocatalytic.

S7.P2

Integrating Molecular Dynamics Simulations with Microscopic Theory to Predict Structural Relaxation in Small Organic Glass Formers

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Small organic molecules play crucial roles in diverse fields, including pharmaceuticals, energy storage, and food preservation. Optimizing their stability and functionality requires a quantitative understanding of their glassy dynamics. In this work, we employ molecular dynamics simulations to estimate the glass transition temperatures (T_g) of propanol, glucose, fructose, and trehalose. These simulation-predicted T_g values are inserted into a thermal mapping in the Elastically Collective Nonlinear Langevin Equation theory to predict the temperature dependence of structural relaxation times. The integrated approach allows us to connect microscopic structural information with macroscopic dynamical behavior without any adjustable parameter. Numerical results are in a quantitative agreement with prior experimental data and this completely validates our predictive framework.
Keywords: Glass transition temperature, Relaxation time, Small organic material.

S7.P3

Damped fall of a magnet inside a polygonal conducting tube

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We investigate the uniform motion of a short cylindrical magnet falling inside a hollow conducting tube with various cross-sectional geometries. From a triangular, square, and circular cross-section, we generalize the analysis to the n-sided regular polygonal prism. We also consider two theoretical models of the magnet, including the two-disk model and dipole approximation, when analyzing the effect of the magnetic field due to eddy current and describe the experiments that validate our models.

Keywords: Magnetic damping, Electromagnetic induction, Falling magnet.

S7.P4

Optoelectrical properties of SALD-grown SnO_2 nanostructure thin films: Effect of post-annealing environments.

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Semiconducting metal oxide thin and ultrathin films (<10 nm) such as SnO2 have attracted great interest due to their potential applications in electronic devices and energy conversion technologies. In this study, nanostructured n-type SnO2 thin films were fabricated by spatial atomic layer deposition (SALD) and subsequently subjected to post-deposition annealing in various environments, including vacuum, N_2, O_2, $SiCl_4$, NH_3. Structural modifications induced by these different atmospheres were systematically investigated using advanced characterization techniques such as SEM and XRD-XRR. To correlate the structural changes with optoelectrical performance, we conducted Hall effect measurements at low temperature, photoluminescence, and UV-Vis spectroscopy. The results provide insights into the relationship between the crystal structure, defect states and charge transport behaviour of the films. This work highlights the role of post-annealing annealing environments in tuning the optoelectrical properties of ALD-grown SnO_2 thin films, enabling strategies to optimize the performance for next-generation electronics and energy devices.

Keywords: Optoelectrical properties, Tin Oxide, Thin films, SALD

POSTER SESSION 2

TIME: 15:25   16:00, October 14th

PID. No: (S1.P)8, 9, 10, 11; (S3.P)8, 9, 10, 11, 12, 13, 14; (S4.P)6, 7, 8, 9, 10; (S5.P)10, 11, 12, 13, 14, 15, 16, 17, 18; (S6.P)23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44; (S7.P)5, 6, 7, 8, 9;

S1.P8

Toward precise simulations of polarized ZZ pair production at the LHC

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The production of pollarized pairs of massive diboson has attracted a lot of attention both experimentally and theoretically since LEP. This is because longtitudinal gauge bosons can provide new resources as well as hints of physics beyond the Standard Model. It is therefore important if we can measure the fraction of longitudinal polarization in VV production as precise as possible. This is not easy to achieve because we cannot detect the longitudinal mode directly, hence the measurement must rely heavily on simulations. Of the three diboson production processes (ZZ, WZ, WW), the ZZ case is easiest because the four charged-lepton final state ($e^+e^-\mu^+\mu^-$) can be well measured at the LHC. In this contribution, we summarize the theoretical status of the ZZ calculation and discuss what still be needed to achieve a precise simulation.

Keywords: LHC; Diboson; Polarization.

S1.P9

Finding the Higgs Boson with ATLAS Open Data

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This study investigates the existence of the Higgs boson using open-access collision data from the ATLAS detector at CERN's Large Hadron Collider (LHC). The Higgs boson is a fundamental particle predicted by the Standard Model, significant for confirming the existence of the Higgs field. The Higgs field is an important field in particle physics, directly connected to the Electroweak Symmetry Breaking Mechanism (ESBM). ESBM is a new mechanism to generate mass to fundamental particles such as the electron, quarks as well as the gauge bosons.

Although the Higgs boson discovery was confirmed in 2012 by two experiments ATLAS and CMS, further analyses of collision data remain important to studying its properties such as its coupling to the other particles and to itself. Utilizing ATLAS Open Data's provided codes and analysis frameworks, this study uses modified Python programs derived from ATLAS Open Data's Jupyter notebooks to generate graphs analyzing both real and simulated collision data at 13 TeV center-of-mass energy provided by the ATLAS collaboration. Data are focused on diphoton decay channels with the diphoton invariant mass around 125 GeV, specifically within the 100 GeV to 160 GeV range.

In this presentation, we show that it is possible for a high-school student (HMD) to explore the ATLAS open data and produce plots thereby getting a feeling for the real data from a very deep level of nature, collected by one of the best detectors of mankind. This work is done under the supervision of Dr. Duc Ninh Le, a theoretical particle physicist who has been working on physics at the LHC for more than 20 years.

Keywords: LHC; Higgs boson; ATLAS Open Data; Particle Physics.

S1.P10

Scalar Dark Matter in Singlet Extension of the Standard Model with Vectorlike Quarks

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We study a minimal extension of the Standard Model with a Z_2 symmetry, featuring an inert scalar doublet, a real singlet, and vectorlike quarks. The lightest mixed scalar acts as a stable dark matter candidate. After constructing the scalar potential and deriving the spectrum, we compute the thermal relic abundance using the Gondolo–Gelmini method. Our analysis focuses on 2-to-2 annihilation and co-annihilation channels, where the final states include all three generations of up-type quarks via vectorlike quark mediation. The thermally averaged cross section shows strong temperature dependence, and by scanning the parameter space we reproduce relic density values in exact agreement with experimental observations. The framework can also be extended to address neutrino masses and other phenomena beyond the Standard Model.

Keywords: Dark matter; Freeze-out; Relic density.

S1.P11

A Flavor-Dependent U(1) Extension for Flavor Puzzle, Neutrino Mass, and Dark Matter

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Assuming fundamental fermions possess a new Abelian gauge charge that depends on flavors of both quark and lepton, we obtain a simple extension of the Standard Model, which reveals some new physics insights. The new gauge charge anomaly cancellation not only explains the existence of just three fermion generations as observed but also requires the presence of a unique right-handed neutrino ν_R with a non-zero new gauge charge. Further, the new gauge charge breaking supplies a residual matter parity, under which the fundamental fermions and ν_R are even, whereas a right-handed neutrino N_R without the new charge is odd. Consequently, light neutrino masses in our model are generated from the tree-level type-I seesaw mechanism induced by ν_R and from the one-loop scotogenic contribution accommodated by potential dark matter candidates, N_R and dark scalars, odd under the matter parity. We also investigate the potential dark matter candidates by considering relic density and direct detection.

Keywords: Beyond Standard Model, Neutrino mass, Dark matter.

S1.P12

The role of radion in SN1987A cooling

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In this work, we have investigated radion effects on plasmon plasmon scattering in SN1987A explosion. We have shown that the cross-section is values up to 0.89pb. Assuming that the supernovae cooling rate $\mathcal{E} \leq 7.288 \times 10^{-27}$ GeV, we find the lower bound on the radion vacuum expectation value.

Keywords: SN1987A; Energy loss rate; Radion; Plasmon plasmon scattering.

S3.P8

Machine Learning-Informed Microscopic Theory for Predicting the Glass Transition of Metallic Glasses

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Accurately predicting and understanding the glass transition and dynamical characteristics remains a significant challenge. In this study, we propose a hybrid approach that integrates machine learning models with theoretical modeling to predict the temperature dependence of structural relaxation time and diffusion coefficient of metallic glasses. We use a large dataset of 9196 oxide glasses and 921 metallic glasses to train machine learning models to predict the glass transition temperature directly from the chemical compositions. This approach is currently the simplest while still achieving high predictive accuracy. The predicted glass transition values are then incorporated into the Elastically Collective Nonlinear Langevin Equation (ECNLE) theory to determine the temperature dependence of the structural relaxation time, $\tau_\alpha(T)$. Furthermore, the correlation between $\tau_\alpha(T)$ and the diffusion coefficient within the ECNLE theory provides a pathway to quantitatively predict diffusion coefficients from relaxation dynamics. Our numerical results agree quantitatively well with experimental data in prior works.

Keywords: Machine learning, Metallic glasses, Structural relaxation time, Diffusion coefficient.

S3.P9

The interaction of hydrogen to 2D silicon carbide: DFT study

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Based on its structural features and electrical conductivity, two-dimensional silicon carbide (2D SiC) emerges as a promising candidate for sustainable hydrogen energy applications. In this study, the effect of surface hydrogenation on 2D SiC is systematically investigated using density functional theory (DFT) calculations performed with the SIESTA (Spanish Initiative for Electronic Simulations with Thousands of Atoms) package. An ultrahigh vacuum surface supercell of SiC was constructed, with an average Si–C bond length of 1.857 Å, and subsequently optimized within SIESTA. Hydrogen atoms were then introduced onto the top sites of silicon (T_{Si}) and carbon (T_C) atoms, with varying numbers and relative configurations. The results reveal that the adsorption energy and interaction strength strongly depend on the ratio between hydrogen atoms adsorbed at T_{Si} and T_C sites. For a fixed number of hydrogen atoms, a more balanced ratio leads to increasingly negative adsorption and interaction energies, indicating a tendency for hydrogen atoms to preferentially adsorb on adjacent T_{Si} and T_C sites. Moreover, the band gap width in the electronic structure is also modulated by this ratio. Specifically, as the proportion of hydrogen adsorption on T_{Si} relative to T_C increases, both the direct and indirect band gaps decrease, nearly independent of the total number of adsorbed hydrogen atoms. Taken together, these findings highlight 2D SiC as a promising material for hydrogen storage and demonstrate its tunable electronic properties through a relatively small degree of hydrogen adsorption. To gain further insight, detailed analyses of charge distribution before and after hydrogen adsorption, as well as comprehensive investigations of the thermodynamic stability of the system, are required.

Keywords: Hydrogen adsorption; Silicon carbide; Density functional theory.

S3.P10

Developing an Interactive Computational Platform for Molecule-Surface Material Interaction: Applying to Area Selective Atomic Layer Deposition simulations

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It is necessary to know molecule-surface interactions in order to design area-selective atomic layer deposition (AS-ALD) techniques. Currently, computational resources like density functional theory (DFT) and kinetic Monte Carlo (kMC) simulations offer useful information but require considerable resources and are not user-friendly. To address the aforementioned issue, we introduce a resource friendly and simple simulation platform to simulate steric hindrance-driven adsorption in AS-ALD. Grounded on previous Monte Carlo and random sequential adsorption (RSA) modeling studies, this model allows for simulating and visualizing precursors and inhibitors adsorption on solid surfaces. Molecular factors such as size, shape, and packing density are adjustable by users. Our simulations show that such molecular attributes play a significant role in selective adsorption behavior. The platform allows facile probing of AS-ALD mechanisms and is an asset for screening materials at the initial stage as well as pedagogical use, connecting theoretical models to experimental realities.

Keywords: Molecule-surface interactions; Steric hindrance.

S3.P11

Computational Design of Goldene-Based Metal-Semiconductor Heterostructures

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The search for and exploration of metal-semiconductor contacts with Ohmic contact or tunable Schottky barriers poses both challenges and research interest. Recently, scientists have fabricated the thinnest gold sheet in the world, only one atom thick (Goldene), which promises significant applications in the field of electronics and semiconductors [Nature Synthesis 3, 744-751 (2024)]. Motivated by this breakthrough, we employ first-principles calculations to construct and investigate the structures, electronic properties, and contact behavior of goldene-based metal-semiconductor heterostructures integrated into solid-state device architectures. Moreover, we explore the tunability of Schottky barriers under external electric fields and interlayer coupling effects, further broadening the application potential of such heterostructures. Our findings suggest that goldene-based metal–semiconductor heterostructures can be seamlessly incorporated into next-generation devices, offering a promising alternative to traditional silicon-based technologies.
This research is funded by Vietnam National Foundation for Science and Technology Development (NAFOSTED) under grant number 103.01-2024.14
Keywords: Goldene; Metal-semiconductor heterostructure; First-principles calculations; Electronic properties.

S3.P12

Investigate the Impact of Lattice Defects on the Electronic Structure and Electronic Properties of Two-Dimensional Materials

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In realistic conditions, even nearly perfect two-dimensional (2D) materials naturally contain defects such as vacancies and dislocations. These imperfections can substantially alter the electronic structure and physical properties of the material. We propose a real-space computational framework to investigate the influence of diverse lattice defects—including Stone–Wales defects, mono- and multi-vacancies and interlayer defects in stacked structures. Our method follows the time evolution of electronic states directly within the atomic lattice and expresses physical operators as polynomial expansions of the tight-binding Hamiltonian. This approach avoids the need for translational symmetry and bypasses the computational burden of large matrix diagonalizations. This study provides new insights into the role of lattice defects in shaping the electronic structure and properties of 2D materials, while advancing computational methodologies for large-scale, defect-inclusive modeling.

Keywords: 2D materials; Defect; Electronic properties.

S3.P13

Predicting the onset of collective motion in hcp-Fe under extreme conditions

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Recent machine-learning simulations have observed the emergence of collectively diffusive atoms in hcp-Fe, the most abundant metal inside icy, rocky, and gaseous planets. This significant finding is expected to help scientists elucidate how planetary cores respond to mechanical stresses, interact with electromagnetic fields, and act on surface processes. Nevertheless, determining the geophysical properties of hcp-Fe with collective motion requires a lot of time and effort. To overcome this challenge, we develop a combined theory based on the density scaling law in soft-matter physics and the statistical moment method in solid-state physics. Our theoretical calculations show a good agreement with large-scale, long-time atomistic simulations. On that basis, we can resolve the long-standing controversy on molten Fe, explain the abnormal shear softening at Earth's center, and predict the core state of planets outside the Solar System.

Keywords: Collective motion; Planetary core; Density scaling law; Statistical moment method.

S3.P14

Predicting Glass Transition Dynamics of Metallic Glasses from Structural Correlations Using Integrated Simulation, Theory, and Machine Learning

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In this study, we investigate thermal and dynamical properties of metallic glasses using theory, molecular dynamics (MD) simulations, and machine learning. MD simulations are first employed to compute the radial distribution functions $g(r)$ over a range of temperatures. From the ratio g_{min}/g_{max} as a function of temperature, we estimate the glass transition temperature (T_g). These T_g values are then input into the Elastically Collective Nonlinear Langevin Equation (ECNLE) theory to calculate the temperature dependence of the structural relaxation time ($\tau_\alpha(T)$) and the diffusion coefficient. Based on these results, we construct machine learning models that take $g(r)$ as inputs and predict $log_{10}[\tau_\alpha(T)]$ as a function of $1000/T$ and T_g/T for different metallic glass systems. This integrated MD–ECNLE–ML approach provides a simple yet powerful framework for predicting the thermal and dynamic behaviors of metallic glasses.
Keywords: MD simulations; Metallic glasses; Machine Learning.

S4.P6

Preparation of Nitrogen-doped Graphene Quantum Dots as Fluorescent Reporters on HeLa Cells

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This study explores the potential of nitrogen-doped graphene quantum dots (N-GQDs) as fluorescent reporters in cultured cells, focusing on physicochemical properties, biocompatibility, and cellular uptake. Nitrogen-doped graphene quantum dots are a novel class of carbon-based nanomaterials with tunable photoluminescence and low cytotoxicity, offering promising applications in biomedical imaging. N-GQDs were synthesized and treated specially for interacted characterizing with HeLa cells. Cell viability assays in HeLa cells revealed a dose-dependent response, with an IC_{50} of ~214 μg/mL and a biocompatibility threshold. Flow cytometry and fluorescence microscopy confirmed cellular internalization and optimal fluorescence emission in the green–yellow spectral range. The findings highlight the compatibility of N-GQDs with conventional imaging systems and their potential use in cell labeling and bioimaging. This study provides foundational data supporting the development of N-GQD-based fluorescent probes tailored for biomedical applications.

Keywords: Nitrogen-doped graphene quantum dots, photoactivity, HeLa cells, bioimaging

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S4.P7

Nitrogen-doped Graphene Quantum Dots and Nanocomposite For Potential Application in Photoactivity and Biology

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Graphene quantum dots (GQDs) are promising nanomaterials for various applications because of their unique optical, tunable photoluminescence and biocompatibility. Graphene quantum dots can be prepared with doping form are researched combining with various materials to improve rapidly transforming the energy fields and photonic applications. We used nitrogen-doped graphene quantum dots (N-GQDs) for fabricating of nanocomposite films as N-GQD:TiO_2. The analysis methods as UV-VIS, photoluminescence, Raman, HR-TEM, SEM and XRD were conducted for this research purpose with explanations. This work presents some important aspects of N-GQD:TiO_2 nanocomposites as photocatalyst applications. These include: synthesis methods of nanocomposites with structural formulations and various characterization techniques which can be used to judge the photocatalytic performance for the application in solar energy conversion and although some new challenges. This report also discusses the future opportunities for GQDs, emphasizing potential in advancing modern photocatalyst, solar energy and drive healthcare solutions. With biocompatible property, GQD also contribute to the expanding field of research in biomedical applications. Here in we present some results of Hela cytotoxicity by N-GQDs from our research.

Keywords: Nitrogen-doped graphene quantum dots, photoactivity, HeLa cells, bioimaging

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S4.P8

Optimizing Au Ion Implantation in ZnO Nanostructures: A SRIM Simulation Study

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Au ion implanted in ZnO nanostructures are a promising platform for plasmon-enhanced biosensing and optoelectronic applications due to the synergistic combination of localized surface plasmon resonance (LSPR) from Au nanoparticles and the photoluminescence (PL) properties of ZnO nanostructures. This study employs SRIM (Stopping and Range of Ions in Matter) Monte Carlo simulations to optimize the implantation of Au ions into ZnO nanostructures, specifically to enhance their physical performance. The effects of ion energy (3-5 MeV) and implantation angle on the depth distribution and lattice damage were investigated. Results show that higher energies increase penetration depth, while the implantation angle critically controls ion distribution by mitigating channelling effects. These findings provide essential guidance for experimentally designing implantation parameters to achieve optimal Au ion distributions while managing structural damage in ZnO nanostructures.

Keywords: ZnO nanostructures, Au implantation, ion irradiation, SRIM simulation

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S4.P9

Qsun: An open-source platform towards practical quantum machine learning applications

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Currently, the limitations of quantum hardware are primarily attributed to noise and the restricted number of qubits available. In this context, a quantum virtual machine (QVM) that simulates the operations of a quantum computer on classical computers serves as a critical tool for the development and testing of quantum algorithms prior to their implementation on actual quantum systems. Numerous variational quantum algorithms (VQAs) have been proposed and evaluated within QVMs to overcome the constraints posed by quantum hardware. Our objective is to further leverage VQAs for practical applications in quantum machine learning (QML) utilizing advanced quantum computing technology. We are pleased to introduce Qsun, a

QVM distinguished by its foundation in quantum state wavefunctions. This platform offers an array of native tools to support VQAs, particularly through the parameter-shift rule, enabling the implementation of quantum differentiable programming (QDP), which is vital for gradient-based optimization. In practical applications, Qsun has demonstrated better performance for quantum differentiable programming (QDP), quantum linear regression (QLR), quantum neural networks (QNN), and quantum kernel methods (QKernel). Overall, Qsun represents an effective integration of a QVM with QDP capabilities, tailored to address challenges in machine learning.
Keywords: Quantum virtual machine; Quantum machine learning; Quantum differentiable programming.

S4.P10

Quantum Deep Learning Force Field

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Machine learning force fields are emerging as powerful tools for predicting atomic interactions with near density functional theory (DFT) accuracy at significantly reduced computational cost. In this study, we propose a quantum deep learning force field (QDFF) model that leverages quantum neural networks (QNNs) or quantum convolutional neural networks (QCNNs) to represent atomic environments and predict interatomic forces. These models are constructed from parameterized quantum circuits, where the model parameters are encoded through the rotation angles of quantum gates. We evaluate QDFF on a silicon crystal by comparing the predicted forces and total forces acting on atoms with results from classical machine learning force fields and DFT calculations. Furthermore, we use the QNN or QCNN-predicted forces to compute the phonon dispersion relation and compare them with DFT calculations.
Keywords: Quantum neural networks; Quantum convolutional neural networks; Machine learning force fields; Quantum neural network force fields;

S5.P10

ISO 4037 Low Air Kerma Rate X-ray Reference Fields: Simulated Data

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Characteristic properties of the ISO-4037 low air kerma rate series (L-series, where the "series" digit value denotes the maximum spectral energy in keV) X-ray reference fields typically include radiometric (i.e., mean energy, half-value layer, beam homogeneity coefficient) and physical (air kerma rate, $\dot{K}$) quantities. This paper presents SpekPy-simulated values of the radiometric quantities for L-series X-ray reference fields and compares them with those specifed in the ISO-4037 and published data. The trend of $\dot{K}$ simulated values for the ISO-4037 L-series X-ray reference fields as a function of averaged energy was also examined. Furthermore, the standard uncertainties associated with the radiometric and physical quantities of the ISO-4037 L-series X-ray reference fields were investigated and discussed.
Keywords: Radiometric, half-value layer, kerma

S5.P11

Development of a New Analysis Method for Artificial Radionuclides ^{134}Cs, ^{137}Cs, and ^{131}I in Foodstuff and Drinking Water Samples Using a NaI(Tl) Scintillation Spectrometer

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A new method based on the combination of standard spectra for rapid analysis of artificial radionuclides ^{134}Cs, ^{137}Cs, and ^{131}I in foodstuff and drinking water samples using a NaI(Tl) scintillation spectrometer is presented in this study. The obtained results are promising for rapid analysis applications of artificial radionuclides in nuclear emergency situations according to Operational Intervention Levels (OILs). Under the same sample preparation procedure, analytical conditions with Marinelli 0.5 L containers, and integration with the RQ-01 measurement system developed by the Military Institute for Chemical and Environmental Engineering, the deviation does not exceed 30% compared with analyses conducted on HPGe systems. Meanwhile, the analysis time is significantly shorter (≤ 10 minutes).

Keywords: NaI(Tl) scintillation spectrometer, artificial radionuclides, standard spectra, rapid analysis

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S5.P12

Application of a Two-Point Linear Calibration Method for Spectrum Drift Correction in $\gamma - \gamma$ Coincidence Spectrometer

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Spectrum drift and peak broadening are common issues in long-term measurements, particularly in the $\gamma - \gamma$ coincidence spectrometer employing an analog electronic system. These effects degrade the accuracy of measurements, where the reliability of experimental data is crucial in nuclear structure research. In this study, we applied a two-point linear calibration method to correct spectrum drift through measurements of ^{182}Ta and ^{186}W nuclei via thermal neutron capture reaction, using the $\gamma - \gamma$ coincidence spectrometer at the Dalat Nuclear Research Reactor. The effectiveness of the method was evaluated by comparing the full width at half maximum (FWHM) of one selected low-energy peak and one selected high-energy peak from both detectors, before and after correction. The analysis demonstrate that the applied calibration method significantly improves peak resolution and restores spectral consistency. For ^{186}W, the FWHM decreased by approximately 10–13% at the low-energy peak and 38–59% at the high-energy peak. For ^{182}Ta, the FWHM improved approximately 5–11% at the low-energy peak, while at high energies, spectrum drift led to artificial peak splitting, which was eliminated after correction to restore the true single peak. These results confirm the applicability of this method

in the $\gamma - \gamma$ coincidence spectrometer and suggest its continued application to studies of other nuclei.

Keywords: Two-point linear calibration, $\gamma - \gamma$ coincidence spectrometer, Spectrum drift correction, ^{182}Ta, ^{186}W

S5.P13

Role of Nuclear Level Density and Photon Strength Function in Reproducing the Isomeric Ratio of the ^{165}Ho(γ,n) reaction

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The isomeric ratio of the reaction cross section for the ^{165}Ho(γ,n)^{164}Ho, leading to the ground state ^{164g}Ho and the isomeric state ^{164m}Ho, has been investigated. Experimental data were compared with theoretical calculations performed using the TALYS code version 1.95. The calculations were carried out for all possible combinations of the six nuclear level density (NLD) and eight photon strength function (PSF) models implemented in TALYS. The comparison, based on χ^2 analysis, shows that the combination of NLD model 5 and PSF model 2 provides the best agreement with the experimental isomeric ratios. In general, the results demonstrate a stronger sensitivity of the calculated ratios to the choice of NLD than to RSF. Among the NLD models, NLD 5 consistently provides the most reliable description, while NLD 6, despite being close to NLD 5 in terms of total level density, fails to reproduce the data. The discrepancy is traced to their different treatments of spin dependence, highlighting the significant role of spin-dependent NLD in describing isomeric ratios in photonuclear reactions.

Keywords: Nuclear Level Density, Photon Strength Function, Isomeric Ratio, ^{165}Ho(γ,n)^{164}Ho.

S5.P14

Evaluating the impact of Elitism in Differential Evolution for the DNRR fuel reloading problem

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Elitism is a widely used strategy in evolutionary algorithms, though its effectiveness often depends on population size and problem characteristics. This study investigates the impact of an elitism strategy on the performance of Differential Evolution (DE) for the multiobjective fuel reloading problem of the DNRR research reactor. The problem involves balancing fuel efficiency and safety across loading patterns for 100 fuel bundles with varying burnup levels. The analysis focused on the relationship between the elitist archive size (A) and the population size (N_P). The findings show that standard DE performed robustly without elitism, achieving peak performance with a minimal population size of N_P=5. In comparison, the DE variant incorporating an elitist archive did not surpass the standard version; however, it achieved comparable peak performance under the optimal parameters of N_P=30 and A=25%N_P. These results indicate that DE's intrinsic search mechanism is highly effective for this application on its own, and while elitism provides a path to comparable solutions, it does not represent a mandatory enhancement.
Keywords: Differential Evolution; Elitism; fuel loading optimization; DNRR.

S5.P15

Preliminary Digital $\gamma-\gamma$ Coincidence Spectroscopy at the Dalat Nuclear Research Reactor

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A digital $\gamma-\gamma$ coincidence spectrometer has been developed and commissioned at the Dalat Nuclear Research Reactor (DNRR) to advance the capabilities of the existing analog system. The setup employs a CAEN DT5730S digitizer with Digital Pulse Processing for Pulse Height Analysis (DPP-DHA) firmware, which directly acquiring signals from two HPGe preamplifiers. Compared with conventional analog electronics, this digital approach offers enhanced flexibility, stability, and performance. The Multi-Channel Analyzer (MCA) mode was used to characterize preamplifier outputs and optimize acquisition parameters for two input channels, resulting in an energy resolution of 4.0 keV (FWHM) at 1.33 MeV for ^{60}Co. For higher-energy gamma ray, prompt gamma spectra from ^{35}Cl$(n_{th},\gamma)_{36}$Cl and ^{182}W$(n_{th},\gamma)^{183}$W reactions were measured for energy calibration and system validation, showing consistency with results from the existing analog setup. The coincidence mode were subsequently implemented using the Generic Writes mode of the CAEN MC^2-Analyzer software to record cascade gamma rays, achieving a timing resolution of 14 ns. The coincidence spectra show a good agreement with those obtained from the analog system, confirming the reliability and precision of the digitizer-based one. These initial results establish a solid foundation for future applications of advanced digital coincidence spectroscopy in nuclear structure studies and neutron capture experiments at the DNRR.
Keywords: $\gamma-\gamma$ coincidence, CAEN digitizer, thermal neutron, digital γ spectroscopy, DNRR.

S5.P16

A COMPARATIVE BIOACCUMULATION OF POLONIUM-210 IN COMMENT MARINE ORGANISMS IN THE COASTAL OF VIETNAM: IMPLICATIONS FOR BIOINDICATOR SELECTION AND RADIOLOGICAL RISK ASSESSMENT

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Polonium-210 (^{210}Po) is a naturally occurring radionuclide with high radiotoxicity, representing a significant contributor to internal radiation exposure through seafood consumption. This study compares the bioaccumulation of ^{210}Po activity concentrations across diverse common marine groups, including fish, mollusks (e.g., squid), crustaceans (e.g., crab and shrimp), and bivalves. Measurements were conducted using alpha spectrometry with PIPS detectors. Results revealed a distinct taxonomic pattern in ^{210}Po bioaccumulation, following the order: bivalves > mollusks > fish > crustaceans. Among bivalves, Asian green mussels exhibited the highest concentrations, strongly influenced by habitat characteristics and feeding strategies. For fish species, ^{210}Po levels correlated with behavioral patterns, feeding habitats, and trophic positions within marine food webs. These findings underscore the integrated influence of ecological and biological factors on radionuclide bioaccumulation processes. From an environmental monitoring perspective, green mussels are identified as effective sentinel organisms for long-term assessment of marine radiological conditions due to their high accumulation capacity and ecological representativeness. Regarding public health protection strategies, elevated ^{210}Po concentrations in smaller bivalves indicate potential dietary risks, emphasizing the necessity for prudent seafood selection to minimize radiological exposure. Overall, this study provides a comparative framework for bioindicator selection and offers practical recommendations for seafood safety concerning ^{210}Po contamination.

KEYWORDS: Polonium-210, marine organisms, bioindicator, radiological risk assessment

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S5.P17

Assessment of Natural Radioactivity and Associated Radiological Hazards in Hanoi Vegetable Farm Soils Using HPGe Gamma-Spectrometry

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Natural radioactivity and associated radiological hazards in Hanoi vegetable farm soils (Vietnam) were assessed using a gamma spectrometry with a low-background

high-purity germanium (HPGe) detector. fifty soil samples were collected from typical farms in Hanoi to measure the activity concentrations and radiological hazard indices. The average activity concentrations of ^{232}Th, ^{226}Ra, and ^{40}K are 67.3 ± 2.0, 49.8 ± 1.4, and 1038 ± 28 Bq/kg, respectively, which are greater than the global average values. The radium equivalent activity ranges from 137.9 ± 4.0 to 399.5 ± 7.8 Bq/kg, with an average of 226.0 ± 4.5 Bq/kg. The outdoor absorbed gamma dose rate (64.9 –188.1 nGy/h, average of 108.2 ± 3.1 nGy/h) and the annual effective dose equivalent (0.080 – 0.231 mSv/y, average of 0.133 ± 0.004 mSv/y) are greater than the corresponding global averages of 59 nGy/h and 0.07 mSv/y. These hazard indices are within the recommended safety limits as reported by UNSCEAR.

Keywords: Hanoi farm soil, Activity concentration, radiological hazards.

S5.P18

Neutronic analysis of the NuScale-like Small Modular Reactor (SMR)

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This study presents a detailed full-core neutronics analysis of a NuScale-like Small Modular Reactor (SMR) to evaluate the fundamental physical characteristics of typical core configurations using a continuous Monte Carlo method. Criticality calculations were performed for scenarios with all control rods withdrawn and fully inserted, yielding effective multiplication factors (k_{eff}) of 1.00281 and 0.85445, respectively. Under the all-rods-out condition, the maximum Power Peaking Factor (PPF) was determined to be 1.1697. The evaluated reactor kinetics parameters include an effective delayed neutron fraction (β_{eff}) of 702.28 pcm, a neutron generation time (Λ) of 26.83 μs, and a prompt neutron lifetime (l_p) of 27.58 μs. These results offer a comprehensive characterization of the NuScale-like SMR core and serve as a reference for future design and safety analyses.
Keywords: NuScale, criticality, kinetics parameters, ENDF/B-VIII.0.

S6.P23

Silver Nanoparticle-Functionalized Nanoporous Silicon Electrode for Non-Enzymatic Cholesterol Detection

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In this work, a novel non-enzymatic cholesterol biosensor was developed by in situ chemical reduction of silver nanoparticles (Ag-NPs) onto a nanoporous silicon (NP-Si) electrode prepared via an electrochemical method. This approach enabled the direct modification of the NP-Si substrate with Ag-NPs, providing an efficient platform for cholesterol detection without the use of enzymes. The structural and morphological properties of the fabricated electrode were characterized by Raman spectroscopy, X-ray diffraction (XRD), and field-emission scanning electron microscopy (FE-SEM). The electrochemical behavior of the sensor was investigated using cyclic voltammetry (CV). The Ag-NPs/NP-Si electrode exhibited excellent electrochemical performance, achieving a sensitivity of 44 $\mu A \cdot mM^{-1} \cdot cm^{-2}$ within the cholesterol concentration range of 3.0–9.0 mM, along with a low detection limit of 0.12 mM. Furthermore, the biosensor demonstrated good reproducibility and long-term stability. These findings highlight the great potential of Ag-NPs/NP-Si electrodes for the development of practical non-enzymatic cholesterol biosensors.

Keywords: Nanoporous, Silicon, Biosensor, Cholesterol, Nonenzymatic

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S6.P24

Synthesis of Eu^{3+}-Doped $CaMoO_4$ Phosphors for Solid-State Lighting Applications

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Red-emitting materials play a crucial role in enhancing the colour rendering index

(CRI) and adjusting the correlated colour temperature (CCT) of white light-emitting diodes (w-LEDs), making the emitted light more suitable for lightings, and advanced display technologies. Among various red-emitting materials that have been developed, Eu^{3+}-doped $CaMoO_4$ (CMO: Eu^{3+}) phosphors with a scheelite-type structure exhibit optical properties suitable for phosphor converted LED (pc-LED) applications, such as good red emission performance and intense thermal stability. This work, the synthesis procedure, structural characteristics, and optical properties of CMO: Eu^{3+} phosphors are systematically investigated and optimized. By the XRD, FESEM, EDS, and XPS analyses, the high-quality crystalization with a single-phase structure of CMO: Eu^{3+} were confirmed at a relatively low sintering temperature of 700 oC. At an optimized doping content of 6% Eu^{3+}, the CMO phosphor exhibits the strongest emission peaking at wavelengths of 611 and 614 nm under the excitation of both wavelength ranges peaking at 394 and 465 nm. The PL intensity is retained at a level of 74.8% when the phosphor operates at 150°C, compared to its values at room temperature. The obtained results suggest that CMO: Eu^{3+} is a promising red component for pc-LED using near-UV chip LED.

Keywords: $CaMoO_4:Eu^{3+}$, Red emisson, white-LED

S6.P25

Two-Fold Photoluminescence Enhancement of CdSe Quantum Dots by ZnO Thin Film on Glass Substrate.

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In this study, there are three main parts. First, CdSe quantum dots (QDs) were successfully prepared by TOPO–TOP-based organometallic synthesis. Specifically, CdSe QDs were synthesized using a TOPO–TOP-based organometallic method. A 2 M stock solution of trioctylphosphine selenide (TOP:Se) was prepared by dissolving 15.8 g of Se into 100 mL of TOP. The stock solution was placed in a 100 mL three-neck round-bottom flask fitted with a thermocouple temperature sensor and condenser, along with TOPO (10 g), HDA (10 g), and TOP (2.5 mL). The mixture was heated to 170 °C under vacuum for 1–2 h and then the temperature was raised to 340–350 °C. In a separate vial, $Cd(acac)_2$ (620 mg), HDDO (1 g), and TOP (5 mL) were mixed and heated under vacuum to 100 °C until the solution became

homogeneous. The mixture was cooled to approximately 80 °C, and 5 mL of the 2 M TOP:Se solution was added. The cadmium and selenium precursor solution was rapidly injected into the hot flask containing the coordinating solvent and then cooled using different solvents. The QDs extracted from the same hot batch were divided into different cooling solvents. Synthesized CdSe QDs were characterized using a field-emission transmission electron microscope (FE-TEM, Titan G2 ChemiSTEM Cs Probe, FEI Co.). High-resolution TEM images revealed spherical CdSe QDs with an average diameter of about 5 nm.

Second, the synthesized CdSe QDs were used for spin coating on a glass substrate (CdSe). A ZnO thin film was then deposited on the CdSe quantum-dot-coated glass substrate (ZnO/CdSe).

Third, all samples were investigated for photoluminescence (PL) properties with and without the ZnO thin-film layer as a function of temperature. The PL spectra of the samples were measured using an iHR320 imaging spectrometer (Horiba Jobin Yvon). The temperature-dependent PL measurements were conducted in the range of 170–270 K to study the thermal quenching behavior of CdSe QDs with and without the ZnO thin layer. The results show that, with increasing temperature, the PL intensity decreased, the emission spectra exhibited a slight green shift, and the linewidth broadened. The study also indicates clear changes in PL intensity, peak position, and FWHM. Notably, when a ZnO thin film was deposited on the CdSe QDs, the PL intensity was enhanced by more than two-fold compared to the CdSe QD layer alone.

Keywords: CdSe quantum dots; CdSe photoluminescence; photoluminescence enhacement.

S6.P26

Effect of experimental conditions on optical properties of Cr^{3+} doped $NaAlP_2O_7$ phosphors syntheiszed by a simple solid state reaction method

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Near infrared (NIR) emitting phosphor are widely applied in fields such as biophotonic, optical information processing, and security monitoring. In this work, NIR-emitting Cr^{3+}-doped $NaAlP_2O_7$ phosphors ($NaAlP_2O_7:Cr^{3+}$) were synthesized via a simple solid-state reaction. X-ray diffraction (XRD) analysis confirmed the formation of a single-phase $NaAlP_2O_7:Cr^{3+}$ phosphor at calcination temperature ε 600 °C with Cr^{3+} ions successfully substituting for Al^{3+} ions in the lattice. FESEM images and EDS spectra revealed a granular morphology with paricle sizes ranging from 0.5 to 1.0 µm, indicating the high purity of the $NaAlP_2O_7:Cr^{3+}$ phosphor. Under blue light excitation, the synthesized $NaAlP_2O_7:Cr^{3+}$ phosphor exhibits a strong NIR emission peaking at 763 nm. The optimal photoluminescence intensity was observed in $NaAlP_2O_7$:4%mol Cr^{3+} samples annealed at 700 °C for 15 hours in air. Furthermore, a prototype LED device, fabricated by integrating the optimized $NaAlP_2O_7:Cr^{3+}$ phosphor with a blue LED chip, demonstrated strong NIR emission alongside the chip's native emission. These results highlight the great potential of the synthesized $NaAlP_2O_7:Cr^{3+}$ phosphor for next-generation NIR LED applications.

Keywords: $NaAlP_2O_7:Cr^{3+}$; Near infrared emisison; Phosphors; NIR LED.

S6.P27

Red emitting Mn^{3+} doped $Y_3Ga_5O_{12}$ phosphor for WELDs applications

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The development of red-emitting phosphors has attracted considerable attention due to their crucial role in enhancing the performance of white light-emitting diodes (WLEDs). In this work, red emitting Mn^{3+} doped $Y_3Ga_5O_{12}$ garnet phosphors ($Y_3Ga_5O_{12}:Mn^{3+}$) were successfully synthesized via a solid-state reaction method. X-ray diffraction (XRD) confirmed the single-phase $Y_3Ga_5O_{12}:Mn^{3+}$ phosphors with high purity, while FESEM exhibited a granular morphology with particle sizes ranging from 0.5 to 1.0 µm. It is demonstrated that Mn^{3+} ions substiture for Ga^{3+} ions in the $[GaO_6]$ octahedral sites of the lattice. The synthesized $Y_3Ga_5O_{12}:Mn^{3+}$

phosphors can be efficiently excited by UV light peaking at 275 nm or blue light peaking at 480 nm, exhibiting a strong red emission band centered at 620 nm. This emission band is particularly suitable for improving the color rendering index (CRI) of white WLEDs. The highest emission intensity was found in the $Y_3Ga_5O_{12}$:0.7%mol Mn^{3+} sample annealed at 1300 °C for 5 hours in air. The findings indicate that $Y_3Ga_5O_{12}:Mn^{3+}$ promisingly can be used as red emitting compoment for enhanced CRI WLEDs applications.

Keywords: $Y_3Ga_5O_{12}:Mn^{3+}$; Red emission, Improved CRI WLEDs; Garnet phosphors

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S6.P28

Unusual tetrahedral occupancy of Mn^{4+} in $BaWO_4$ and its far-red luminescence properties

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The incorporation of Mn^{4+} into octahedral sites has been extensively investigated with significant success, particularly in oxide- and fluoride-based phosphors. In contrast, doping Mn^{4+} into tetrahedral sites remains challenging and has been rarely reported. In this work, we present far-red–emitting $BaWO_4:Mn^{4+}$ phosphors in which Mn^{4+} ions occupy tetrahedral sites, as confirmed by X-ray diffraction (XRD) combined with Rietveld refinement. The $BaWO_4:Mn^{4+}$ phosphors were synthesized via a solid-state reaction route. Remarkably, the dominant emission peak appears at ~745 nm, well aligned with the absorption band of phytochrome P_{FR}, indicating strong potential for applications in promoting seed germination, flowering, fruiting, and senescence regulation in crops.

Keywords: $BaWO_4:Mn^{4+}$ phosphors; Far-red emission; Tetrahedral sites

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S6.P29

Pt nanoparticles with narrow size distribution achieved by room-temperature atomic layer deposition and low-temperature annealing

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Achieving uniform and size-controlled platinum (Pt) nanoparticles (NPs) on oxide supports is important for optimizing their catalytic performance. In this regard, atomic layer deposition (ALD) has been the method of choice. However, conventional ALD processes typically require elevated temperatures (>200 °C), which often lead to significant particle sintering and broad particle size distributions (PSDs). In this work, we present a strategy to synthesize Pt/TiO_2 catalysts with highly uniform Pt NPs by decoupling the deposition and growth steps. Pt NPs were first deposited onto TiO_2 nanoparticles at room temperature, resulting in highly dispersed sub-nanometer Pt clusters. The as-prepared Pt/TiO_2 composites were subsequently annealed in air at 200, 300, and 400 °C for varying durations to promote controlled particle growth. While annealing led to increased particle sizes, the Pt NPs remained homogeneously distributed, and the PSDs remained significantly narrower than those obtained by direct deposition at elevated temperatures (150–250 °C). This two-step approach enables precise control over Pt NP size and distribution, offering a promising pathway for the rational design of advanced Pt-based catalysts.

Keywords: Pt/TiO_2 catalysts; Atomic layer deposition; Room-temperature deposition; Fluidized bed reactor; Particle sintering

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S6.P30

Enhanced red emission from the $BaSi_2O_5$ – SnO_2:Eu^{3+} phosphor for NUV-pumped WLED applications

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In this study, $BaSi_2O_5–SnO_2:Eu^{3+}$ phosphors were synthesized via a simple solid-state reaction. Structural and compositional analyses using X-ray diffraction (XRD), Raman spectroscopy, scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDS) confirmed the formation of stable phases and high-purity powders after annealing at 800–1200 °C. Photoluminescence excitation (PLE) and emission (PL) spectra revealed that $SnO_2:Eu^{3+}$ absorbs in the UV region (~320 nm) and emits in the orange range (580–590 nm). Incorporation of the $BaSi_2O_5$ host with SnO_2 significantly enhanced the orange–red emission band (580–650 nm) and shifted the absorption toward stronger near-UV (NUV) sensitivity (~395 nm). The optimized phosphor, when coated onto a 395 nm LED chip, exhibited strong potential for supplementing orange–red light in white LED (WLED) applications.

Keywords: $BaSi_2O_5$-SnO_2: Eu^{3+}, red-emitting phosphor, WLED

S6.P31

Sub-1 nm Pt nanoparticles achieved by temperature-variation atomic layer deposition

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Platinum (Pt)-based catalysts are widely recognized for their superior activity in electrochemical reactions. However, their high cost and limited supply require synthesis strategies that minimize the Pt usage while maximizing the catalytic efficiency. Atomic layer deposition (ALD) has emerged as a promising method for fabricating highly dispersed Pt nanoparticles (NPs) with atomic-level control. Yet, achieving uniformly small particle sizes with narrow particle size distributions (PSDs) remains a major challenge due to the complex interplay of precursor adsorption, surface diffusion, nanoparticle aggregation, and Ostwald ripening during growth. In this work, we introduce a temperature-variation ALD approach to overcome these limitations. Unlike conventional ALD processes performed at a fixed temperature, our method cyclically alternates the reaction temperature within each ALD cycle. Using MeCpPtMe3 as the precursor and O2 as the co-reactant in a fluidized bed reactor (FBR-ALD), the Pt deposition was carried out on graphene powders. The precursor adsorption step was performed at a higher temperature (T1), while the subsequent oxidation step with O2 was conducted at a lower temperature (T2). This strategy enabled the formation of highly uniform, sub-1 nm Pt

nanoparticles with narrower PSDs compared to conventional ALD. Our results demonstrate that temperature-variation ALD is a powerful method to tailor Pt nanoparticle size, providing a new pathway toward more efficient and sustainable use of Pt in catalytic applications.

Keywords: Pt/Graphene catalysts; Temperature-variation atomic layer deposition; Fluidized bed reactor; Sub-1 nm Pt nanoparticles.

S6.P32

Tailoring atenolol release kinetics via atomic layer deposition

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Hypertension is one of the most prevalent cardiovascular diseases worldwide, and its effective management often requires strict adherence to long-term medication. Atenolol, a widely prescribed β-blocker, suffers from rapid dissolution and absorption, which can lead to fluctuations in plasma drug levels and reduced therapeutic compliance. Achieving controlled and sustained drug release is therefore essential to improve treatment efficacy and patient adherence. In this study, we demonstrate the application of atomic layer deposition (ALD) as a novel approach to tailor the release profile of atenolol. By coating atenolol particles with ultra-thin SiO_2 films, we achieved precise modulation of dissolution kinetics. Remarkably, a more than threefold reduction in release rate was obtained compared to uncoated atenolol, indicating the effectiveness of the ALD coating in slowing drug release. This work shows that ALD can be exploited as a versatile platform for designing controlled-release formulations, offering new opportunities for improving therapeutic outcomes in hypertension and other chronic diseases requiring sustained drug delivery.

Keywords: Cardiovascular diseases; Atenolol; Atomic layer deposition; Fluidized bed reactor; Surface engineering.

S6.P33

Synthesis and study of optical properties of $SrMoO_4$: Pr^{3+} prepared by the co-precipation method

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As modern technology has advanced, phosphor-converted white LEDs (pc-WLEDs) have become an integral part of everyday life and are essential in both residential and commercial settings. One of the pc-WLED technologies currently being used is the combination of a blue-LED chip with a yellow-emitting phosphor, along with the addition of a red-emitting component to improve the CRI, as well as adjusting the CCT of the light. In this work, we focus on developing a red-emitting phosphor with high quantum efficiency and improved compatibility with blue LED chip excitation based on $Sr_{1-x}Mo_xO_4$: xPr^{3+} (SMO: Pr^{3+}) materials. The SMO: Pr^{3+} phosphors were prepared by a co-precipitation, and their structural and optical properties were systematically investigated. The XRD results indicate that the material samples exhibits a single-phase structure of $SrMoO_4$. The PLE spectra of SMO: Pr^{3+} show a strong absorption in the wavelength range, peaking at 450 nm, consistent with the blue LED chip emission. Under 450 nm excitation, the phosphor showed a strong red emission at a peak of 645 nm. The optimized emission was obtained for the 1% Pr^{3+} doped SMO sample after being annealed at 800 °C for five hours in air. Findings suggest that SMO: Pr^{3+} holds strong potential for use in pc-WLEDs.

Keywords: $SrMoO_4$:1% Pr^{3+}; co-precipitation reaction; red emission; pc - WLEDs.

S6.P34

High Seebeck Coefficient and Wide Band Gap in GeP Monolayer: A DFT Study Toward Tunable 2D Thermoelectrics

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In this study, we employ density functional theory (DFT) to investigate the structural, mechanical, electronic, and thermoelectric properties of the GeP monolayer, a promising two-dimensional (2D) semiconductor. The optimized crystal structure demonstrates excellent mechanical stability, with elastic constants satisfying Born criteria and peak stress values reaching 26% (ε_{xx}), 18% (ε_{bia}), and 18% (ε_{yy}) under strain, indicating notable anisotropic flexibility. At natural case, GeP exhibits a direct band gap of 2.23 eV, suggesting strong semiconducting behavior suitable for nanoelectronic applications. Remarkably, the Seebeck coefficient reaches values of 2147.64 µV/K and -2000.09 µV/K at 300 K, positioning GeP among high-performance thermoelectric materials. While the present work focuses on equilibrium properties, we also outline ongoing investigations into the effects of mechanical strain, external electric fields, and atomic doping. These modulation pathways are expected to further enhance the electronic and transport characteristics of GeP, paving the way for its integration into multifunctional nanoscale devices. Our findings establish a solid foundation for future experimental and theoretical exploration of this versatile 2D material.

Keywords: GeP monolayer, strain, band gap energy, thermoelectric

S6.P35

Solution combustion synthesis and intense green upconversion emission in $CaZrO_3$: Er, Yb, Mo phosphor

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This work reports an intense green upconversion emission of $CaZrO_3$: Er, Yb, Mo phosphor synthesized using the solution combustion method with urea as fuel. X-ray diffraction results confirmed the formation of a single-phase $CaZrO_3$ with a perovskite structure. The scanning electron microscope indicates the cubic-like morphology of the obtained phosphor. Diffuse reflectance spectra show the presence of absorption peaks corresponding to dopant ions of Er and Yb. Under 975 nm excitation, the phosphors showed intense green emission at 520/550 nm and a weak red emission at 660 nm. The dominance of green emission related to the formation of Yb^{3+} - MoO_4^{2-} ion pair followed the energy transfer from these pair ions to Er^{3+} ions, leading to selective enhancement of green UC emission. Furthermore, the obtained phosphor showed a high color purity of green emission up to 96 %. These results indicate that the phosphor is a candidate material for solid-state lighting and optoelectronic device applications.
Keywords: $CaZrO_3$: Er, Yb, Mo phosphor; Intense green upconversion emission; Solution combustion method

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S6.P36

Synthesis and properties photocatalytic of Bi_2MoO_6: Er/Yb/Ho phosphors

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In this paper, we reported the photocatalytic properties of Er/Yb/Ho tri-doped Bi_2MoO_6. The powdered photocatalyst was synthesized via a sol-gel combustion method, followed by thermal annealing. The crystalline structure, elemental composition, morphology, and luminescent properties of the material were characterized using X-ray diffraction (XRD), energy-dispersive X-ray spectroscopy (EDS), scanning electron microscopy

(SEM), and photoluminescence (PL) spectroscopy. The photocatalytic activity of the as-synthesized product was evaluated by the degradation of methylene blue (MB). High degradation efficiencies were achieved after 180 minutes under irradiation from both a UV lamp and natural sunlight.

Keywords: Bi_2MoO_6:Er/Yb/Ho ; sol – gel combustion method, Methylene blue (MB)

S6.P37

Thermoelectric properties of *n*-type skutterudite-nanocarbon composites

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We report the effect of nanocarbon (NC) incorporation on the thermoelectric properties of *n*-type skutterudite $Yb_{0.2}Co_4Sb_{12}$ (SKD). The SKD powder was synthesized by induction melting followed by melt spinning. To introduce NC, a high-energy ball milling process was employed, and bulk composites (SKD-x wt% NC, x = 0.01–0.04) were fabricated via spark plasma sintering (963 K, 50 MPa, 15 min). Microstructural characterization confirmed that the carbon additives were uniformly dispersed in the composites. In the composites, electrical conductivity (σ) decreased with increasing NC content, while the Seebeck coefficient (S) increased. This behavior was attributed to low-energy charge-carrier filtering via interfacial energy barriers between SKD and NC. The reduced carrier concentration led to enhanced mobility, thereby optimizing the power factor($S^2\sigma$). A maximum power factor of 47.9 × 10^{-4} W/mK² was obtained at 664 K for the SKD-0.01 wt% NC composite. Moreover, the electronic thermal conductivity was effectively suppressed due to the reduced σ. As a result, SKD-0.01 wt% NC composite achieved a peak ZT of 1.35 at 762 K. These results demonstrate that nanocarbon incorporation is a promising strategy to enhance the thermoelectric performance of skutterudite-based materials in the mid-temperature range.

Keywords: Thermoelectric; Skutterudite; Nanocarbon; Composite.

S6.P38

Fabrication and study of structural, magnetic and magnetocaloric behaviours of Fe-doped $Nd_{0.6}Sr_{0.4}MnO_3$ compounds

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In recent years, magnetocaloric (MC) materials have attracted much attention of the solid-state physics community because of their potential application in cooling devices. Among numberous investifated materials, perovskite-type compounds are considered to be one of the most promising-material systems that can be fabricated in large quantities using simple techniques at low cost. In addition, these compounds show many interesting physical properties, such as colossal magnetoresistive and MC effects, charge ordering, spin-orbital coupling, spin glass, Griffiths phase, *etc*. To further explore this material system, we prepared $Nd_{0.6}Sr_{0.4}Mn_{1-x}Fe_xO_3$ (x = 0~0.12) by using the solid state method, and then studied their room-temperature structure, and magnetic and MC behaviors. X-ray diffraction analysis showed that all the materials were orthorhombic, belonging to the space group of *Pnma*. The lattice parameters and density were remarkably changed when Fe was doped in the $Nd_{0.6}Sr_{0.4}MnO_3$ host lattice. Besides, this system displays a significant decrease in the ferromagnetic-paramagnetic transition temperature (the Curie temperature, T_C) when Fe-doping concentration (x) in $Nd_{0.6}Sr_{0.4}Mn_{1-x}Fe_xO_3$ increases. Around the T_C values, the magnetic-entropy change reaches the maximum, varying in the range of 2.6~1.8 J/kg·K (depending on x) for a field change of H = 30 kOe. Particularly, the soft-magnetic behavior together with the character of a second-order phase transition of $Nd_{0.6}Sr_{0.4}Mn_{1-x}Fe_xO_3$ materials indicate their potential applications in environmentally-friendly cooling devices operating at temperatures T = 60~250 K. We believe that the changes in the Mn^{4+}/Mn^{3+} ratio, the lattice distortion, and the additional appearance of Fe^{3+}-/Fe^{4+}-related exchange interactions led to the interesting properties, as observed above.

Keywords: Perovskite manganite; Crystal structure; Magnetic/magnetocaloric effect.

S6.P39

Room-Temperature VOC Sensing Using Pt-Functionalized SWCNT/ZnO Composite Nanomaterials under UV Irradiation

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Volatile organic compounds (VOCs) are widely recognized as hazardous air pollutants that pose significant risks to both human health and the environment. The development of highly sensitive and selective gas sensors that can operate at room temperature has therefore become a critical research objective. In this work, we report on the fabrication and characterization of composite nanomaterials based on single-walled carbon nanotubes (SWCNTs) and zinc oxide (ZnO) nanoparticles, further functionalized with platinum (Pt) nanoparticles, for VOC sensing under ultraviolet (UV) irradiation. Commercial SWCNTs were first dispersed in sodium dodecylbenzene sulfonate (NaDDMs) solution through ultrasonic agitation, followed by high-speed centrifugation at 10,000 rpm to effectively remove residual catalyst particles. The purified SWCNTs were then mixed with ZnO nanoparticles synthesized via a solvothermal method using dimethyl sulfoxide (DMSO) and zinc acetate as precursors. The resulting SWCNT–ZnO composites were further modified by deposition of Pt nanoparticles through a UV-assisted photochemical reduction process at 365 nm. The prepared materials were drop-coating onto alumina (Al_2O_3) substrates integrated with bar-shaped gold electrodes to construct gas sensor devices. The structural, morphological, and optical properties of the composites were systematically investigated using Raman spectroscopy, X-ray diffraction (XRD), UV–Vis spectroscopy, scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDS). Electrical and gas-sensing characteristics were evaluated under room temperature conditions with the assistance of UV irradiation (365 nm). The fabricated sensors exhibited a pronounced response to ethanol and acetone vapors at low concentrations, while demonstrating relatively lower response to other tested VOCs, combustible gases, and toxic gases, including isopropanol, toluene, methanol, methane, hydrogen, CO_2, and NO_x. Notably, Pt nanoparticle functionalization significantly enhanced both response and recovery times compared to pristine SWCNT–ZnO composites. This improvement is attributed to the catalytic

role of Pt, which promotes oxygen adsorption–desorption dynamics on the composite surface under UV illumination, thereby accelerating charge transfer processes at the heterojunction interfaces. Based on the experimental findings, a sensing mechanism is proposed wherein the synergistic interactions between SWCNTs, ZnO nanoparticles, and Pt catalytic sites under UV activation collectively contribute to enhanced gas adsorption, efficient electron–hole separation, and improved recovery kinetics. The study highlights the potential of SWCNT–ZnO–Pt composite nanomaterials as promising candidates for highly sensitive, selective, and room-temperature operable VOC sensors, particularly for monitoring ethanol and acetone vapors. These findings provide new insights into the design of hybrid nanostructures for next-generation gas sensing technologies with applications in environmental monitoring, industrial safety, and healthcare diagnostics.

Keywords: VOC sensor; single-walled carbon nanotube; ZnO nanoparticle; room-temperature gas sensor.

S6.P40

Photoluminesnce properties of Bi^{3+} doped $CaGa_2O_4$-$Ca_3Ga_4O_9$ phosphor for high color rendering index warm white lighting emit diodes applications

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In recent years, cyan-emitting phosphor powders has attracted significant attention due to their potential applications in high-CRI warm white light-emitting diodes (w-WLEDs). In this study, we report the synthesis of cyan emitting Bi^{3+} doped $CaGa_2O_4$-$Ca_3Ga_4O_9$ phosphors via a solid-state reaction method. X-ray diffraction

(XRD) patterns confirm the coexistence of two $CaGa_2O_4$ and $Ca_3Ga_4O_9$ phases. Rietveld refinement further demonstrates the successful substitution of Bi^{3+} ions for Ca^{2+} ions within both phases. FESEM images and EDS spectra indicate that the high-purity phosphors consist of particles with diameters in the micrometer range. Under excition at 342 nm, the synthesized $CaGa_2O_4$-$Ca_3Ga_4O_9$ phosphors exhibit a strong cyan emission band peaking at 480 nm. Moreover, 3D photoluminescence (PL) spectra demonstrate tunable emission, with the peak shifting from the cyan to the green light region as the excitation wavelength decreases from 350 nm to 260 nm. The highest PL intensity was observed in the $CaGa_2O_4$-$Ca_3Ga_4O_9$:2%mol Bi^{3+} sample annealed at 1100 °C for 5 hours in air. A prototype warm WLED device, fabricated by coating a layer of these phosphors onto a NUV-LED chip, exhibited a high CRI value of 88, a warm correlated color temperature (CCT) of 4000K and a good luminous efficacy of radiation (LER) of 255 lum/W. These results highlight the significant potential of the $CaGa_2O_4$-$Ca_3Ga_4O_9$ phosphors for high-CRI warm WLEDs applications

Keywords: $CaGa_2O_4$-$Ca_3Ga_4O_9$:Bi^{3+}; Cyan emission, High CRI warm WLEDs; Solid state reaction

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S6.P41

Enhanced thermal stability of cyan-emitting phosphor materials by atomic layer deposition

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The utilization of phosphor-based LEDs in human-centered lighting is a solution to simulate the natural diurnal cycle of sunlight (intensity, colour temperature, spectrum, timing of changes, etc.) to support human circadian rhythms. However, the phosphor component faces a major obstacle: thermal quenching, in which the luminous decreases with increasing temperature, affecting both the efficiency and colour stability of the LEDs. Here, we report a cyan light-emitting phosphor material (λ=495 nm) that exhibits an improved quenching effect while heating up to 200 ℃. The effect occurs when the phosphor material is coated with an SiO2 film using

atomic layer deposition (ALD) technology, in which the degree of the quenching can be tailored by controlling the coating thickness. Our results may initiate the exploration of developing phosphors materials with improved thermal stability and photoluminescence efficiency for high-power LED applications.

Keywords: Phosphors; Anti-thermal quenching; FBR-ALD; Surface coating.

S6.P42

Crystal structures and electrical properties of binary BNT-BKT lead-free piezoelectric ceramics

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Lead-free piezoceramics based on the $(Bi_{0.5}Na_{0.5})TiO_3$-$(Bi_{0.5}K_{0.5})TiO_3$ (BNT–BKT) system were successfully fabricated by the conventional solid-state reaction method. The phase formation and crystal structure were examined by X-ray diffraction (XRD), confirming a perovskite phase without detectable secondary phases. Microstructural analysis using scanning electron microscopy (SEM) revealed well-developed grains with uniform morphology and average grain size in the range of 1-3 μm, indicating effective densification. Ferroelectric polarization-electric field (P-E) hysteresis loops demonstrated typical saturated polarization behavior, suggesting good ferroelectric properties with a remanent polarization of over 25 μC/cm^2 and coercive field of over 30 kV/cm. Strain-electric field (S-E) measurements exhibited stable piezoelectric strain response under bipolar cycling. The dielectric and electromechanical properties were further evaluated: the piezoelectric charge coefficient (d_{33}) reached ~145 pC/N, planar electromechanical coupling factor (k_p) was ~0.31, and mechanical quality factor (Q_m) exceeded 170, highlighting a balanced combination of piezoelectric activity and mechanical stability. These results demonstrate that BNT-BKT ceramics synthesized via a simple solid-state route are promising candidates for environmentally friendly piezoelectric devices, offering a viable alternative to lead-based ceramics for actuator and transducer applications.

Keywords: Lead-free; relaxor; electroceramics; piezoelectrics.

S6.P43

Crank – Nicolson scheme for one-dimentional time-dependent Ginzburg – Landau Equation

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Since its first introduction in 1950, the time–dependent Ginzburg–Landau–Landau (TDGL) equation has been successful in predicting the dynamics of Cooper pairs in superconductors. Despite its prominence with subsequent Nobel Prizes in 1962 and 2003, finding analytical solutions of the TDGL equation is very difficult, with strong approximations often required due to nonlinear terms and thermal fluctuations, especially for high-temperature superconductors and, more recently, iron-based superconductors. Accurate numerical integration is therefore essential but remains nontrivial. In this work, we present a robust Crank–Nicolson scheme for the one-dimensional TDGL equation, incorporating a scalar potential term and Langevin noise according to the fluctuation–dissipation theorem. The scheme applies a semi-implicit method to the nonlinear term and uses an iterative predictor-corrector approach to ensure numerical stability while maintaining computational efficiency. Spatial discretization is performed on a uniform grid with periodic boundary conditions. We verified the method against analytical steady-state solutions, achieving second-order convergence in both time and space. The thermal noise implementation is validated against the fluctuation–dissipation scaling of Mukerjee and Huse (Phys. Rev. B, 2004). In addition, our fully nonlinear Crank–Nicolson approach contrasts with recent analytical studies (Physica C 625, 2024) that rely on self-consistent linearization to describe fluctuation-driven transport in superconducting nanowires. The proposed approach enables reliable simulation of time-dependent phenomena in superconductors and is ready to extend to two-dimensional geometries.

Keywords: Time – dependent Ginzburg – Landau equation; type II – superconductors; Crank – Nicolso method.

S6.P44

Study on the Effect of Polymer Coatings on the Superhydrophobicity of 3D Porous Materials for Oil–Water Separation

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This study focuses on investigating the effect of low-surface-energy coating materials on the superhydrophobicity of 3D porous structures. Specifically, PDMS, HDPE, stearic acid, epoxy resin, and formaldehyde resin were applied as coatings onto ZnO-coated 3D polyurethane foams at various loading levels. The aim was to determine the critical coating content at which the porous surface exhibits superhydrophobic behavior.
The results revealed that the 3D polyurethane foam surfaces achieved superhydrophobicity when coated with more than 20% HDPE, more than 15% stearic acid, or with PDMS in the range of 40–60%. These superhydrophobic porous samples demonstrated oil absorption capacities ranging from 40 to 60 times their own weight, depending on the type of oil.
Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM) were employed to characterize the surface chemistry and morphology of the coated materials.
Keywords: Superhydrophobic sponge, Oil/water separation

S7.P5

Development of triboelectric nanogenerator based on PVDF/TiO_2 membrane fabricated via atomic layer deposition and vapor phase infiltration technologies

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Triboelectric nanogenerator (TENG) is a device that converts mechanical energy into electrical power or signals. This study presents a high-performance triboelectric nanogenerator (TENG) based a TiO_2-decorated polyvinylidene fluoride (PVDF) membranes by using atomic layer deposition (ALD) and vapor phase infiltration (VPI) methods. ALD is a technique that allows precise control of TiO_2 thickness and composition at atomic level, while VPI creates organic – inorganic hybrid structures and improves stability of the membrane. This hierarchical structure significantly improves mechanical durability, hydrophilicity, and interfacial charge transfer properties. Experimental results indicate that both ALD and VPI effectively alter the film structure to improve electrical properties of the TENG device. Furthermore, PVDF/TiO_2 membranes were deposited using ALD and VPI under various temperatures with different thickness to evaluate the relationship between the experimental parameters and the obtained results.

Keywords: Atomic layer deposition, polyvinylidene fluoride, triboelectric nanogenerator, vapor phase infiltration

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S7.P6

Sunlight-driven enhanced photocatalytic activity of Gradient Sn-doped ZnO thin film prepared by Spatial ALD

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Sn-doped ZnO thin films were fabricated at atmospheric pressure using the spatial atomic layer deposition (SALD) technique. A key innovation of this work is the application of a gradient doping strategy, in which the Sn concentration was systematically varied to elucidate its influence on the films' properties. The deposited films were thoroughly characterized in terms of morphology, structure, and optical response using X-ray diffraction (XRD), scanning electron microscopy (SEM), photoluminescence (PL) spectroscopy, and ultraviolet–visible (UV–Vis) spectrophotometry.

Photocatalytic performance was evaluated via the degradation of Methylene Blue dye in wastewater, revealing a strong correlation between Sn content and activity. An optimal doping level markedly improved charge separation efficiency and UV absorption, resulting in a degradation efficiency of 78% within 180 minutes. This

performance significantly surpassed that of pure ZnO and remained stable over three consecutive degradation cycles, highlighting excellent durability.

These findings demonstrate the critical role of precise dopant control and underscore the potential of SALD for the scalable, atmospheric-pressure synthesis of gradient-doped ZnO films. The approach offers a tunable and sustainable pathway toward high-performance photocatalysts for advanced environmental and industrial wastewater treatment applications

Keywords: SALD; Sn-doped ZnO; Photocatalytic activity; Organic dyes.

S7.P7

Study electrical properties of ultrathin SnO_2 films by atmospheric pressure atomic layer deposition.

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Atmospheric pressure spatial atomic layer deposition (AP-SALD) has emerged as a versatile and scalable technique for fabricating ultrathin metal oxide films with atomic-level precision under ambient conditions. In this study, we report the deposition and systematic characterization of ultrathin SnO_2 films prepared by AP-SALD. Particular emphasis is placed on correlating electrical properties with key process parameters, including film thickness, deposition temperature, and post-deposition treatments.
A central focus of this work is the thickness-dependent evolution of carrier density. The unintentionally doped SnO_2 films exhibit exceptionally high carrier concentrations, characteristic of degenerate semiconductors. Both in situ and ex situ electrical measurements especially cryogenic Hall effect analyses – reveal that grain boundary scattering is the dominant mechanism limiting carrier transport. These insights highlight the importance of nanoscale control in AP-SALD SnO_2 films for tailoring their electrical performance, paving the way for their integration in next-generation transparent electronics and energy devices.

Keywords: Carrier transport, in-situ characterization, SALD, tin dioxide

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S7.P8

Development of Hydrophobic Coatings for Polymer Composites with Improved Resistance to Water and Contaminants

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The surface of polymer composites is prone to wetting and soiling, motivating hydrophobic surface engineering for improved cleanliness and durability. This work develops a hydrophobic self-assembled monolayer (SAM) and evaluates its effect on water and stain repellence, with and without a vapor-phase-infiltrated (VPI) SiO_2 interphase. Hydrophobic performance was quantified by static water contact angle, and stain resistance was assessed using methylene-blue dye uptake followed by cleaning with common solvents (e.g., isopropanol, acetone). SAM functionalization substantially increased hydrophobicity, while the SiO_2 interphase further suppressed dye uptake and facilitated stain removal, indicating a synergistic interaction between the inorganic interphase and the organic monolayer. Overall, the results demonstrate a low-temperature, solution-processable route to durable, easy-to-clean polymer composite surfaces and highlight the value of optimizing monolayer chemistry, thermal post-treatment, and infiltration parameters for practical use.

Keywords: Hydrophobic coating; Vapor phase infiltration; Dirt-repellent surface; Water-repellent surface.

S7.P9

Effect of sintering temperature and Eu^{3+} ion concentration on the structure and optical properties of CaY_2O_4 material

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Eu^{3+} ion-doped CaY_2O_4 material was synthesized by us using the solid-state reaction method with sintering temperatures ranging from 1000 to 1300 °C and doping concentrations from 0.5 to 5%. XRD, Raman, XPS, fluorescence, and fluorescence excitation measurements revealed that the material crystallized optimally at 1200 °C, exhibiting the typical structure of spinal CaY_2O_4 material, and tended to break this structure as the sintering temperature increased. The material exhibits the ability to strongly absorb ultraviolet radiation near 395 nm, resulting in strong emission in the red light region, characterized by the characteristic emission of the Eu^{3+} ion through energy level transitions from state $^5D_0$ to state ^7F_j (j = 0-4). The fluorescence quenching phenomenon with the material was observed at a concentration of 3% Eu^{3+} ions. The material has good potential for applications as red-emitting fluorescent materials in white-light emitting LEDs.

ABOUT PHENIKAA GROUP AND PHENIKAA UNIVERSITY

Phenikaa Group

Founded in 2010, PHENIKAA is currently a multi-industry group with more than 30 member units operating domestically and internationally in the core fields: Industrial Manufacturing, Technology Development, Education and Training, Healthcare, and other services.

Vision: The multi-industry PHENIKAA Group is steadily realizing its vision of becoming a Happy and Sustainable Corporation, guided by ESG principles, with the aspiration to contribute to a happy and prosperous life for its employees, customers, and the broader community.

Mission: Based on conscious business culture, PHENIKAA is committed to realizing all commitments to satisfy the needs of customers and partners best; develop fast and sustainably, harmonize the interests of all stakeholders, aim towards NetZero and ESG standards for people and the environment, and contribute to a higher-quality, safer, smarter, and happier life every day.

Strategic Direction: Become a sustainable economic group in its core areas: Technology Development, Industrial Manufacturing, Education, and Healthcare based on a conscious business culture with the goal of sustainable development, in which:

- Industrial Manufacturing is the core business and production activity; advanced materials, ecological materials, and innovative materials are vital products, bringing stable growth in revenue for the Group;
- Technology Development is the core element of difference, competitive advantage, and brand position, fostering and supporting other areas of the Group's active and sustainable development;
- Education - training and Healthcare are the invested areas that help fulfil the Group's responsibilities and aspiration to serve - to contribute to the social community and join hands for a nation of knowledge, health, happiness, and sustainable development.

Gradually develop the core areas of the Group in a balanced and harmonious long-term manner.

At the heart of the Phenikaa Culture, five core values of the group include Reliability, Innovation, Strive to rise, Responsibility, and Respect and Critical thinking, and seven qualities are bold with Trust, Accountability, Care, Transparency, Integrity, Loyalty, Equality.

The Phenikaa Group is committed to establishing and nurturing a sustainable ecosystem driven by innovation, founded on the close integration of Training – Scientific Research – Innovation – Production and Business. This ecosystem operates across four core fields: Technology Development, Industrial Manufacturing, Education & Training, and Healthcare, on 3 fundamental factors: People - Systems - Technology, in which People are the decisive force, driving the transformation of vision into reality and conquering new heights.

The Phenikaa ecosystem forms a chain of organically linked components that encourages creative freedom, nurtures and develops talent under the guiding principle of leveraging the value of training – scientific research – technology development to meet both the Group's production and business demands and broader societal needs.

The 4 pillars of the Phenikaa Ecosystem are closely integrated, mutually supportive, and united by shared values. They operate in a continuous cycle: Training – Research – Commercialization and Transfer – Production – Sales. This cycle is designed to optimize efficiency and increase overall strength, effectively creating a "trading floor" for Orders – Offers between enterprises and University- Institute/ Research center.

The Phenikaa Ecosystem thrives on the organic integration of its components, leveraging the effective linkage of TRAINING – SCIENTIFIC RESEARCH – INNOVATION – PRODUCTION & BUSINESS. This comprehensive integration forms the core of the Group's breakthrough strategy for proactive and sustainable development, as well as realizing the aspiration to develop Vietnamese talent and intellect; creating high-impact scientific and technological research achievements with real-world applications that make transformative contributions to the nation's economy and scientific progress, always striving for a green environment, aligning with NetZero and ESG standards.

INDUSTRIAL MANUFACTURING

Pioneering – Innovation – Sustainable Efficiency

ECOLOGICAL MATERIAL FIELD

The Group now operates one Cristobalite material factory, the second largest in the world, with the production capacity of about 100,000 tons of material per year, and one Composite plastic material factory with the first and unique technological know-how in Vietnam, which was researched, developed, and applied by Phenikaa Group. The Group is successfully implementing localization strategy and owning 95% of the input materials, while deeply integrating in the supply chain for ecological materials.

POLYESTER RESIN

Production of unsaturated **Polyester resin**

The first and unique
Technology know-how in Vietnam

Mastering
100%
Resin Materials

Cristobalite

TOP 2
Cristobalite Factories worldwide

Production capacity of
100,000 tons/year

TECHNOLOGY DEVELOPMENT

Smarter and more comfortable

TRANSPORT ROBOT

With a desire to contribute to creating a smart and happy life, and aiming to become a leading technology and industrial group in smart solutions and smart manufacturing, PHENIKAA dedicates significant investment to in-depth research, development, and ownership of core technologies that address essential needs of the digital economy. These technologies have the potential to lead trends and be effectively applied in daily life and production-business activities, such as: semiconductor technology, autonomous technology, energy storage technology, and biomedical technology.

Aimed at creating a smarter and happier life, these technologies are effectively applied in daily life and production-business activities:

- Successfully launched the first Level 4 made-in-Vietnam autonomous vehicle in Vietnam
- Products including autonomous robots, autonomous drones, and more
- Investing in developing a leading regional chip design ecosystem that enables the synchronized implementation of chip design activities and mastery of key core technologies in the semiconductor industry, such as: Processor design (NPU, CPU, DSP) for specific applications, Algorithm design (AI, Wireless, Control), Compiler and software development environments, Traditional IP development (ADC/DAC, interface), Advanced chip design processes, and more.

Phenikaa's core technology-based products have been exported to global markets, proving their competitiveness and potential for worldwide expansion.

HEALTHCARE

For a peaceful and happy community

PHENIKAA aims to become a top trusted brand in the healthcare sector

With a strong foundation in training human resources in Medicine - Pharmacy and Scientific Research, PHENIKAA aims to become a top trusted brand in delivering superior healthcare products and services, contributing to a better quality of life and promoting health, peace, and happiness for all.

The close-knit and mutually supportive relationship among the three "core pillars" in the Phenikaa Healthcare Ecosystem creates distinctiveness and outstanding strength, driven by four breakthrough factors:

- **Comprehensive Institute–University model at Phenikaa:** a place that gathers talented individuals in a "3-in-1" role (Educator – Scientist – Doctor), all dedicated to community health and medical advancement. The curriculum is based on a comprehensive modular system that spans foundational, pre-clinical, and clinical training... Notably, Phenikaa students are the first in Vietnam to undertake residency training at a private hospital, thereby integrating academic study with hands-on experience within the PhenikaaMec Healthcare System.

- **Breakthrough in training:** Students at Phenikaa University of Medicine and Pharmacy are fully equipped for global integration, possessing comprehensive competencies and international collaboration, and are encouraged to innovate from their very first year.

- **Breakthrough in scientific research:** Driving pioneering studies in six specialized fields, including: Genes and Genetics; Molecular Biology; Stem Cells; Oncology; Obstetrics – Fetal Medicine; Diagnostic Imaging.

- **Promoting career orientation - entrepreneurship:** Applied research and innovation centers are established to continuously promote career orientation, entrepreneurship, and community service.

EDUCATION AND TRAINING

Awaken and Realize Your Potential

Phenikaa School

Inspiring young innovators

Our aim is to create preeminent generations of Vietnamese students that are creative and confident in the global theatre. In order to realize their dreams and live a happy life, Phenikaa School is aimed at becoming a cheerful school with an advanced curriculum, as well as a compassionate, innovative and cooperative learning environment that provides students and teachers with a culture of continuous learning, critical thinking and active learning methods.

The school is geared towards providing an international quality education, pioneering in educational innovation and leadership in STEM/STEAM-oriented teaching.

Phenikaa Inter-level School – A happy and inspiring school with five uniquely designed educational programs:

- English Program – A Passport to Global Integration
- STEM Program – Igniting Passion, Shaping the Future
- ICT Program – Mastering Technology, Embracing the Digital Future
- Art & Physical Education – Nurturing Emotions, Cultivating the Soul
- 21st Century Skills & Career Orientation – A Solid Foundation for the Future

29,230m²
Of campus with modern facilities

American international education system with a
Focus on STEM

Around **1,000m²**
For **"maker space"**, a place to encourage creativity

Inspiring
Teaching staff

Phenikaa University

Established on October 10th, 2007, under Decision No. 1368/QD-TTg of the Prime Minister, in October 2017, Thanh Tay University became a member of Phenikaa Group – one of the top multi-industry economic groups in Vietnam. On November 21st 2018, the institution was officially named Phenikaa University according to Decision No. 1609/QD-TTg of the Government.

With the investment from Phenikaa Group, the University has undergone a comprehensive restructuring in all aspects, alongside with the inter-level school education system to become one of the three Centers of the Phenikaa Ecosystem: Manufacturer-Businessman, Educator and Scientist; with 4 pillars encompassing Industry, Technology, Education-Training and Health care. The ecosystem has facilitated Phenikaa University to operate effectively under a knowledge enterprise model with the orientation of being a sustainable and excellent university in education and scientific research, the leading institution in Vietnam in terms of innovation breakthrough and effectiveness — a place where education, scientific research, and innovation are developed in harmony and closely interconnected, ensuring equality among all stakeholders.

On April 15th, 2025, pursuant to Decision No. 775/QD-TTg issued by the Prime Minister, the institution was officially allowed to expand from a multi-disciplinary one into a university with multiple member schools across various fields – the first private university in Northern Vietnam to be developed under this smart, innovative, and multidisciplinary model. The academic units under Phenikaa University include:

- Phenikaa School of Engineering
- Phenikaa School of Computing
- Phenikaa School of Economics and Business
- Phenikaa School of Foreign Language Studies and Social Sciences
- Phenikaa School of Medicine and Pharmacy
- Faculty of Law
- Faculty of Interdisciplinary Digital Technology
- Faculty of Fundamental Sciences
- School of International Education
- Research Institutes & Centers

With the educational philosophy of "RESPECT - INNOVATION – CRITICAL THINKING", Phenikaa University will truly become an experiential institution, where teaching and learning activities are closely linked to reality. In research, the University develops both basic research and applied studies simultaneously. The University's training programs are designed to combine teaching - learning - research with practice through case studies, interdisciplinary projects, or applied research projects, which helps students have enough knowledge and skills to work effectively upon graduation.

MILESTONES

2025

- **One of the 10** comprehensive universities in Vietnam.
- **THE Awards Asia 2025 – Top 8** Finalist in 2 categories (Technological or Digital Innovation of the Year, Teaching and Learning Strategy of the Year).
- **Scimago Rankings 2025 – Top 6** in Vietnam.

2023 - 2024

- **Top 401 – 600** "Partnership for sustainable development goals" (THE Impact Rankings 2023).
- **Top 601 – 800** "Quality Education" (THE Impact Rankings 2023).
- **Top 1** among universities and research institutes in Vietnam (Nature Index).
- **UPM 5 Stars** | #1 Innovation-Oriented University in Vietnam.
- **Top 2** in economic research (RePEc Vietnam 2024).

2021 - 2022

- **Top 1** among universities and research institutes in Vietnam (Nature Index).
- **1 of 4** universities in Vietnam ranked by THE Impact Ranking 2021.
- **Top 5** IPStar in Vietnam for outstanding achievements in patent registration and innovation.

2019 - 2020

- **Top 5** among universities and research institutes in Vietnam (Nature Index).
- **Top 3** HEIs with more than 1000 citations (Google Scholar).
- Certificate of Institutional Accreditation by VNU-CEA.

2017 - 2018

- Became a member of Phenikaa Group.
- Relaunched as Phenikaa University following strategic restructuring.

FACTS AND FIGURES

- **~37,000** Students
- **95%** job placement
- **>1000** Staff members
- **140,000m^2** Campus
- **4000m^2** Sport Complex
- **~100** Advanced laboratories
- **~15%** of Academic Staff are Professors and Associate Professors
- **~50%** of Academic Staff are PhD holders
- **~300** Multimedia classroom and lecture halls
- **~50** clubs across various fields: academics, hobbies, volunteering, etc.

ACADEMIC PROGRAMS

UNDERGRADUATE PROGRAMS

Engineering & Technology

Advanced Materials and Nanotechnology
Artificial Intelligence and Data Science
Artificial Intelligence for Materials
Automotive Engineering
Automotive Mechatronics Engineering
Biomedical Engineering
Biotechnology
Chemical Engineering
Computer Science
Control and Automation Engineering
Electronics and Telecommunication Engineering
Environmental Science
Information Technology
Information Technology Program Toward Japan IT Market
Mechanical Engineering
Mechatronics Engineering
Physics
Robotics and Artificial Intelligence Engineering
Software Engineering
Artificial Intelligence
Information Security
Mechatronics Engineering
Semiconductor Chip and Packaging Technology
IC design
Intelligent Mechatronics System

Health Sciences

Nursing Science
Medical Doctor
Medical Testing Techniques
Pharmacy
Rehabilitation Technology
Odonto - Stomatology - Dentistry
Traditional Medicine
Medical Imaging and Radiological Technology
Hospital Management
Biomedical Sciences
Midwifery

Economics – Business; Tourism - Hospitality; Law; Interdisciplinary Digital Technology

Accounting
Business Administration
Economic Law
Finance - Banking
Human Resource Management
International Business
Logistics and Supply chain management
Marketing
Financial Technology
Multimedia Communications
Business Law
Law
International Law
International Trade Law
Auditing
Digital Tourism Business
Tourism
International Tour Guide
Hospitality Management
Marketing Technology
Digital Economics
E-commerce
Digital Business
Digital Logistics

Social Sciences

Chinese Language
English Language
Japanese Language
Korean Language
French Language
Oriental Studies

GRADUATE PROGRAMS

Master Programs

Business Administration
Chemical Engineering
Computer Science
Economics Management
Materials Science
Mechanical Systems Engineering
Nursing
Pharmacology and Clinical Pharmacy
English Language
Accounting
Pharmaceutical technology and pharmaceutics
Finance - Banking
Control and Automation Engineering
Mechatronics Engineering
Electronic Engineering
Economic Law

PhD Programs

Chemical Engineering
Materials Science
Mechanical Systems Engineering
Theoretical and Mathematical Physics
Computer Science
Pharmacology and Clinical Pharmacy
Business Administration
Chemical Engineering
Polymers and Composites
Electronic Materials
Optical, Optoelectronic, and Photonic Materials

INTERNATIONAL JOINT PROGRAMS (UNDERGRADUATE)

UWE Bristol - Phenikaa Campus

Business and Management
Business Management and Marketing
Business and Events Management
Accounting and Finance
Computer Science - Artificial Intelligence
Computer Science - Smart Devices Development
Information Technology

2+2 Program in Chinese language

Chinese Business Language Orientation
Chinese Tourism Language Orientation

2+2 Program in Korean language

Korean Language for Translation and Interpretation in Science and Technology
Korean Language for Translation and Interpretation in Tourism and Trade

RESEARCH

KEY LABORATORIES

- Nanosensors Lab
- High Energy Physics and Cosmology
- Nanomaterials for Biomedical and Environmental Applications
- Medicinal Chemistry & Bioactive Compounds
- Intelligent Communication Systems
- Nanomaterials for Electronics and Renewable Energy
- Optoelectronic & Photonics
- Social Sciences Data Analysis Lab
- Renewable Energy Conversion & Storage Lab
- Optimize Large Systems
- Network Research and Intelligent Computing
- Nuclear Energy and Engineering

POTENTIAL RESEARCH GROUPS

- ALD Research Lab
- Quantum Materials Lab
- Smart Lighting and IoT
- Applied Fluid Mechanics
- nBIORD Lab
- Environmental Chemistry and Ecotoxicology
- Applied Materials Science
- Complex Analysis and Differential Equations
- Gravitation and Cosmology
- Research for nursing improvement
- Astrophysics
- Smart Digital Media&Intelligient Control
- Sustainable Energy for Automobile
- Mechanics of Materials/Structures and Applications
- Smart Sensing and Applications
- Drug Design and Synthesis
- Applications of Biomedical Science and Molecular Biology in Medicine
- Artificial Intelligence and Internet of Things
- Integral Solving & Differential Equations
- Interdisciplinary Research in Data Science and Artificial Intelligence

PHENIKAA UNIVERSITY

SPIN-OFF COMPANIES

- PHENIKAA-X
- S-PHENIKAA
- PHX SMART SCHOOL SOLUTIONS JOINT STOCK COMPANY
- PHENIKAA TRADING AND TECHNOLOGY TRANSFER COMPANY
- AQP RESEARCH AND DRUG TESTING COMPANY
- ADVANTECH COMPANY
- PHENIKAA NATURAL TRUECIRCADIAN LED LIGHTING

UNIVERSITY HOSPITALS AND CLINICS

In addion to education, healthcare is a pivotal focus area for Phenikaa Group, driven by its commitment to serving and contributing to the social community. Together, we strive towards nurturing a knowlegeable, healthy, strong and happy nation, fostering sustainable development.

Notably, Phenikaa University Hospital is structured to operate according to:

Smart Hospital Model:

- Implementation of advanced technology
- Adoption of smart management practices

Institute-School Connection Model:

- Integration of theoretical and clinical teaching methodologies
- Close alignment between training and practical application

PHENIKAAMEC HEALTHCARE SYSTEM:

- Phenikaa University Hospital
- Phenikaa University General Clinic - Hoang Ngan
- Phenikaa University Dental Clinic

PHENIKAA UNI HOLDING

Phenikaa Uni Holding (PKAHUB) is the innovation and entrepreneurship hub of Phenikaa University. Acting as a bridge between research and business, PKAHUB focuses on technology transfer, startup incubation, and commercialization. It plays a key role in fostering collaboration between scientists, students, and enterprises to bring practical, market-ready solutions to society. Notably, Phenikaa-X develops Level-4 autonomous vehicles, industrial robots, and drones for forest monitoring. Its solutions have been piloted in smart cities, adopted by major FDI manufacturers like Samsung Thai Nguyen, and exported to Korea and Europe. PHX Smart School offers comprehensive digital platforms that enhance school management and teaching, contributing to Vietnam's educational digital transformation.

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Scan QR code
to go on virtual Campus tour

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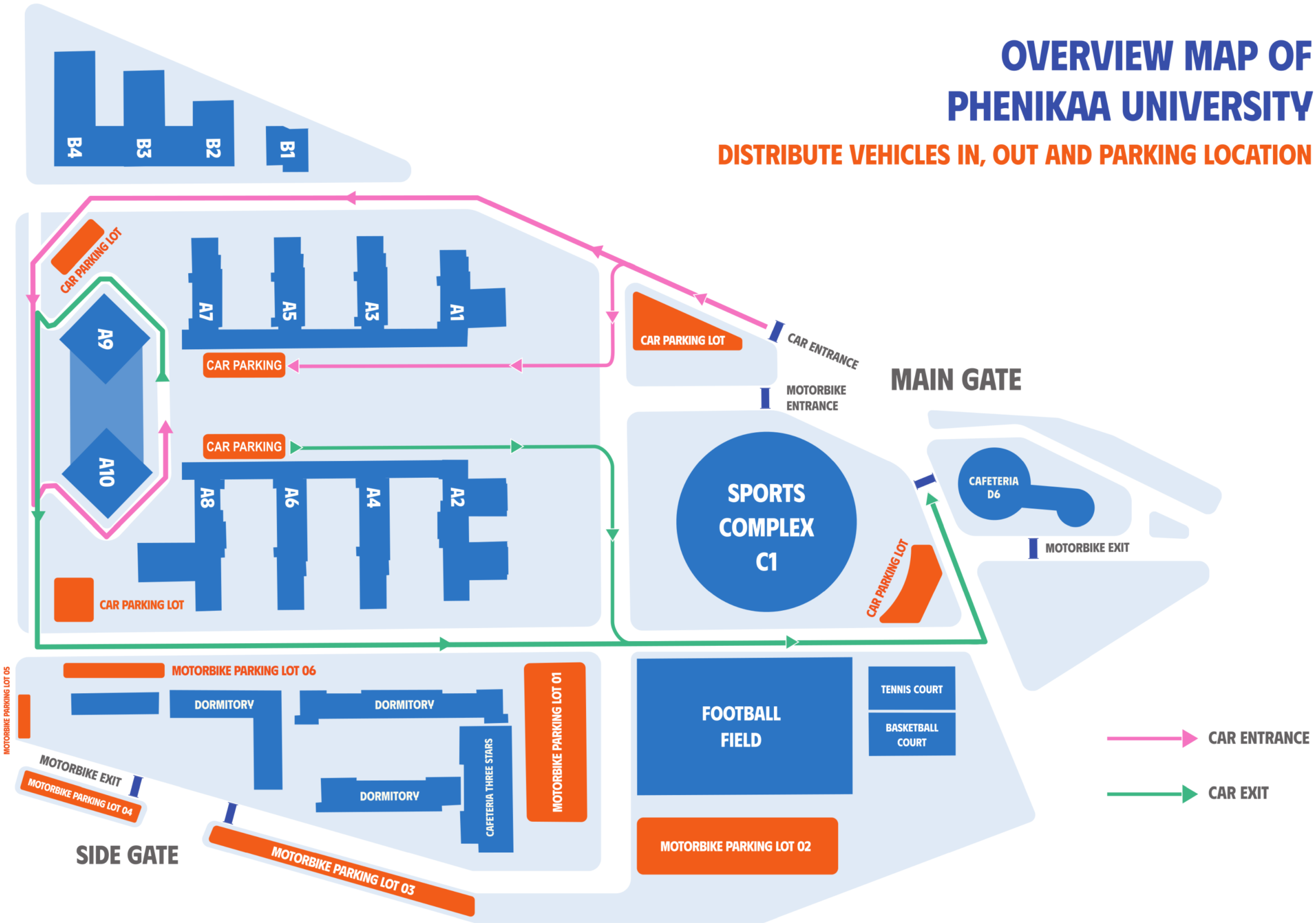
to access the University website



OVERVIEW MAP OF
PHENIKAA UNIVERSITY
DISTRIBUTE VEHICLES IN, OUT AND PARKING LOCATION
B4
B3
B2
B1
CAR PARKING LOT
A7
A5
A3
A1
A9
A10
CAR PARKING
CAR PARKING
A8
A6
A4
A2
CAR PARKING LOT
CAR PARKING LOT
CAR ENTRANCE
MAIN GATE
MOTORBIKE ENTRANCE
SPORTS COMPLEX C1
CAR PARKING LOT
CAFETERIA D6
MOTORBIKE EXIT
MOTORBIKE PARKING LOT 05
MOTORBIKE PARKING LOT 06
DORMITORY
DORMITORY
DORMITORY
CAFETERIA THREE STARS
MOTORBIKE PARKING LOT 01
FOOTBALL FIELD
TENNIS COURT
BASKETBALL COURT
MOTORBIKE EXIT
MOTORBIKE PARKING LOT 04
SIDE GATE
MOTORBIKE PARKING LOT 03
MOTORBIKE PARKING LOT 02
CAR ENTRANCE
CAR EXIT

BOOK OF ABSTRACTS

PHENIKAA INTERNATIONAL PHYSICS CONFERENCE 2025

CELEBRATING 100 YEARS OF QUANTUM PHYSICS

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