THE PROGRAM AND BOOK OF ABSTRACT

14th International Physics Seminar and Seminar Nasional Fisika

2025

on June 21st
Latief Hendradiningrat Room,
Dewi Sartika Building 2nd Floor,
State University of Jakarta

Penerbit Erlangga
Walcoo
attin

14th International Physics Seminar and Seminar Nasional Fisika

THE PROGRAM AND BOOK OF ABSTRACTS

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Jakarta, 21 June 2025

Department of Physics & Physics Education
Faculty of Mathematics and Natural Sciences
State University of Jakarta

SCHEDULE OF EVENTS

Schedule for Seminar
Saturday, 21st of June 2025

Planerary Session

Time (Jakarta, Indonesia, WIB)	Activity
07.30 – 08.00	Registration
08.00 – 08.05	Opening by MC
08.05 – 08.10	Indonesia Raya Anthem and Mars UNJ
08.10 – 08.15	Opening Prayer
08.15 – 08.20	Musical Performance by Oscilostrings
08.20 – 08.45	1. Report from Head of Committee 2. Speech from Dean of Faculty of Mathematics and Natural Sciences UNJ 3. Speech from Head of Physical Society of Indonesia (PSI) Chapter Jakarta-Banten 4. Opening remark from Rector UNJ
08.45 – 08.55	Presentation of Sponsor Plaque
08.55 – 09.40	Keynote 1: Prof. Aung Ko Ko Kyaw, Ph.D
09.40 – 10.25	Keynote 2: Prof. Supriyanto A. Pawiro, Ph.D

10.25 – 10.30	Musical Performance by Oscilostrings
10.30 – 11.15	Keynote 3: Dr. Noorzana binti Khamis
11.15 – 12.00	Keynote 4: Dr. rer. nat. Sparisoma Viridi, S.Si., M.Si.
12.00 – 12.15	Presentation from Erlangga
12.15 – 12.20	Musical Performance by Oscilostrings
12.20 – 12.30	Photo Session
12.30 – 13.30	Afternoon Break
13.30 – 15.50	Parallel Sessions
15.50 – 16.00	Closing in each parallel room

ABSTRACT OF KEYNOTE SPEAKER

Success Story of Over 40 Years of Research in Organic Photovoltaics: From Fundamental Discoveries to Commercialization

Aung Ko Ko KYAW

Department of Electronic and Electrical Engineering
Southern University of Science and Technology

Over the past four decades, organic photovoltaics (OPVs) have played a pivotal role in advancing emerging solar cell technologies. Unlike traditional silicon-based solar cells, OPVs offer several advantages, including light weight, low cost, flexibility, and a short energy payback time, thanks to their solution-processable nature. Initially demonstrated in 1985 with a power conversion efficiency (PCE) of about 1%, OPVs have made remarkable progress and now achieve efficiencies exceeding 20%, bringing them close to commercial viability. In this talk, I will explore the technological evolution of OPVs over the past 40 years from various perspectives, including device architecture, material development, and processing techniques. We will discuss the challenges faced and opportunities ahead for the commercialization of this technology. Finally, I will highlight potential niche applications of OPVs, such as building-integrated photovoltaics, agrivoltaics, and indoor photovoltaics for Internet of Things (IoT) networks.

ABSTRACT OF KEYNOTE SPEAKER

Development and implementation of Audit Dosimetry in Radiotherapy

Supriyanto A Pawiro
Universitas Indonesia

Most of hospital have implemented the advances techniques radiotherapy to help the cancer patient worldwide. To ensure the accuracy of delivering radiation dose to patient, the audit dosimetry is needed. The audit procedure covers dosimetry ranging from point dose measurement, 2D dosimetry with film and/or dosimeter array, to 3D dosimetry. Although dose verification is often applied locally in hospitals, some studies show that local QA results do not always match the results of independent audits. A common approach to evaluating dose distribution is using gamma analysis, which in some cases has shown inconsistencies between results performed with local QA equipment and from independent audits, which usually result in lower pass rates. Inconsistencies between local and independent audit QA results support the need for independent dosimetry audits (in addition to relying solely on local QA measurements) for consistent, accurate, and safe radiation therapy treatments using complex modalities. The methods of audit dosimetry and result from several implementations will presented.

ABSTRACT OF KEYNOTE SPEAKER

From Particles to People: Exploring Complex and Sustainable Systems with Agent-Based Modeling

Sparisoma Viridi
Physics Department, Institut Teknologi Bandung, Indonesia

Agent-Based Modeling (ABM) is a powerful computational framework for simulating systems composed of many interacting agents. These agents—representing individuals, cells, vehicles, or economic actors—follow local rules, producing complex, emergent behavior. ABM is conceptually related to Molecular Dynamics (MD), which simulates physical particles, but it extends more broadly to behavioral and socio-technical systems.

This presentation summarizes a series of ABM studies across physical, biological, and socio-economic domains. Applications include pedestrian evacuation using a social-force-enhanced ABM, traffic flow simulation on simplified networks, and cell reproduction and stem cell deposition, combining MD and ABM elements to simulate biological dynamics. Disease spread is modeled by linking ABM with the classical SIR framework, capturing spatial heterogeneity in infections.

Socio-economic systems are explored through simulations of commuting networks using origin-destination matrices and a gravity-driven ABM of regional economic growth. ABM is also applied to bioeconomy modeling, comparing smart, green, and conventional farming systems, and to marine sector dynamics around Patimban Deep Sea Port using System Dynamics (SD).

These diverse studies illustrate ABM's role in modeling interactions across scales—from microscopic to societal. They also align with key Sustainable Development Goals (SDGs): SDG 2 (sustainable agriculture), SDG 3 (health), SDG 4 (education), SDG 9 (infrastructure), SDG 11 (sustainable cities), and SDG 14 (life below water). The integration of ABM with MD and SD supports a multi-method understanding of sustainability challenges.

ABM offers a flexible and visual approach to exploring how local rules lead to global outcomes. This makes it a valuable tool not only in research but also in education, where systems thinking and interdisciplinary modeling are increasingly essential.

Keywords : Agent-Based Modeling, Emergent Behavior, Sustainable Development Goals, Simulation, Hybrid Modeling.

ABSTRACT OF KEYNOTE SPEAKER

Innovative Strategies to Empower Physics Education for a Sustainable Future

Dr. Noorzana Khamis
Universiti Teknologi Malaysia (UTM), Malaysia

Innovative pedagogical strategies are essential in transforming Physics education to meet the goals of sustainable development. Methods such as interactive simulations, 3D animations, and gamification have demonstrated strong potential in improving students' conceptual understanding, particularly in abstract topics like heat and geometrical optics. These strategies also enhance student motivation, foster creativity, and support the development of critical 21st-century skills such as problem-solving and collaboration. Technological tools make learning more engaging and bridge the gap between theoretical concepts and real-world applications. When incorporated into teacher education programs and reinforced through collaboration with the wider school community, these strategies contribute meaningfully to inclusive and high-quality Physics education. They also align with broader efforts to promote innovation, resilience, and environmental awareness within education systems. By embracing student-centered, reflective, and forward-thinking practices, Physics education can serve as a powerful platform for nurturing scientifically literate, socially responsible individuals who are prepared to contribute meaningfully to a sustainable future.

ABSTRACT OF INVITED SPEAKER

Development of Anti-Plasmodium falciparum Lactate Dehydrogenase IgY for Rapid Diagnostic Test Antigen of Malaria

Fifi Fitriyah Masduki[1,2*], Robi'atul Adawiyah[1], Yovin Sugiyo[1], Eva Nursyifa[1], Ihsanawati[1], Dessy Natalia[1,2]

[1]Biochemistry Division, Faculty of Mathematics and NaturalSciences, Institut Teknologi Bandung; [2]Bioscience and Biotechnology Research Center, Institut Teknologi Bandung *Corresponding author: fifimasduki@itb.ac.id

Malaria is a severe and potentially fatal disease caused by Plasmodium, a unicellular eukaryotic protozoan parasite. To date, five Plasmodium species have been identified as infectious to humans: P. falciparum, P. vivax, P. ovale, P. malariae, and P. knowlesi. In 2024, Indonesia reported a significant surge in malaria cases, reaching 519,628 confirmed cases—an increase of over 100,000 compared to the previous year. Notably, 89% of these cases originated from Papua, which is also endemic to other infectious diseases such as AIDS and tuberculosis. As all three conditions often manifest with fever, accurate differential diagnosis is critical to avoid misdiagnosis and the unwarranted use of antimalarial drugs, which could accelerate resistance development. To mitigate this issue, the World Health Organization (WHO) advocates the use of malaria Rapid Diagnostic Tests (RDTs) before administering antimalarial treatment. RDTs are based on the lateral flow assay (LFA) technique, relying on antigen–antibody interactions for detection. They are widely adopted due to their affordability, ease of use, and rapid diagnostic results. Commercial RDTs commonly target one or more of the following Plasmodium proteins: Lactate Dehydrogenase (pLDH), Aldolase, and P. falciparum Histidine-Rich Protein II (PfHRP-II), with pLDH offering higher sensitivity and broader species detection. This study aims to develop a domestic solution by producing anti-P. falciparum Lactate Dehydrogenase Immunoglobulin Y (IgY) antibodies for potential integration into Indonesian-made malaria RDTs. This research contributes to the development of affordable and locally sourced diagnostic components, aligning with the national goal of achieving at least 40% local content (TKDN) in in-vitro diagnostic tools.

ABSTRACT OF INVITED SPEAKER

Expressibility-Dependent Efficiency and Accuracy of Hardware Efficient Ansatz for Electronic Structure Calculations

Rasyid Ustman Ramadhan1,Teguh Budi Prayitno1, Yanoar P. Sarwono2

1Department of Physics, Faculty of Mathematics and Natural Science, Jakarta State University, East Jakarta 13220, Indonesia
2Research Center for Quantum Physics, National Research and Innovation Agency (BRIN), South Tangerang 15314, Indonesia

Abstract

Variational quantum eigensolver (VQE) holds promise for solving the Schrodinger equation on noisy intermediate-scale quantum (NISQ) computers, with its success relying on a well-designed wave function ansatz. In this work, we calculate the total energy of the hydrogen molecule using five hardware efficient ansatz. Furthermore, we evaluate their expressibility and link it to the efficiency and the accuracy of the energy calculations. Understanding the expressibility of an ansatz is crucial for efficient quantum computation.

Keywords: VQE, expressibility

Topic: Instrumentation and Computational Physics

SCHEDULE FOR EACH ROOM

Room : 1
Scope : Medical Physics and Biophysics

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:45	Invited Speaker	Dr.rer.nat. Fifi Fitriyah Masduki	Development of Anti-Plasmodium falciparum Lactate Dehydrogenase IgY for Rapid Diagnostic Test Antigen of Malaria	Onsite
2	13:45-13:55	ABS-84	Assyifa Rahman Hakim	Effect of Patient Gender on the Calculation of Time-Integrated Activity Coefficient in Radionuclide Therapy: A Study Using the Non-Linear Mixed-Effects Model	Onsite
3	13:55-14:05	ABS-83	Asyifa Khoerunnisa	Investigation of the Effects of Compartments in Physiologically Based Pharmacokinetic (PBPK) Model on AUC Calculation in Alpha Therapy Using 212Pb-DOTAMTATE	Onsite
4	14:05-14:15	ABS-62	Zahra Azizah	Pipeline for Visual Interpretability in Breast Cancer Classification Using Grad-CAM	Onsite
5	14:15-14:25	ABS-201	Aurellyallodia Faiza Kusuma	Computational Biophysics of Drug-Target Interactions: In Silico Investigation of 2-Anilino-4-Amino Quinazoline Derivatives as Potential Inhibitors of Plasmodium falciparum Dihydroorotate Dehydrogenase	Onsite
6	14:25-14:35	ABS-73	Chamrern Doeur	Study The Calculated Area Under The Curve in Molecular Radiotherapy Using Opendose and CFTool Software (Opendose Vs CFTool)	Onsite
7	14:35-14:45	ABS-22	Indra Budiansah	Evaluating Renal Time-Integrated Activity Coefficient Consistency in [177Lu]Lu-DOTA-TATE Therapy: Simultaneous vs. Separate Kidney Modeling Using Non-linear Mixed-effects Modeling	Onsite
8	14:45-14:55	ABS-82	Jenni Natalia Corebima	Study the Effect of Compartments in Physiologically Based Pharmacokinetic (PBPK) model of Alpha Therapy Using Ac-225 mcp-M-alb-PSMA to the AUC calculation	Onsite
9	14:55-15:05	ABS-96	Parinza Ananda	Effect of Manual Segmentation on the Accuracy of Calculated Absorbed Dose in Liver and Kidney: Comparison with the Automatic Mode in OpenDose3D	Onsite
10	15:05-15:15	ABS-68	Ratna Sari Dewi	Effects of ion recombination on high dose rate electron using TRS-398, AAPM TG-51, and modified methods	Onsite
11	15:15-15:25	ABS-81	Rohma Novitasari	Investigation of the Effect of Changing the Tolerated Dose for Kidney and Spleen on the Predicted Distribution of 212Pb-DOTAMTATE and Its Daughters in Alpha Therapy	Onsite
12	15:25-15:35	ABS-186	Rohul rizki mubaroq Hartman	Effect of Negatively Charged Amino Acid and Nanohydroxyapatite Concentrations on The Surface Hydrophilicity of PVA Nanofiber Scaffolds	Onsite
13	15:35-15:45	ABS-87	Rosa Desinta	Impact of Varying the Maximum Tolerated Dose for Kidney on the Predicted Distribution of Ac-225-mcp-M-alb-PSMA and Its Daughters in Alpha Therapy	Onsite
14	15:45-15:55	ABS-72	Fira Dwi Ananda	The Effects of Intra-Individual Variability Setting on the Accuracy of Time-Integrated Activity Calculations	Onsite
15	15:55-16:05	ABS-58	Syahril Siregar	Discriminating Benign and Malignant Breast Lesions Using Shape Descriptors in Ultrasound	Onsite

Room : 2
Scope : Physics Education

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:40	ABS-161	A Halim	Identification of Deterministic, Intermediate, and Probabilistic Thinking in Terms of Gender, Cumulative Grade Point Average, and Mathematical Ability	Onsite
2	13:40-13:50	ABS-202	Emza Sinar Pamungkas	RANCANG BANGUN ALAT PERAGA MOMENTUM SUDUT GYROSKOP RODA	Onsite
3	13:50-14:00	ABS-36	Kareena Zalfa Elysia	Rancang Bangun Alat Peraga Termoskop	Onsite
4	14:00-14:10	ABS-31	Maudi Endah Lestari	Rancang Bangun Audiobook Materi Energi untuk Siswa Berkebutuhan Khusus (Tunanetra)	Onsite
5	15:00-15:10	ABS-235	KRISANTINI A/P VINAYAGAN	The Relationship between conceptual understanding and problem solving abilities among Universiti Teknologi Malaysia's undergraduates	Onsite
6	14:10-14:20	ABS-127	Nining Kusumastuti	DEVELOPMENT OF INTERACTIVE MODULES BASED ON DIGITAL SIMULATION FOR TRAINING NATIONAL SCIENCE OLYMPIAD (OSN) ON MECHANICS MATERIAL IN JUNIOR HIGH SCHOOL	Onsite
7	15:10-15:20	ABS-236	NUR ALYA QISTINA BINTI ZAINUDDIN	Pengetahuan dan Cabaran Penggunaan Teknologi Guru Pelatih dalam Pengajaran dan Pembelajaran Fizik	Onsite
8	14:20-14:30	ABS-74	Shofiyah Muthmainnah	Pengembangan Permainan Simulasi Bird Simulator sebagai Media Pembelajaran untuk Penjumlahan Vektor	Onsite
9	15:20-15:30	ABS-237	NUR AMANI BASIRON	Keberkesanan Pendekatan Pembelajaran Kooperatif dalam Meningkatkan Pemahaman Konsep Pelajar Terhadap Subjek Fizik Topik Daya dan Gerakan 1	Onsite
10	14:30-14:40	ABS-35	Taufik Putra Nurdiansyah	RANCANG BANGUN ALAT PERAGA SPEKTROSKOP ANALISIS SPEKTRUM WARNA (SPEKTRA)	Onsite
11	15:30-15:40	ABS-238	NURUL IMAN HANISAH BINTI AZMI	Effectiveness of Using Simulations in Learning the Concepts of Force and Motion	Onsite
12	14:40-14:50	ABS-153	Vina Serevina	The Basic Physics Learning Tools Based on STEAM to Improve Students Literacy and Numeracy Skills	Onsite
13	15:40-15:50	ABS-239	NURUL NABILA BINTI A RAZAK	Hububgan antara Pencapaian Fizik dengan Kemahiran Penyelesaian Masalah Matematik dalam Kalangan Pelajar	Onsite
14	14:50-15:00	ABS-33	Vira Dermawanty Saputri	Alat Peraga Medan Magnet Menggunakan Kawat Penghantar	Onsite

Room : 3
Scope : Material Physics

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:40	ABS-228	Ahmad Mohammad Fahmi	Optimizing Lightweight Lattice Structures via Unit Cell Size and Subdivision for Efficient Additive Manufacturing of Complex Surface Parts	Onsite
2	13:40-13:50	ABS-233	Anindita Prameswari Safitri	ANALISIS CELAH ENERGI OPTIK NANOROD ZnO YANG DITUMBUHKAN PADA Zn FOIL MENGGUNAKAN TEKNIK HIDROTERMAL	Onsite
3	13:50-14:00	ABS-151	Fransisca Maria Farida	The effect of adding perlite to unfired and fired geopolymer concrete made from fly ash and perlite on pore distribution and compressive strength	Onsite
4	14:00-14:10	ABS-203	Haifany	Analisis Pengaruh Variasi Konsentrasi Dopan ZnO, FeO, MnO, dan MgO Terhadap Sifat Optik Sistem Kaca P2O5-CaO serta Perbandingan dengan Sistem Kaca P2O5-Cangkang Telur	Onsite
5	14:10-14:20	ABS-184	Laelatul Dalilah	Nanopartikel Emas (Au): Sintesis dan Uji Sifat Absorbansi pada Temperatur Ruang	Onsite
6	14:20-14:30	ABS-183	Nova Nur Elisa Dewi	The influence of Mg Substitution at A and B-Sites on the Structural and Optical Properties of LaFeO3 Perovskites	Onsite
7	14:30-14:40	ABS-169	Muhammad Shaquille Hisham	Accelerated Lattice Thermal Conductivity calculations for (\alpha-CX) (X=N, P, As) using a combination of Density Functional Theory, Machine Learning, and Molecular Dynamics	Onsite
8	14:40-14:50	ABS-195	Ansell Alvarez Anderson	Intrinsic and Extrinsic Spin Hall Conductivity of BaPb_{0.75}Bi_{0.25}O_{3}	Onsite
9	14:50-15:00	ABS-100	Azza Azahra Ronald	THE EFFECT OF PURIFICATION PROCESS ON COLOIDAL GOLD AND SILVER CAPPED BY ORGANIC MATERIALS AND ITS APPLICATION AS PLASMONIC BIOSENSOR	Onsite
10	15:00-15:10	ABS-144	Bramasto Arista Wibisono	The Effect of Hydrothermal Temperature Variations in the Synthesis of Copper (II) Oxide Nanoparticles in CuO-doped TiO2 Photoanode Fabrication on the Performance of Dye Sensitized Solar Cells (DSSCs)	Onsite

Room : 4
Scope : Material Physics

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:40	ABS-212	Destia Nurika	Effect of Holding Time on the Phase Formation and Microstructure of Mullite Synthesized at 1200C	Onsite
2	13:40-13:50	ABS-217	Fransisca Maria Farida	Analysis Pore Volume and Compressive Strength of Fly Ash and Perlite Concrete Geopolymer at 900 Degree Celcius	Onsite
3	13:50-14:00	ABS-122	Hawinda Restu Putri	COMPARATIVE STUDY OF THE USE GOLD AND SILVER NANOPARTICLES IN N-719 DYE TO THE PERFORMANCE OF DYE SENSITIZED SOLAR CELL (DSSC)	Onsite
4	14:00-14:10	ABS-111	Hilarius Donatus Hun	Synthesis Strategy of Cs2SnI6 Perovskite by Modified Hot Injection Method and Its Potential Application for Optoelectronic Device	Onsite
5	14:10-14:20	ABS-124	Irasani Rahayu	Effect of Annealing Techniques on the Thermoelectric Properties of Molybdenum Disulfide Thin Films Prepared by RF Sputtering	Onsite
6	14:20-14:30	ABS-29	Kholik Hidayatullah	Impact of Adhesive Composition on the Quality of Charcoal Briquettes from Corn Cob Biomass Waste as Renewable Energy	Onsite
7	14:30-14:40	ABS-116	Maria Gabriela Sabandar	A Comparative Analysis of Uncoated and PAN Nanofiber-Coated QCM Sensors for Volatile Organic Compound Sensing	Onsite
8	14:40-14:50	ABS-150	Nazaruddin Nasution	Preparation and Characterization of the Magnetic Properties of Barium Hexaferrite via the Solid-State Reaction Method	Onsite
9	14:50-15:00	ABS-63	Ninis Hadi Haryanti	Characteristics of Briquettes Made from Nipah Palm Fronds (Nypa fruticans) and Galam Bark (Melaleuca leucadendron)	Onsite
10	15:00-15:10	ABS-8	Rony Febryarto	Energy Gap Analysis of Ba0.25Sr0.75TiO3 Thin Film on Glass Indium Tin Oxide (ITO) Substrate	Onsite
11	15:10-15:20	ABS-181	Safitry Ramandhany	Influence of Cr3C2-NiCr Coating Thickness on Corrosion Behavior of Carbon Steel in Alkali Chloride Atmospheres	Onsite
12	15:20-15:30	ABS-102	Rossyaila Matsna Muslimawati	Synthesis, Characterization, and SCAPS-1D Simulation of \(FASnI_{3}\) and \(CsSnI_{3}\) as Active Layers in Perovskite Solar Cells	Onsite

Room : 5

Scope : - Instrumentation and Computational Physics
- Earth Physics and Space Science

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:45	Invited Speaker	Yudhiakto Pramudya	Fuzzy Logic-Based Classification of Crescent Moon Images Using Brightness and Thickness Parameters	Onsite
2	13:45-13:55	ABS-43	Bayu Satrio	Rancang Bangun Landslide Early Warning System (LEWS) Berbasis Wireless Sensor Network Menggunakan ESP32 dan LoRaWAN	Onsite
3	13:55-14:05	ABS-229	Irwan Setyanto	Development of an Acoustic Emission Inspection Using Wavelet Scattering Method for Investigating the Shearing Process in Microforming	Onsite
4	14:05-14:15	ABS-103	Muhammad Doni Setiawan	Estimation of Gravitational Lens Parameters at Intermediate Redshifts Using Convolutional Neural Networks (CNN)	Onsite
5	14:15-14:25	ABS-148	Muhammad Farhan Shadiq	Modeling Granular Mixtures with Simple Rules: A Student Project in Agent-Based Simulation	Onsite
6	14:25-14:35	ABS-147	Pinkan Amanda Putri	Sensor Characterization for Self Service Medical Check Up Machine	Onsite
7	14:35-14:45	ABS-37	Reksa Akbar Kinasih Gusti	IMPLEMENTATION OF MULTIVARIATE PREDICTION BASED ON LONG-SHORT TERM MEMORY OF MACHINE LEARNING TECHNIQUES FOR PHOTOVOLTAIC SOLAR PANELS	Onsite
8	14:45-14:55	ABS-204	Alfi Nur Albab	Hypocenter Determination and Uncertainty Analysis Using the Reciprocal Fast Marching Wavefront Modeling (RFMW)	Onsite
9	14:55-15:05	ABS-110	Ariffudin	Correlation Analysis of Solar Radiation and Cloud Parameters: A Case Study at Jambi Climatological Station Using Ground Observation and Reanalysis Data	Onsite
10	15:05-15:15	ABS-91	Bayu Septiadi	Estimating Seeing Values From Various Refractive Index Structure Parameter Models at Mauna Kea, Hawaii	Onsite
11	15:15-15:25	ABS-159	Nurlina	Spatio Temporal Monitoring of Land Surface Temperature in Rubber and Oil Palm Plantations: A Google Earth Engine-Based Analysis	Onsite
12	15:25-15:35	ABS-7	Sudarningsih Sudarningsih	Magnetic Susceptibility and Heavy Metal Elements in Sand from Batakan Beach	Onsite
13	15:35-15:45	ABS-167	Andry Setiawan	Resrad Parameter Sensitivity Simulation to Ascertain Local Parameters for Safety Assesment on Bangka Island	Onsite
14	15:45-15:55	ABS-248	Airin Marsaulina Hutabarat	Techno Economics Analysis of Off-Grid Photovoltaic (PV) Systems in a Remote Area in Indonesia for Rural Village Electrification	Onsite

Room : 6

Scope : - Theory, Nuclear, and Particle Physics
- Earth Physics and Space Science

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:45	Invited Speaker	Dr. Yanoar P. Sarwono	Expressibility-Dependent Efficiency and Accuracy of Hardware Efficient Ansatz for Electronic Structure Calculations	Onsite
2	13:45-13:55	ABS-14	Billie Rizky	An Isobar Model for Eta-Prime Meson Photoproduction on the Nucleon with Nucleon Resonances up to Spin-7/2	Onsite
3	13:55-14:05	ABS-10	Fingken Stevanus Sagai	Charger-based quantum battery with periodically driven-dissipative	Onsite
4	14:05-14:15	ABS-11	Jovan Alfian Djaja	New Isobar Models for \(K^+\Lambda\) Electroproduction	Onsite
5	14:15-14:25	ABS-12	Muhammad Fahmi Fauzi	Witnessing the destruction of regular black hole	Onsite
6	14:25-14:35	ABS-5	Muhammad Ridwan	M1 Radiative Transition of Light Mesons in the Light-Front Quark Model	Onsite
7	14:35-14:45	ABS-175	Hanum Fazah Aditya Kusuma Wardani	Geometrical Influence on the Orthogonal Ratio of the Earth Ambient Vibration Evaluated by Particle Dynamics Method	Onsite
8	14:45-14:55	ABS-126	Fatimah Zahra	Preliminary Calculation of Intermediate Mass Black Hole Detection using Microlensing in Globular Cluster	Onsite
9	14:55-15:05	ABS-101	Hafiz Indra Arwinata	Optimization Residual Network for Spiral Galaxy Spin Direction Classification	Onsite
10	15:05-15:15	ABS-85	Marleni Wirmas	Theoretical Study of \(CO_{2}\) Hydrogenation to HCOOH on Subnanometer PdZn Cluster	Onsite

Room : 7
Scope : Physics Education

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:40	ABS-115	Abdul Karim	Collaborative Learning in Physics: An Overview of the Group Investigation Approach and Its Impact on Learning Outcomes	Online
2	13:40-13:50	ABS-224	Afridha Sesrita	Ethnophysics through Marble Games: A Learning Trajectory Design to Reduce Kinematics Misconceptions	Online
3	13:50-14:00	ABS-156	Anderias Henukh	The Effect of Contextual Teaching Approach on Cognitive Learning Outcomes and Student Responses in the Topic of Light	Online
4	14:00-14:10	ABS-95	Aprina Defianti	Investigating the Impact of Jigsaw Cooperative Model and Case Method on Undergraduate Students Physics Concept Understanding and Communication Skills	Online
5	14:10-14:20	ABS-49	Arika Arika	Needs Analysis of a STEM-Based Problem-Based Learning Electronic Module in Fluid Mechanics to Enhance Students^ Critical Thinking and Problem-Solving Skills	Online
6	14:20-14:30	ABS-129	Asep Irvan Irvani	Exploring the Role of Computational Thinking in Enhancing Problem-Solving and Creative Thinking: A Bibliometric and Systematic Literature Review	Online
7	14:30-14:40	ABS-142	Dian Artha Kusumaningtyas	Analysis of Future Physics Teachers Abilities Using STJ and Pedagogical Content Knowledge Approaches	Online
8	14:40-14:50	ABS-158	Dita Istiqomah	Design and Calibration of a Low-Cost Resonance Frequency Meter Arduino-based for Educational Laboratories	Online
9	14:50-15:00	ABS-41	Fitria Herliana	Developing Project-Based Learning Tools with VAK Multi-Modality Differentiation to Enhance Students Conceptual Understanding	Online
10	15:00-15:10	ABS-213	Ignatius Edi Santosa	Students experiences in laboratory activities	Online
11	15:10-15:20	ABS-157	Imin Agustina Dwi Astuti	Needs Analysis of Android-Based Ethnophysics Learning Media on Traditional Dances of North Maluku	Online
12	15:20-15:30	ABS-223	Susilawati Susilawati	The Using of Interactive Electronic Modules to Improve Students^ Digital Literacy	Online

Room : 8
Scope : Physics Education

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:40	ABS-180	Firros Hirzy	Enhancing Vocational High School Students^ Higher Order Thinking Skills through E-Module of Bar Force Analysis in Simple Frame Constructions	Online
2	13:40-13:50	ABS-90	Jasmine Cupid Amaratirta	Needs Analysis of a Contact Angle Measurement Practicum to Support Students Scientific Process Skills and Collaboration in Physics Education	Online
3	13:50-14:00	ABS-154	Muhammad Reyza Arief Taqwa	Active Learning with Multi-Representation Support for Deep Conceptual Understanding of One-Dimensional Kinematics	Online
4	14:00-14:10	ABS-75	Muhammad Syukri	Engineering Design Process in PjBL-STEM Teaching Materials to Improve Students Scientific Literacy Skills	Online
5	14:10-14:20	ABS-174	Ni Kadek Savita Radharani	The Effect of STEAM-Integrated PBL-C Model with Formative Assessment on Improving Students^ Scientific Literacy Skills on Static Fluid Topics	Online
6	14:20-14:30	ABS-187	Rafika Elmutiah	Bridging the Gap in Physics Education: A Study on Higher-Order Thinking Skills Among High School Students	Online
7	14:30-14:40	ABS-155	Ria Asep Sumarni	Exploring the Development and Effectiveness of Physics Simulation-Based Learning Media within Blended Learning Environments: A Systematic Literature Review	Online
8	14:40-14:50	ABS-120	Sarina Hanifah	Fostering Pre-Service Vocational High School Teachers Conceptual Understanding of the Lambert-Beer's Law in the Context of Electromagnetic Radiation-Solution Interaction	Online
9	14:50-15:00	ABS-128	Shabrina Quraisy	The Effect of The Argument Driven Inquiry Integrated With STEAM Assisted by DMM to Improve Critical Thinking Skill on The Material of Sound and Light Waves	Online
10	15:00-15:10	ABS-34	SUNU WAHYUDHI	The Development of Science Identity Self-Test to Measure the Level of Science Identity Based on PISA 2025 Framework	Online
11	15:10-15:20	ABS-50	Widia Ainun Anasi	Project Based Learning (PjBL) Integrated STEM Research Trend for Last 5 Years: A Bibliometric Analysis	Online
12	15:20-15:30	ABS-137	Winanda Amilia	From Traditional to Intelligent Systems: Reviewing the Role of AI-Integrated IT Models in Advancing Physics Education in Higher Education	Online
13	15:30-15:40	ABS-3	Adi Setiawan	The Role of Student Well-Being in the Success of Physics Learning: A Literature Review	Online
14	15:40-15:50	ABS-231	Rika Siti Syaadah	Development of an Interactive Learning Website Using a Deep Learning Approach on Thermodynamics Material	Online

Room : 9
Scope : Material Physics

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:40	ABS-54	Ahmad Fakhrudin	Analisis Energi Gap Film Tipis Ba0,875Sr0,125TiO3 di atas Substrat Kaca Indium Tin Oxide (ITO) dan Substrat Si (100) Tipe P	Online
2	13:40-13:50	ABS-215	Aniza Salviana Prayugo	ZIF-8 modified with N-doped Carbon Dots using the direct mixing method at room temperature	Online
3	13:50-14:00	ABS-64	Anugrah Rezki Akhmad	Effect of Calcination Temperature and Holding Time on Crystal Structure and Size of Tetragonal ZrO2	Online
4	14:10-14:20	ABS-57	Ayu Bonita Pertiwi Harianja	Analisis Energi Gap Film Tipis Ba0,625Sr0,375TiO3 di atas Substrat Kaca Indium Tin Oxide (ITO) dan Substrat Si (100) Tipe P	Online
5	14:20-14:30	ABS-69	Budi Hariyanto	Structural Characterization of Tetragonal ZrO2 Derived from Zircon Sand: Crystal and Local Atomic Insights	Online
6	14:30-14:40	ABS-16	Catur Pramono	Bioplastic Reinforced by Microcrystalline Cellulose via Sonication-Assisted Solvent Blending: Mechanical and Morphological Properties	Online
7	14:40-14:50	ABS-185	Dr. IMAM BASORI, MT.	Microstructure, Hardness, and Corrosion Resistance Analysis of Cu-40Zn-xSn Prepared by Gravity Die Casting Process	Online
8	14:50-15:00	ABS-119	Fina Nurfaradila	Analysis of Physical - Chemical Properties and Variation of Rare Earth Elements in Ciuyah Mud Volcano and Supported by SEM and XRD Data to Bolster Advanced Materials Industry in Indonesia	Online
9	15:00-15:10	ABS-19	Harjo Seputro	Experimental Study on the Influence of Variation in Thickness and Solution Temperature on the T6 Heat Treatment Process on the Dimensional Stability of Al-6061	Online
10	15:10-15:20	ABS-227	Hazra Yuvendius	The Impact of Freezing Treatment on Physicochemical Characteristics of Oil Palm Kernel Shell-Derived Activated Carbon	Online
11	15:20-15:30	ABS-222	Mediniah Putri Simatupang	Structure-Property Relationship in Ce-Doped ZnO for Photocatalytic Applications under UV Light	Online
12	15:30-15:40	ABS-166	Nur Ika Puji Ayu	Tuning Ionic Conductivity and Stability in Perovskite-Derived Hydrides via Fluorine Substitution	Online
13	15:40-15:50	ABS-130	Rangga Aditya Pratama	Karakterisasi Morfologi dan Komposisi Lapisan Ni-TiN-AlN-Al2O3 dengan Variasi Rapat Arus Pulsa	Online

Room : 10

Scope : Material Physics

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:40	ABS-114	Imam Sholahuddin	Effect of Cu Doping on the Formation of Metastable Al2O3 Nanoparticles Synthesized through Plasma Arc	Online
2	13:40-13:50	ABS-2	Indreswari Suroso	Analysis of Characteristics Comparison between New Brake Lining and 100-hour Flight Cessna 208B	Online
3	13:50-14:00	ABS-26	Irfan Khadam	EFFECT OF HYDROTHERMAL REACTION TIME ON THE EFFECTIVENESS OF ZINC OXIDE PHOTOCATALYST IN DEGRADING METHYL ORANGE	Online
4	14:00-14:10	ABS-118	Iswadi Ibrahim Patunrengi	Thermoelectric properties of Epoxy/SWCNT/Polyaniline ternary nanocomposite	Online
5	14:10-14:20	ABS-39	Juan Carlos Sihotang	Plasma Electrolytic Oxidation of Pure Zirconium in Chromium Containing Electrolyte	Online
6	14:20-14:30	ABS-199	Vita Efelina	Comparative Study of Electrochemical CO2 Reduction Using Electrodes made of Metal Nanoparticles deposited on a Metal Substrate	Online
7	14:30-14:40	ABS-56	Kinanthi Freda Bhanuwati	Analisis Celah Energi Lapisan Tipis Ba0,75Sr0,25TiO3 pada Substrat Kaca Indium Tin Oxide (ITO) dan Substrat Si (100) Tipe-P	Online
8	14:40-14:50	ABS-198	Kormil Saputra	Morphological, Crystal Characterization, and Magneto-Thermal of Superparamagnetic Iron Oxide Nanoparticles (SPION) from Natural Sand based Coprecipitation Sono-Chemical	Online
9	14:50-15:00	ABS-200	Kormil Saputra	Structural and Electronic Properties of Manganese-Doped Superparamagnetic Iron Oxide Nanoparticles Derived from Natural Iron Sand	Online
10	15:00-15:10	ABS-226	Luh Krisnawati	The Physical Characteristics of Activated Carbon-Derived Sugarcane Bagasse/FeF3 Composite	Online
11	15:10-15:20	ABS-55	Muhammad Izatul Al Fajar	Analisis Celah Energi pada Film Tipis Ba0,375Sr0,625TiO3 di atas Substrat Kaca Indium Tin Oxide (ITO) dan Substrat Si (100) Tipe P	Online
12	15:20-15:30	ABS-15	Noni Novianti	UTILIZATION OF TiO2-DOPED ACTIVATED CARBON FROM TEAK WOOD SAWDUST FOR PURIFICATION OF USED COOKING OIL	Online
13	15:30-15:40	ABS-13	Nonik Septiani	Physicochemical Characterization of CaO Derived from Pearl Oyster Shells (Pinctada maxima) via Thermal Processing for Potential Biomedical Applications	Online

Room : 11

Scope : - Material Physics
- Medical Physics and Biophysics

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:40	ABS-51	Afrizal Afrizal	Analysis of Capacitance Resistance Membran Polymethylmetacrylate-Mesogen Reactive Diacrylate	Online
2	13:40-13:50	ABS-179	Esmar Budi	Mechanical and Oxidation Properties of Ni-TiN Composite Coatings	Online
3	13:50-14:00	ABS-189	Evi Ulina Margareta Situmorang	Impact of post heat treatment on the Crystallinity of hydroxyapatite Synthesized from Limestone and the adhesion of various Gram Positive and Gram Negative Bacteria	Online
4	14:00-14:10	ABS-30	Rudy Fernandez	Impact of Ultrasonication Time on the Electrical Properties of Polyvinyl Alcohol/Zinc Oxide/MXene/Cellulose Nanocrystal Composites for Electronic Applications	Online
5	14:10-14:20	ABS-17	Sefrian Rizki Bintoro	Influence of Electroless Coating on Bottom Ash Reinforcement in Aluminum Matrix Composites: A Study of Microstructure and Mechanical Properties	Online
6	14:20-14:30	ABS-171	Tanti Dewinggih	Overview of Transparent Conductive Materials for Hybrid Perovskite Solar Cells	Online
7	14:30-14:40	ABS-23	Yessi Gusnia	Preparation of micro-sized cellulose from rice husk using ball mill and acid hydrolysis method	Online
8	14:40-14:50	ABS-164	Agastya Surya Visinanda	A Continuous Flow UV-C Radiation and Ozone System for Yeast Reduction in Honey	Online
9	14:50-15:00	ABS-121	Hany Putri Yuliati	Evaluation of Standard and Iterative Two-Stage Approaches for Estimation of Area-Under-the Curve in Thyroid Disease Dosimetry	Online
10	15:00-15:10	ABS-214	Humaidillah Kurniadi Wardana	Classification of Raw Minced Beef, Chicken, and Pork Using AS7341 Spectrophotometer Sensor with Naive Bayes Method	Online
11	15:10-15:20	ABS-86	Aulia Firma	Influence of Different OpenDose 3D Registration to Dose Calculation of [177Lu]Lu-DOTATATE Patients	Online
12	15:20-15:30	ABS-205	Yusmaniar Yusmaniar	Synthesis of Rice Husk Silica PVA Xerogel Film as Food Temperature Insulator	Online

Room : 12

Scope : - Instrumentation and Computational Physics
- Theory, Nuclear, and Particle Physics

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:45	Invited Speaker	Dr. Widyaningrum Indrasari	DC-DC BUCK CONVERTER IN THE SOLAR PANEL SYSTEM	Online
2	13:30-13:40	ABS-221	Akhmad Yusuf	Computational Implementation of Linear Reference Elbow (LRE) Method for Optimal Cluster Determination in k-Means Algorithm	Online
3	13:40-13:50	ABS-32	Chery Chaen Putri	Optimizing of active noise control for acoustic calibration: influence of control speaker distance and algorithm	Online
4	13:50-14:00	ABS-106	Eko Priyatno	Hybrid DAE-GAN Model with U-Net Architecture for Seismic Signal Denoising	Online
5	14:00-14:10	ABS-141	Iwan Sugriwan	An Internet of Things system design and implementation for monitoring carbon dioxide, methane, humidity, and temperature	Online
6	14:10-14:20	ABS-9	Ninuk Ragil Prasasti	A Point-symmetrical Position for Vibration Measurement of Analytical Sieve Shakers	Online
7	14:20-14:30	ABS-117	Rida SN Mahmudah	CFD-Based Evaluation of Heat Transfer Behavior for Air, Water, and Molten Salt in a Multi-Region Heat Exchanger	Online
8	14:30-14:40	ABS-172	Seno Aji	Effect of magnetic anisotropy on spin-current driven by resonant dynamics of skyrmion lattices	Online
9	14:50-15:00	ABS-165	Ahmad Kadarisman	Early Detection of Seismic Signal Anomalies Using Raspberry Pi 5 and Lightweight Machine Learning Models	Online
10	15:00-15:10	ABS-76	Muhammad Rosyid	Optimizing E-Nose Performance for Coffee Aroma Detection through Sample Heating and Machine Learning Integration	Online
11	15:10-15:20	ABS-77	Bambang Heru Iswanto	Optimization of Support Vector Machines and Window Sampling for E-Nose-Based Classification of Black and Green Tea Aroma	Online
12	15:20-15:30	ABS-107	Didik Nur Huda	From Batik to Physics: Generating and Analyzing Fractal Patterns Inspired by Indonesian Textile Art	Online
13	15:30-15:40	ABS-193	Piksi Amanda Sari	Quantum Stirling Engine with Bose-Einstein Condensate	Online
14	15:40-15:50	ABS-188	Shofiyah	Performance of a Bosonic Quantum Otto Refrigerator with Partial Thermalization	Online

Room : 13
Scope : Earth Physics and Space Science

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:40	ABS-207	Achmad Aulia Fikri	One Dimensional Modelling of Magnetotelluic Data using Deep Learning Based Inversion and its application to delineate the fault structure	Online
2	13:40-13:50	ABS-196	Andika Pratama	Dimensionality analysis of Magnetotelluric Data in Carbon Capture Storage	Online
3	13:50-14:00	ABS-168	Anggie Susilawati	Preliminary Study on Magnetic Anomaly Analysis in Parongpong, West Java, Indonesia: Implications for Landslide Risk Mitigation	Online
4	14:00-14:10	ABS-162	Asep Harja	Investigation of Deep Aquifers in the Catchment Area of Haruman Peak, Malabar Mountains, Using the Audio-Magnetotelluric (AMT) Method	Online
5	14:10-14:20	ABS-65	Budy Santoso	Identification of Natural Asphalt (Asbuton) Using the Electrical Resistivity Tomography Method	Online
6	14:20-14:30	ABS-131	Dini Fitriani	Soil Physicochemical Properties and Magnetic Grain Morphology of The Batujaya Archaeological Site	Online
7	14:30-14:40	ABS-209	Kusnahadi Susanto	Hydrogeophysical Characterization of Groundwater Distribution in the Upper Citarum River Basin Using DC Resistivity Method	Online
8	14:40-14:50	ABS-160	Mia Uswatun Hasanah	Preliminary Results: P-wave Seismic Tomography Beneath of Java Subduction Zone, Indonesia	Online
9	14:50-15:00	ABS-219	Puja Kasmailen Putri	Assessment of Subsurface Structures for Geothermal Exploration in Curup, Indonesia, Using Satellite-Derived Gravity Anomalies	Online
10	15:00-15:10	ABS-190	Santi Sulistiani	Prediction of X-ray solar flare based on active region evolution	Online
11	15:10-15:20	ABS-206	Suci Ramayanti, M.Si.	Damage Assessment of the 2022 Cianjur Earthquake using Satellite-based Damage Proxy Map	Online
12	15:20-15:30	ABS-60	Taufieq Zannata Ramadhan	A Study of the Variability of H\(\alpha\) Emission Line Parameters in \(\pi\) Aqr as a Be Star	Online
13	15:30-15:40	ABS-218	Nadya Rezky Ananda	Rainfall Climatology Associated with Cyclonic and Non Cyclonic Events in Indonesia New Capital Based on IMERG and IBTrACS	Online
14	15:40-15:50	ABS-197	Nurhasan Nurhasan	ANALYSIS OF LANDSLIDE SUSCEPTIBILITY ZONES POST-2022 CIANJUR EARTHQUAKE BASED ON 2D RESISTIVITY MODELING AND AIUDIO MAGNETOTELLURIC DATA	Online

Room : 14

Scope : Energy and Environmental Physics

No.	Time	Code	Presenter	Title	Attendance
1	13:30-13:40	ABS-104	Aam Amaningsih Jumhur	Structural Integrity Assessment of a Pyrolysis Incinerator Chamber Using FEM in Support of Green Environmental Technologies	Online
2	13:40-13:50	ABS-40	Ahmad Farhan	Rainfall Changes in the Northern Region of Aceh	Online
3	13:50-14:00	ABS-70	Chika Shafa Maura	Electrodeposition of Trimetallic PtSnNi and its Application as Electrocatalyst in Ethanol Electrooxidation	Online
4	14:00-14:10	ABS-53	Diena Noviarini	Analysis The Future of Palm Tree Plantation Tower For Telecommunication Purposes	Online
5	14:10-14:20	ABS-225	Diena Noviarini	Improving The Handling of Humanitarian Disaster in The Indonesian Ring of Fire by Utilizing The Detection of Output From Banten Underwater Mountain	Online
6	14:20-14:30	ABS-66	Halimurrahman	Interactions of Terrestrial and Marine Heatwaves in the Coastal Zone of Southern Java	Online
7	14:30-14:40	ABS-170	Kartika Hajar Kirana	Physical Properties of Sedimen in Ciliwung River as Proxy Indicator of Anthropogenic Activities	Online
8	14:40-14:50	ABS-89	Matthew Savio Kurniawan	DEVELOPMENT OF PYROLYSIS CHAMBER HEATING SYSTEM WITH TEMPERATURE CONTROL BASED ON ESP32 FOR OIL PRODUCTION FROM PLASTIC PET WASTE	Online
9	14:50-15:00	ABS-44	Nuraeni Asriyanti	Analysis of Lenard^s Effect on The Sedudo Siraman Tradition in Beauty Aestetics Myth	Online
10	15:00-15:10	ABS-38	Ragil Sukarno	Experimental investigation of the effect of piston mass on charging efficiency in the compressed air-gravity energy storage	Online
11	15:10-15:20	ABS-88	Victor Christianto	Three plausible ways to improve performance of seawater battery for low budget electrical energy storage system (EESS) in particular for developing countries	Online
12	15:10-15:20	ABS-210	Rahmi Elzulfiah	Characterization of Fractured Rajamandala Carbonate Reservoir Induced by the Dynamics Activity of Cimandiri Fault West Java	Online
13	15:20-15:30	ABS-143	Bambang Wijatmoko	Analysis of the Relationship Between Microtremor Dominant Frequency and Topographic Features	Online
14	15:30-15:40	ABS-191	ACEP PURQON	Machine Learning for Real-Time Environmental Monitoring and Air Quality Prediction	Online

THEORY, NUCLEAR, AND PARTICLE PHYSICS

[ABS-5]

M1 Radiative Transition of Light Mesons in the Light-Front Quark Model

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Abstract

We investigate the M1 radiative transitions between light vector and pseudoscalar mesons in the light-front quark model. To this end, we use the light-front wave functions (LFWFs) obtained from our previous work based on the QCD-motivated effective Hamiltonian that includes smeared spin-spin interactions, where a few harmonic oscillator basis functions were employed as trial wave functions. Our analysis adopts good and transverse current components with both longitudinal and transverse polarizations. The results, including their couplings, widths, and branchings, obtained from LFWFs with different trial wave functions are compared with experimental data and other theoretical predictions.

Keywords: M1 radiative transition, LFQM, light vector and pseudoscalar mesons, LFWFs, currents, polarizations

Topic: Theory, Nuclear, and Particle Physics

[ABS-10]
Charger-based quantum battery with periodically driven-dissipative

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Abstract

Quantum batteries are designed to outperform classical batteries by utilizing quantum effects, particularly in charging speed and energy storage efficiency. Quantum batteries based on chargers that interact periodically with an external energy source are observed within an open quantum system framework, with battery performance parameters such as charging time and total energy used for evaluation. In this paper, the charger and quantum battery are modeled as a quantum harmonic oscillator, and their interaction is governed by the Lindblad master equation. The energy function of the quantum battery is determined by the first momenta obtained by solving a system of coupled first-order linear differential equations formed from the master equation. Based on these results, we investigate the effect of periodic driving on energy charging, energy stability, and decoherence effects in the quantum battery.

Keywords: Periodic driving- Quantum energy- Quantum battery- Open quantum system.

Topic: Theory, Nuclear, and Particle Physics

[ABS-11]
New Isobar Models for K+ΛK+Λ Electroproduction

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Abstract

The electroproduction of kaons on protons has been studied using two covariant isobar models. These models incorporate propagators and vertex factors from our previous work. In total, the current study includes 26 nucleon resonances and 20 hyperon resonances, with spins up to 13/2. Instead of the commonly used dipole model, we adopt two alternative approaches for the electromagnetic form factors. The unknown parameters in the models, such as coupling constants and form factor cutoffs, are determined by fitting to nearly 2000 experimental data points. The resulting models show good agreement with the available experimental data.

Keywords: Kaon Electroproduction, Electromagnetic Form Factor, Nucleon Resonances, Hyperon Resonances

Topic: Theory, Nuclear, and Particle Physics

[ABS-12]

Witnessing the destruction of regular black hole

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Abstract

One proposed method to probe the existence of regular black holes is by overspinning them beyond their critical spin, as they are not constrained by the weak cosmic censorship conjecture. Several mechanisms have been suggested to achieve this, one of which involves sending a test particle to destroy the event horizon. In this study, we review the process of black hole destruction via test particles: its feasibility, necessary conditions, and the potential caveats involved. We also discuss key observables that could be detected by next-generation instruments, particularly the appearance of such objects when surrounded by an accretion disk, in both their final and transitional states. Finally, we highlight potential gaps and open questions in this area of research.

Keywords: regular black holes, overspinning mechanism, observational signatures

Topic: Theory, Nuclear, and Particle Physics

[ABS-14]

An Isobar Model for Eta-Prime Meson Photoproduction on the Nucleon with Nucleon Resonances up to Spin-7/2

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Abstract

We have investigated eta-prime meson photoproduction on the nucleon using an isobar model within an effective Lagrangian approach. This model incorporates background contributions, including Born terms and relevant vector meson exchanges, as well as the effects of intermediate nucleon resonances. Nucleon resonances with spin up to 7/2 and at least two-star status in the 2024 edition of the Review of Particle Physics (RPP) by the Particle Data Group (PDG) were included in the model. The free parameters of the model were fitted using available experimental differential cross section data from the A2 Collaboration at MAMI (2017) and the CLAS Collaboration (2009). By employing this approach, we phenomenologically obtained effective couplings related to the partial decay widths and helicity amplitudes of nucleon resonances. These results provide insight into the properties of nucleon resonances involved in eta-prime meson photoproduction.

Keywords: Eta-prime meson photoproduction, Isobar model, Nucleon resonance

Topic: Theory, Nuclear, and Particle Physics

[ABS-107]

From Batik to Physics: Generating and Analyzing Fractal Patterns Inspired by Indonesian Textile Art

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Abstract

This study explores the intersection of fractal geometry and traditional Indonesian batik patterns through computational analysis. By employing higher-order polynomial functions, specifically variants of the Julia set, we investigate how mathematical models can generate complex motifs that resemble traditional batik. The fractal dimensions of the generated patterns are calculated using the box-counting method, and the visual complexity is compared to selected batik motifs from Indonesia. Results show that certain parameter modifications produce fractal patterns similar to traditional designs, while others reveal unexpected analogies with natural and physical phenomena, such as atomic orbitals and Chladni resonance patterns. This work highlights the potential of combining mathematics and art to both preserve and innovate within cultural heritage, providing new pathways for contemporary batik design using generative algorithms.

Keywords: Fractal geometry, Julia set, batik, fractal dimension, generative design, computational art, cultural heritage, pattern analysis

Topic: Theory, Nuclear, and Particle Physics

[ABS-188]

Performance of a Bosonic Quantum Otto Refrigerator with Partial Thermalization

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Abstract

Quantum refrigerators (QRs) have emerged as an essential study in the research of microscopic thermodynamic systems. In this study, we examine the performance of a quantum Otto refrigerator using an ideal non-interacting bosonic gas trapped in a cubic potential. The system is investigated in finite-time operation with a focus on the effects of partial thermalization during isochoric processes. The novelty of the research is to achieve a higher coefficient of performance (COP) at maximum power, namely CMP, by utilizing partial thermalization. Using the grand canonical ensemble formalism, thermodynamic properties are derived analytically to obtain the COP and the power of the refrigerator. Numerical calculations are performed to evaluate the CMP. This study aims to provide a more realistic characterization of the performance of the quantum refrigerator system at the microscopic scale, especially on the role of partial thermalization during finite-time operation.

Keywords: Quantum Refrigerator, Otto Cycle, Cubic Potential, Coefficient of Performance (COP), Partial Thermalization

Topic: Theory, Nuclear, and Particle Physics

[ABS-193]

Quantum Stirling Engine with Bose-Einstein Condensate

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Abstract

This research investigates the endoreversible quantum Stirling engine using the Bose-Einstein Condensate (BEC) as a working medium trapped in generic law potential. The engine operates endoreversibly in order to capture a realistic condition, where the temperature of working medium depends on the heating and cooling strokes time. The Fourier conduction law is applied to govern the rate of heat transfer between the system and the thermal reservoir in finite time, whilst in isoenergetic strokes, an infinite-time is required to accomplish the thermal equilibrium. The results show that the condensed phase of BEC has the ability to enhance the efficiency of the engine, especially at temperature near absolute zero. In conclusion, by adjusting the temperature and volume ratio, performance can be optimized to achieve the higher efficiency and power output of the Stirling engine.

Keywords: Quantum Stirling Engine, Bose-Einstein Condensate, Generic Law Potential, Efficiency, Endoreversible

Topic: Theory, Nuclear, and Particle Physics

MEDICAL PHYSICS AND BIOPHYSICS

[ABS-22]

Evaluating Renal Time-Integrated Activity Coefficient Consistency in [177Lu]Lu-DOTA-TATE Therapy: Simultaneous vs. Separate Kidney Modeling Using Non-linear Mixed-effects Modeling

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Abstract

Background:
This study aimed to compare renal time-integrated activity coefficients (TIACs) in [177Lu]Lu-DOTA-TATE therapy using non-linear mixed-effects modeling (NLMEM), by evaluating the effect of the fitting setting method of left and right kidney biokinetic data to TIAC calculation.
Methods:
Renal biokinetic data of [177Lu]Lu-DOTA-TATE were collected from ten patients with neuroendocrine tumors. SPECT/CT imaging was performed between days 1 and 7 after injection. The bi-exponential function parameters were fitted to biokinetic data using NLMEM performed using NONMEM version 7.6.0, with two fitting setting approaches: simultaneous fitting of both kidneys and separate fitting of the left and right kidneys. TIACs from the simultaneous fitting were defined as reference TIACs (rTIACs), and those from separate fitting as estimated TIACs (eTIACs). Accuracy was assessed using relative deviation (RD), with eTIACs considered equivalent to rTIACs if RD was below 5%.
Results:
The bi-exponential function successfully describes the renal biokinetic data. eTIACs showed good agreement with the rTIACs, with a maximum RD of 3.9%.
Conclusion:
Simultaneous fitting of left and right kidney biokinetic data using the NLMEM approach produced TIACs comparable to those obtained from separate fittings. Therefore, TIAC calculation based on simultaneous and separate fittings of kidneys biokinetic data is equally accurate can be clinically implemented.

Keywords: TIAC, NLMEM, NONMEM, [177Lu]Lu-DOTA-TATE

Topic: Medical Physics and Biophysics

[ABS-58]
Discriminating Benign and Malignant Breast Lesions Using Shape Descriptors in Ultrasound

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Abstract

Accurate differentiation between benign and malignant breast lesions in ultrasound imaging is essential for timely and appropriate clinical decision-making. While convolutional neural networks (CNNs) have demonstrated high classification performance, their lack of interpretability poses challenges in understanding the morphological basis of their predictions. To address this, the present study emphasizes the use of interpretable, shape-based descriptors rather than texture-based features. Six Shape Factor Analysis metrics-minimum-to-maximum axis ratio, circularity, solidity, extent, elongation, and eccentricity-were extracted from a publicly available dataset containing labeled ultrasound images of breast lesions. Partial Least Squares Discriminant Analysis (PLS-DA) applied to these metrics revealed a clear separation between benign and malignant categories using three latent variables, achieving a cross-validated accuracy of 0.924 and an F1-score of 0.857. All shape features contributed significantly to class distinction, with solidity, extent, and elongation identified as the most influential. Benign lesions exhibited higher values in circularity, solidity, extent, elongation, and eccentricity, reflecting their typically regular and well-defined morphology. Conversely, malignant lesions showed lower values, consistent with their irregular and infiltrative structure. These results underscore the potential of shape-based analysis as an interpretable and physiologically meaningful approach to improving breast lesion classification in ultrasound imaging.

Keywords: Breast Cancer Detection, Ultrasound Imaging, Shape Factor Analysis, PLS-DA, Benign and Malignant Lesions

Topic: Medical Physics and Biophysics

[ABS-62]

Pipeline for Visual Interpretability in Breast Cancer Classification Using Grad-CAM

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Abstract

Breast cancer is a major health challenge, where early detection significantly improves outcomes. While convolutional neural networks (CNNs) achieve high accuracy in breast lesion classification, their lack of interpretability limits clinical adoption. This study presents a computer-aided pipeline for mammogram classification using the pre-trained ResNet-50 model for feature extraction and classification. Preprocessing steps include CLAHE for contrast enhancement, YOLO for Region of Interest detection, and data augmentation to mitigate limited dataset challenges. To address interpretability, Grad-CAM is integrated, providing feature-based visualizations aligned with expert-identified abnormalities. Our pipeline demonstrates robust performance on CC view images with high precision and accuracy while highlighting challenges in MLO view analysis due to variability and model sensitivity. Grad-CAM enhances transparency, supporting radiologists in validating predictions. This approach improves diagnostic accuracy and trustworthiness, paving the way for more effective breast cancer screening. Future efforts will focus on refining MLO view performance and validating across larger datasets.

Keywords: breast cancer, mammography, Convolutional Neural Networks (CNNs), pre-trained ResNet-50, Grad CAM, data preprocessing, medical image analysis

Topic: Medical Physics and Biophysics

[ABS-68]

Effects of ion recombination on high dose rate electron using TRS-398, AAPM TG-51, and modified methods

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Abstract

Aims: Precise dosimetry is essential for ensuring the effectiveness and safety of radiation therapy, particularly in High Dose Rate Electron (HDRE) beams, which exhibit a higher ionization density compared to conventional electron beams. At elevated dose rates, significant charge recombination effects may impose limitations on certain ionization chambers, potentially affecting measurement accuracy. This study aims to evaluate ion recombination (Ks) and polarity effects (Kpol) to determine the most appropriate dosimetry measurement protocol for clinical applications.
Materials & methods: Measurement were performed on LINAC VersaHD, Elekta using ionization chamber IBA PPC40, FC65-P and CC13 at 6 MeV and 10 MeV in HDRE mode. The chambers were positioned at Z placement and a 100 cm SSD. Ks and Kpol were evaluated at voltages of 100 to 400 V using methods from TRS-398, AAPM TG-51, and Modified methods. The modified methods involves a Zplacement shifting correction = 1.39 mm (muir) for IBA PPC40.
Results: Ks values decreased by approximately 0.1% to 0.2% as the voltage increased from 200 V to 400 V. The PPC40 exhibited the lowest Ks value of 1.0099 at 400 V, while the FC65-P exhibited the highest Ks value of 1.0735 at 200 V, exceeding TG 51 and TRS 398 recommendation (Ks<1.05). All Kpol values remained within the acceptable limits, with deviations of less than 0.4% from the ideal chamber readings.
Conclusion: The results show that PPC40 with all three methods at a higher voltage (400 V) than the recommended (300 V) effectively reduces recombination effects, enhancing charge collection efficiency, lowering Ks values, and maintaining Kpol value at acceptable limits.

Keywords: HDRE- Charge collection efficiency- Ionization chamber

Topic: Medical Physics and Biophysics

[ABS-72]
The Effects of Intra-Individual Variability Setting on the Accuracy of Time-Integrated Activity Calculations

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Abstract

Background: Accurate estimation of kidney time-integrated activity (TIA) is essential for treatment planning in peptide receptor radionuclide therapy (PRRT). In the context of pharmacokinetic modeling, the intraindividual variability (IAV) setting-associated with measurement uncertainty-can influence TIA estimates. This study investigates the impact of varying IAV settings on TIA calculation.
Methods: Kidney biokinetic data following [177Lu]Lu-DOTATATE administration were obtained from 10 patients with neuroendocrine tumors using serial SPECT/CT imaging. A Nonlinear Mixed-Effects (NLME) model was used for TIA estimation. In Method 1, reference TIA (rTIA) was calculated by estimating both interindividual variability and IAV. In Method 2, IAV was fixed at half (hTIA) and twice (tTIA) the value obtained in Method 1. The influence of altered IAV on TIA accuracy was evaluated by comparing hTIA and tTIA against rTIA using relative deviation (RD), root-mean-square error (RMSE), and mean absolute percentage error (MAPE).
Results: Fixing IAV at half the reference value resulted in RMSE and MAPE of 4% and 3%, respectively. Furthermore, doubling the IAV led to an RMSE of 13% and MAPE of 10%.
Conclusion: Modifying the IAV setting had a measurable impact on TIA accuracy when doubled, but a negligible effect when halved in our population biokinetic data.

Keywords: PRRT, NLME, Intraindividual variability (IAV)

Topic: Medical Physics and Biophysics

[ABS-73]
Study The Calculated Area Under The Curve in Molecular Radiotherapy Using Opendose and CFTool Software (Opendose Vs CFTool)

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Abstract

Aim:
This study evaluated the accuracy of OPENDOSE software in calculating the area under the curve (AUC) in molecular radiotherapy, comparing its results with those from the Curve Fitting Tool (CFTool) with model selection in MATLAB.
Methods:
Patient data from the University of Michigan Deep Blue Data Repository (Patients 4 and 6) [1] injected with [177Lu] Lu-DOTATATE with activity of 7.21 GBq (patient 4) and 7.31 GBq (patient 6) were analyzed. Auto-segmented volumes of interest (spleen, kidneys, liver, and vertebrae) were processed in OPENDOSE to derive AUC values. In CFTool, time-activity curves were fitted using exponential models with different parameterization (f2, f3, f3a, and f3b), with model selection based on goodness-of-fit metrics (R2, adjusted R2, SSE, CV) and information criteria (BIC) to get the best exponential model. The best model for each organ was used to compute AUC, and relative deviations (RD) between OPENDOSE and CFTool results were assessed. The RD is considered acceptable if it is under 10% [2].
Results:
We initially concentrated on assessing the RD of the AUC of the function utilized in CFTool following model selection, in comparison to the same function provided in OPENDOSE. In patient 4, the RD for the spleen, right kidney, left kidney, liver, L4, and L3 vertebrae were -0.44%, -0.11%, -0.34%, -0.68%, -0.55%, and -0.53%, respectively. In patient 6, the RD for the right kidney, left kidney, liver, L4, L3, and L2 vertebrae were 0.07%, -0.17%, -0.24%, -0.15%, -0.07%, and -0.01%, respectively.
Conclusion:
When the same fitting models are applied, OPENDOSE and CFTool exhibit a good agreement in AUCs, suggesting that both tools may provide accurate and comparable AUC values in molecular radiotherapy with very minor variations in most organs. This validation supports OPENDOSE as a reliable tool for dosimetry in molecular radiotherapy.

Keywords: Keywords: AUC, CFTool, Molecular radiotherapy, OPENDOSE

Topic: Medical Physics and Biophysics

[ABS-81]

Investigation of the Effect of Changing the Tolerated Dose for Kidney and Spleen on the Predicted Distribution of 212Pb-DOTAMTATE and Its Daughters in Alpha Therapy

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Abstract

Background:
Targeted radionuclide therapy with 212Pb-SSTA is a potentially effective approach for treating neuroendocrine cancers. Evaluating biodistribution and dosimetry in non-target organs like kidney and spleen, this study aims to minimize toxicity and improve therapeutic safety.
Methods:
A multicompartment model developed using SAAM II was used to analyze the kinetics of 212Pb-SSTA and its decay products (Bi-212, Tl-208, Pb-208) in kidney and spleen at graded doses of 1-6 Gy. This represents the fractional dose absorbed per cycle based on a total renal dose limit of 23 Gy over four treatment cycles. Area under the curve (AUC) calculated from the activity-time curves in each compartment, were used to assess radionuclide accumulation.
Results:
AUC analysis showed that Pb-212 contributed dominantly in most compartments. The highest activity in the kidney was found in the proximal tubule and excretory compartment. Using 6 Gy as a reference, the average relative deviation (RD) values of using the tolerated dose for kidneys of 1-5 Gy were 83%, 66%, 50%, 33%, and 16%, respectively. RD values at each dose showed a decrease with increasing dose. RD values did not show significant differences between radionuclide compartments.
Conclusion:
The radionuclide distribution has been analyzed, the effect of varying the maximum tolerated dose affects the AUC distribution in each compartment.

Keywords: PBPK model, 212Pb-SSTA, compartment model

Topic: Medical Physics and Biophysics

[ABS-82]

Study the Effect of Compartments in Physiologically Based Pharmacokinetic (PBPK) model of Alpha Therapy Using Ac-225 mcp-M-alb-PSMA to the AUC calculation

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Abstract

Background:
[Ac-225]Ac-mcp-M-alb-PSMA is used in targeted alpha therapy for prostate cancer. Compartmental modeling is essential to understand radiopharmaceutical distribution and identify high-risk organs. The kidneys, being critical organs susceptible to toxicity, require precise dose estimation. This study aims to evaluate the effect of each compartment in PBPK model on the AUC calculation for alpha therapy using [Ac-225]Ac-mcp-M-alb-PSMA.
Methods:
Ex vivo biodistribution data for kidney uptake were obtained from 8-week-old LNCaP tumor-bearing SCID mice. PBPK modeling was performed using SAAM II software to estimate the area under the curve (AUC). The reference AUC (rAUC) was calculated based on a complete compartmental model structure of [225Ac]Ac-mcp-M-alb-PSMA. This rAUC was compared to the AUC estimates obtained after removal of each Ac-225 daughter (Fr-221, Bi-213, Po-213, Pb-209, and Tl-209) from the model. The effect was evaluated by comparing each modified AUC estimate to the rAUC using relative deviation (RD).
Results:
Removal of Fr-221-labeled pharmaceuticals showed the highest deviation in kidney AUC estimation, with an RD of 147%, followed by Fr-221-free (11%). Excluding other daughters showed a small effect on the calculated AUC.
Conclusion:
Fr-221-labeled pharmaceuticals significantly affected the AUC in the kidney. However, further validation with daughter radionuclide biokinetic data is needed to improve the reliability of the PBPK analysis.

Keywords: Ac-225, PBPK, compartmental model, AUC

Topic: Medical Physics and Biophysics

[ABS-83]

Investigation of the Effects of Compartments in Physiologically Based Pharmacokinetic (PBPK) Model on AUC Calculation in Alpha Therapy Using 212Pb-DOTAMTATE

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Abstract

Background:
[212Pb]Pb-DOTAMTATE has a purpose in targeted alpha therapy aimed at somatostatin receptor-expressing tumors. Compartmental modeling, especially PBPK modeling, is crucial for understanding radiopharmaceutical distribution and estimating radiation doses to vital organs like the kidney and spleen. The aim of this study was to assess the effect of each compartment in the PBPK model on the calculation of area under the curve (AUC) during alpha therapy using 212Pb-DOTAMTATE.
Methods:
The 212Pb-DOTAMTATE-PBPK model was evaluated using published biokinetic data from [212Pb]Pb-DOTAMTATE in mice bearing AR42J xenografts. A complex model of 212Pb daughters (212Bi, 208Tl, and 208Pb) was created using SAAM II software. The effect of each compartment was assessed by removing the daughter radionuclides individually and comparing the resulting kidney and spleen AUC with the complex model AUC using relative deviation (RD).
Results:
The highest RD was observed for 212Bi-labeled compartments, with the kidney showing 397% and the spleen 285%. This was followed by 212Bi-free compartments, where the kidney showed 18% and the spleen 15%. Removal of 208Tl and 208Pb showed no significant impact.
Conclusion:
Dose estimates for kidney and spleen were significantly affected by the 212Bi-labeled compartment. The model requires further testing with radionuclides daughter data to be more reliable with the PBPK model.

Keywords: 212Pb, PBPK, compartmental model, AUC

Topic: Medical Physics and Biophysics

[ABS-84]

Effect of Patient Gender on the Calculation of Time-Integrated Activity Coefficient in Radionuclide Therapy: A Study Using the Non-Linear Mixed-Effects Model

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Abstract

Purpose:
This study investigates the influence of patient gender on the calculation of the Time-Integrated Activity Coefficient (TIAC) in radionuclide therapy.
Methods:
Kidney biokinetic data from 10 patients (6 males, 4 females) treated with [177Lu]Lu-DOTATATE were analyzed [1]. A bi-exponential function was used to model both the uptake and clearance phases. The reference TIAC (rTIAC) was determined by fitting bi-exponential parameters to the complete dataset using a Non-Linear Mixed-Effects Model (NLMEM). To assess gender impact, separate NLMEM fittings for male and female subgroups yielded estimated TIACs (eTIACs). rTIAC and eTIAC values were compared using Relative Deviation (RD) and Root-Mean-Square Error (RMSE). Gender was deemed impactful if RD or RMSE exceeded 10%.
Results:
The RMSE was 7.2% for males and 8.8% for females. Among male patients, two individuals showed RD values exceeding 10% (i.e. 10.9% and -13.3%). Similarly, two female patients exhibited RD values beyond this threshold (i.e. -13.0% and 12.3%).
Conclusion:
For [177Lu]Lu-DOTATATE therapy in this study^s tested biokinetic data, gender does not appear to be a major determinant in TIAC calculation, as deviations remain within an acceptable range for most patients.

Keywords: Gender, Time-Integrated Activity Coefficient, Radionuclide Therapy

Topic: Medical Physics and Biophysics

[ABS-86]
Influence of Different OpenDose 3D Registration to Dose Calculation of [177Lu]Lu-DOTATATE Patients

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Abstract

Purpose This study aims to evaluate the impact of image registration to the calculation of absorbed doses in OpenDose3D software in Peptide Receptor Radionuclide Therapy.
Methods Patient imaging data were obtained from the Deep Blue Data repository of the University of Michigan Library [1]. The dataset comprised 177Lu-DOTATATE patient images including three SPECT acquisitions at 4, 24, and 96 hours post-injection (p.i.), and one CT scan acquired at 4 hours p.i. Variation of rotational (1 degree to 9 degree) and translational (-9 cm to 9 cm) transformations were applied to the 4-hour SPECT images to simulate misregistration scenarios. The clinical protocol involves sequential quantitative SPECT/CT imaging and segmentation of Organs at Risk (OARs). Relative Deviation (RD) of the Time Integrated Activity (TIA) was calculated by comparing transformed images against the non-transformed reference.
Results Transformations applied to SPECT images at multiple time points revealed that the 4-hour p.i. time point was particularly sensitive to misregistration, with relative TIA deviations reaching up to -47.41%. However, deviations remained within acceptable thresholds (<10%) for rotations of 1degree - 3 degree and translations of +/-1 cm, indicating the importance of precise alignment at early time points.
Conclusions This study underscores the importance of accurate image registration in quantitative SPECT dosimetry for radionuclide therapy. The implementation of OpenDose3D provided robust support for the analysis process, demonstrating its suitability for future clinical and research applications in nuclear medicine.

Keywords: Lu-177- OpenDose3D- Registration

Topic: Medical Physics and Biophysics

[ABS-87]

Impact of Varying the Maximum Tolerated Dose for Kidney on the Predicted Distribution of Ac-225-mcp-M-alb-PSMA and Its Daughters in Alpha Therapy

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Abstract

Background:
Actinium-225 is offering high cytotoxicity and therapeutic efficacy for prostate cancer. Accurate prediction of radiopharmaceutical biodistribution, organ dosimetry, and potential toxicity can be achieved through physiologically based pharmacokinetic (PBPK) modeling. This study aims to assess the impact of varying maximum tolerated renal doses on the predicted distribution of Ac-225-mcp-M-alb-PSMA and its daughters (Fr-221, Bi-213, Po-213, Pb-209, and Tl-209).
Methods:
A PBPK model adapted from Zaid et al. was evaluated using published biokinetic data from LNCaP tumor-bearing SCID mice. Simulations applied human physiological parameters with maximum renal absorbed doses ranging from 1 to 6 Gy per cycle. The area under the curve (AUC) for Ac-225 and its daughters was obtained from SAAM II for each compartment and analyzed relative to the 6 Gy reference dose.
Results:
The relative deviation (RD) of the AUC for Ac-225 and its daughters in each compartment was 83%, 67%, 50%, 33%, and 16% at doses of 1-5 Gy compared to 6 Gy. These RDs decreased with increasing dose.
Conclusion:
Variations in kidney dose influence AUC distribution. While daughter radionuclide toxicity may be inferred from parent data, further validation of PBPK model structures is needed to confirm these findings.

Keywords: PBPK model, AUC, Ac-225

Topic: Medical Physics and Biophysics

[ABS-96]

Effect of Manual Segmentation on the Accuracy of Calculated Absorbed Dose in Liver and Kidney: Comparison with the Automatic Mode in OpenDose3D

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Abstract

Background:
This study aimed to observe the effect of manual segmentation on the accuracy of absorbed dose calculations compared to automatic segmentation using OpenDose3D software in patients with neuroendocrine tumors (NETs) treated with Lu-177 DOTATATE. The clinical study included sequential quantitative SPECT/CT scan acquisition and rigid registration.
Methods:
The patient images used in this study were obtained from the University of Michigan Deep Blue data repository, including three SPECT/CT images acquired at multiple time points. For each volume of interest (VOI), absorbed dose values were calculated using both automatic (as the reference) and manual segmentation (as the comparison). The average relative deviation of the absorbed dose between manual and automatic segmentation was calculated to assess segmentation accuracy.
Results:
Based on absorbed dose values from manual segmentations compared to automatic segmentation, relative deviation varied across organs and time points. For the liver, deviations ranged from 1.74% to 8.66%- for the right kidney, from 5.82% to 10.35%. The left kidney showed the highest deviation, with values ranging from 4.69% to 19.15%.
Conclusion:
This study provides insight into the effect of manual segmentation on the accuracy of absorbed dose estimations relative to automatic segmentation.

Keywords: Lu-177, OpenDose3D, Segmentation

Topic: Medical Physics and Biophysics

[ABS-121]

Evaluation of Standard and Iterative Two-Stage Approaches for Estimation of Area-Under-the Curve in Thyroid Disease Dosimetry

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Abstract

Background:
The optimal dose estimation of 131I for thyroid disease depends on the accuracy of the area under the curve (AUC) of activity. The individual fitting (IF) method is commonly used as the standard for AUC estimation. However, fitting with inclusion of population-information such as the Standard Two Stage (STS) and Iterative Two Stage (ITS) methods might provide alternatives for analyzing large patient datasets [1]. This study aims to evaluate and compare the performance of STS and ITS methods in estimating AUC.
Methods:
Biokinetic data of 131I from 50 patients were simulated as being measured at 2, 6, 24, 48, 96, and 120 h using the best function as suggested in the literature [2]. Individual AUC (AUCind) was obtained from IF of each patient. The same dataset was then analyzed using both the STS and ITS methods. The root mean square error (RMSE) of the relative deviation was calculated by comparing AUC values obtained from STS (AUCSTS) and ITS (AUCITS) against the AUCind.
Results:
The comparison between the AUCSTS and AUCref resulted in an RMSE of 0%, while the comparison between the AUCITS and AUCref resulted in an RMSE of 8%.
Conclusion:
The individual fitting approach demonstrated only marginal differences compared to the STS method, while the ITS approach exhibited a slightly higher deviation from the individual fitting than that of the STS.

Keywords: I-131- Standard Two Stage (STS)- Iterative Two Stage (ITS)

Topic: Medical Physics and Biophysics

[ABS-164]

A Continuous Flow UV-C Radiation and Ozone System for Yeast Reduction in Honey

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Abstract

Honey is widely recognised for its nutritional benefits and inherent antimicrobial properties. However, due to its hygroscopic characteristics, it remains vulnerable to yeast contamination, particularly in humid conditions. This study evaluates a non-thermal preservation approach that combines UV-C radiation and ozone within a continuous flow system to inhibit yeast growth in honey. Two samples of local Klanceng (Trigona spp.) honey were examined: one serving as a control, and the other subjected to treatment with UV-C at 1.096 \pm 0.004 mW/cm^{2} and ozone at 10.3 \pm 0.3 ppm, each applied for 15 minutes, corresponding to total doses of 11.508 mJ/cm^{2} and 107.8 ppm \cdot s, respectively. The treated sample demonstrated a 48% reduction in yeast count. The \log reduction value reached 0.281, approaching the conventional 0.3 threshold commonly associated with a 50% microbial decline. This finding is particularly noteworthy given that the method avoids thermal degradation, thereby preserving the delicate qualities of honey. While the treatment did not completely eradicate yeast, it produced a measurable and meaningful impact. These results suggest that the combined use of UV-C and ozone may represent a promising, food-safe preservation technique. Further research exploring extended exposure durations, varied flow rates, and long-term effects would be valuable for the food industry to fully elucidate the potential of this approach.

Keywords: Continuous flow processing- honey- Non-thermal pasteurisation- UV-C and ozone treatment- Yeast

Topic: Medical Physics and Biophysics

[ABS-186]

Effect of Negatively Charged Amino Acid and Nanohydroxyapatite Concentrations on The Surface Hydrophilicity of PVA Nanofiber Scaffolds

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Abstract

Polyvinyl alcohol (PVA) is a biodegradable and biocompatible polymer with potential use in tissue engineering. However, its excessively high hydrophilicity potentially led to poor cell adhesion, thus limiting its suitability as a bone scaffold. This study investigates the modification of PVA nanofibers through the incorporation of amino acids (aspartic acid, glutamic acid) and nano-hydroxyapatite (nHA) to tailor their hydrophilicity. Electrospun nanofiber composites of Asp/PVA/nHA and Glu/PVA/nHA fabricated with varying nHA concentration and their wettability evaluated through contact angle measurements. Higher nHA content was seen to increase the contact angles, whereby Asp/PVA/nHA and Glu/PVA/nHA with nHA concentration of 3.5 percent were within the ideal range for optimal cell adhesion and proliferation (around 40 to 70 degree). Samples containing Glu exhibited a lower hydrophilicity compared to their respective Asp-containing samples. Statistically significant differences in wettability (p less than 0.05) suggest that nHA and amino acids effectively modulate surface characteristics. These findings support the potential of fine-tuning PVA hydrophilicity via nHA and amino incorporation for improved performance in bone tissue engineering applications.

Keywords: Aspartic acid, Bone scaffold, Contact angle, Electrospinning, Glutamic acid

Topic: Medical Physics and Biophysics

[ABS-201]

Computational Biophysics of Drug-Target Interactions: In Silico Investigation of 2-Anilino-4-Amino Quinazoline Derivatives as Potential Inhibitors of Plasmodium falciparum Dihydroorotate Dehydrogenase

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Abstract

Malaria, caused by Plasmodium parasites, is regarded as a major global health threat, further exacerbated by increasing resistance to current antimalarial drugs. Consequently, the urgent need for novel therapeutic agents is widely recognized. The 2-anilino-4-amino quinazoline scaffold has been identified as a promising candidate in antimalarial drug development. In this study, a series of substituted quinazoline derivatives were evaluated as potential inhibitors of Plasmodium falciparum dihydroorotate dehydrogenase (PfDHODH), a key enzyme involved in the parasite^s pyrimidine biosynthesis pathway. Molecular docking was carried out to investigate the binding modes and affinities of the compounds at the PfDHODH active site, with chloroquine being employed as a reference. Pharmacokinetic properties and drug-likeness were predicted using in silico ADMET analysis. The stability of the top ligand-PfDHODH complexes was subsequently examined through molecular dynamics simulations. Based on the computational results, favorable binding characteristics and pharmacokinetic profiles were exhibited by several quinazoline derivatives, indicating their potential as PfDHODH inhibitors. These findings are expected to provide a foundation for further structural optimization and experimental validation.

Keywords: Plasmodium, antimalarial drug, molecular docking, PfDHODH, Molecular Dynamics

Topic: Medical Physics and Biophysics

[ABS-205]

Synthesis of Rice Husk Silica PVA Xerogel Film as Food Temperature Insulator

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Abstract

Temperature fluctuations during storage and transportation are among the leading causes of food degradation, promoting microbial growth, reducing product quality, and increasing the risk of foodborne illness. This study aims to develop a sustainable and thermally insulating packaging film based on polyvinyl alcohol (PVA) reinforced with silica xerogel synthesized from rice husk ash, an abundant agricultural waste. Silica xerogel was synthesized via the sol-gel method using rice husk ash reacted with an alkaline solution under controlled conditions. The resulting gel was characterized using Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy with energy-dispersive X-ray analysis (SEM-EDX), X-ray diffraction (XRD), and Brunauer-Emmett-Teller (BET) surface area analysis. Packaging films were fabricated by the solution casting method with varying silica xerogel concentrations, and a plasticizer was added to improve flexibility. The film containing 3% silica xerogel exhibited the highest tensile strength (25.27 MPa) and demonstrated improved thermal insulating behavior. Higher silica xerogel content led to slower environmental degradation rates. Application tests showed the film effectively maintained the physical integrity of chocolate, confirming its insulating capability. The PVA/silica xerogel composite film presents a promising solution for eco-friendly thermal insulation packaging, combining mechanical strength, thermal performance, and environmental sustainability. Its development highlights the valorization of rice husk ash into functional packaging materials.

Keywords: bioplastic,biodegradable, packaging film, PVA, silica xerogel. rice husk ash

Topic: Medical Physics and Biophysics

[ABS-214]

Classification of Raw Minced Beef, Chicken, and Pork Using AS7341 Spectrophotometer Sensor with Naive Bayes Method

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Abstract

Meat has a high nutritional source needed by the human body because it contains sources of protein, vitamins, minerals, amino acids and fatty acids. The rise of cases of adulteration of beef and chicken meat mixed with pork often occurs every year. For this reason, a standard of meat purity is needed so that it is halal and safe for consumption. This research proposes the manufacture of a portable spectrophotometer that is easy to use, low in price, and able to distinguish beef, chicken, pork. The spectrophotometer is made using an AS7341 sensor equipped with 1 LED light source, 11 spectral channels with a range of 400-940 nm, raspberry pi 4B as a microcontroller, and the results are displayed on the LCD. The results show that the system can distinguish beef, chicken, pork, beef-pork mixture with a ratio of (7:3, 5:5, 1:9) grams, and chicken-pork mixture with a ratio of (7:3, 5:5, 1:9) grams using the Naive Bayes Classifier method. It is obtained that the evaluation value of the beef, pork, and beef-pork mixture classification system with a total data set of 753 data, training data and testing data has a ratio of (70:30), (80:20) getting an accuracy value of 1.0, precision 1.0, recall 1.0, F1-score 1.0, and AUC 1.0 (excellent classification). While the evaluation of the classification system for chicken, pork, and chicken-pig mixtures with a total data set of 758 data, training data and testing data has a ratio of (70:30), (80:20) getting an accuracy value of 1.0, precision 1.0, recall 1.0, F1-score 1.0, and AUC of 1.0 (excellent classification).

Keywords: Meat Classification, Spectrophotometer, AS7341 Sensor, Naive Bayes

Topic: Medical Physics and Biophysics

PHYSICS EDUCATION

[ABS-3]

The Role of Student Well-Being in the Success of Physics Learning: A Literature Review

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Abstract

Student well-being plays a crucial role in academic success, particularly in challenging subjects such as physics. It encompasses school-related, social, emotional, and academic aspects that interrelate to foster an optimal learning experience. This study aims to investigate the relationship between student well-being and achievement in physics learning while offering insights for educators to develop a supportive learning environment that enhances student well-being. The method employed in this article is a Systematic Literature Review (SLR) based on the PRISMA 2020 protocol. Data were gathered from articles published over the past six years, sourced from the Scopus database. The findings indicate that supportive learning environments, such as classrooms and laboratories, indirectly influence physics learning outcomes. Emotional well-being, including the ability to manage stress and maintain intrinsic motivation, directly impacts student engagement in physics education. Furthermore, social support from teachers and peers significantly contributes to boosting students self-confidence. This research confirms that student well-being not only affects academic success but also fosters essential social and emotional skills. Consequently, a comprehensive integration of teaching strategies is required to create inclusive learning experiences that promote student well-being. These findings offer valuable insights for educators and policymakers seeking to enhance the quality of physics education.

Keywords: Education- Student Well-Being- Physics Learning

Topic: Physics Education

[ABS-31]

Rancang Bangun Audiobook Materi Energi untuk Siswa Berkebutuhan Khusus (Tunanetra)

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Abstract

Penelitian ini bertujuan untuk menghasilkan media pembelajaran berupa audiobook materi energi yang dirancang khusus untuk siswa tunanetra. Media ini dilengkapi dengan modifikasi visual berupa gambar taktil/perabaan dan tulisan dalam huruf Braille timbul guna memudahkan siswa dalam memahami konsep energi yang umumnya bersifat visual. Penelitian menggunakan metode penelitian dan pengembangan (Research and Development) dengan model 4D (Define, Design, Develop, dan Disseminate), namun dibatasi hingga tahap Develop. Pada tahap Define dilakukan analisis kebutuhan melalui wawancara dengan guru SLB, observasi langsung terhadap proses pembelajaran, serta studi literatur yang relevan. Hasil analisis menunjukkan adanya keterbatasan akses terhadap bahan ajar yang sesuai bagi siswa tunanetra, terutama dalam mata pelajaran IPA. Berdasarkan hasil tersebut, peneliti merancang audiobook interaktif dengan narasi audio dan elemen taktil untuk menggantikan peran visual. Pada tahap Design dan Develop, dilakukan penyusunan konten, perancangan storyboard, pemilihan format audio, serta pembuatan prototipe produk. Audiobook ini dirancang agar dapat diakses melalui perangkat digital secara fleksibel dan mendukung proses pembelajaran inklusif di SLB. Produk akhir diharapkan dapat menjadi solusi media pembelajaran alternatif yang ramah tunanetra.

Keywords: audiobook- energi- tunanetra- media taktil- huruf Braille

Topic: Physics Education

[ABS-33]

Alat Peraga Medan Magnet Menggunakan Kawat Penghantar

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Abstract

Mata pelajaran fisika sering dianggap sulit oleh peserta didik karena paradigma masyarakat yang menggiring opini fisika adalah pelajaran yang sulit dan tidak menarik. Berdasarkan teori kerucut pengalaman Edgar Dale, penggunaan media pembelajaran dapat membantu menvisualisasikan konsep-konsep fisika yang abstrak. Penelitian ini menggunakan metode Research and Development (R&D) dengan model pengembangan 4D (Define, Design, Develop, and Disseminate), yang dibatasi pada tahap Develop karena fokus penelitian adalah pada pengembangan alat peraga medan magnet menggunakan kawat penghantar. Pada tahap Define dilakukan analisis kebutuhan melalui wawancara dengan guru fisika, observasi alat peraga medan magnet serta studi literatur yang relevan. Hasil analisis menunjukkan 96,6% peserta didik menyatakan penggunaan alat peraga memudakan dalam memvisualisasikan konsep-konsep fisika. Berdasarkan hasil tersebut, penelitian ini bertujuan untuk mengembangkan alat peraga medan magnet menggunakan kawat penghantar sehingga dapat memudahkan dalam menvisualisasikan garis-garis gaya magnet. Pada tahap Design dan Develop, dilakukan perancangan model alat peraga, pembuatan alat peraga, dan penguji coba alat peraga. Alat peraga ini dapat memvisualisasikan garis-garis gaya magnet dalam medan magnet menggunakan kawat penghantar.

Keywords: Alat Peraga, Medan Magnet, Kawat Penghantar, R&D, Visualisasi

Topic: Physics Education

[ABS-34]

The Development of Science Identity Self-Test to Measure the Level of Science Identity Based on PISA 2025 Framework

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Abstract

In the face of rapid and complex global change, we need more scientists who apply scientific methods to generate new knowledge, and communities who apply this knowledge effectively. Previous research revealed that cultivating a science identity (SCID) or environmental identity (EID) can motivate individuals to develop skills, interests, and enthusiasm in addressing environmental issues. The literature study's results reveal a lack of widespread use of science identity instruments in research. The PISA 2025 Science Framework announced the inclusion of the concept of science identity. For this reason, it is necessary to prepare a science identity instrument based on the PISA Framework 2025. The purpose of the study is to develop SIST (Science Identity Self-Test) to measure the level of science identity based on the PISA 2025 Framework and to test the validity and reliability of SIST. Using the Rasch measurement model, the psychometric evaluation revealed that the instrument demonstrated high reliability, with Person reliability (0.91) and item reliability (0.98) categorized as excellent. Out of the 49 items tested, 37 met the fit criteria, ensuring robust measurement properties. The dimensionality analysis validated the instrument's uni-dimensionality, as measures explained raw variance at 35.7%, satisfying the threshold requirements. The SIST instrument provides a reliable and valid tool for assessing science identity among students and can serve as a basis for future research and practical applications in science education.

Keywords: Science Identity, Science education, PISA 2025, Rasch Model

Topic: Physics Education

[ABS-35]

Rancang Banguna Alat Peraga Spektroskop Analisis Spektrum Warna (Spektra)

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Abstract

Pembelajaran berbasis hands-on semakin penting di Indonesia yaitu meningkatkan keterampilan siswa melalui pengalaman langsung salah satunya ialah dengan alat peraga pembelajaran. Penelitian ini bertujuan untuk menghasilkan media pembelajaran berupa alat peraga spektroskop untuk menganalisis spektrum warna yang dirancang khusus untuk siswa. Alat ini dilengkapi dengan kustomisasi visual berupa webcam guna memudahkan siswa dalam melihat visualisasi spektrum warna pada berbagai macam sumber cahaya. Penelitian menggunakan metode penelitian dan pengembangan (Research and Development) dengan model 4D (Define, Design, Develop, dan Disseminate), yang dibatasi hingga tahap Develop. Pada tahap Define dilakukan analisis kebutuhan melalui wawancara terhadap guru, observasi langsung terhadap pembelajaran, serta studi literatur. Hasil analisis menunjukkan adanya kesulitan bagi siswa dalam memahami dan memvisualisasikan materi cahaya. Berdasarkan hasil tersebut, peneliti merancang alat peraga spektroskop analisis spektrum warna (SPEKTRA) yang dilengkapi dengan buku panduan. Pada tahap Design dan Develop, dilakukan penyusunan kerangka alat dan bahan yang digunakan, perancangan storyboard, serta pembuatan prototipe produk. Alat peraga spektroskop ini diharapkan menjadi solusi media pembelajaran berbasis hands-on yang dapat menunjang siswa memahami pembelajaran fisika.

Keywords: hands-on-alat peraga-spektroskop-media pembelajaran

Topic: Physics Education

[ABS-36]
Rancang Bangun Alat Peraga Termoskop

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Abstract

Penelitian ini bertujuan untuk mengevaluasi tingkat validitas dari alat peraga fisika berupa termoskop yang dirancang sebagai media pembelajaran dalam materi termodinamika. Alat ini berperan dalam membantu meningkatkan pemahaman konsep melalui keterkaitan langsung antara teori fisika dan pengalaman empiris siswa, sehingga memperkuat pemahaman teori. Penelitian menggunakan metode penelitian dan pengembangan (Research and Development) dengan proses pengembangan model 4D (Define, Design, Develop, dan Disseminate), namun penelitian dibatasi hingga tahap Develop. Pada tahap Define dilakukan literatur terhadap prinsip kerja termoskop dan analisis kebutuhan melalui penyebaran angket, wawancara dengan guru, dan observasi langsung pada proses pembelajaran. Hasil analisis menunjukkan adanya ketertarikan pada pembelajaran apabila dilakukan peragaan terutama pada materi termodinamika. Berdasarkan hasil tersebut, peneliti merancang alat peraga sederhana sebagai media pembelajaran. Pada tahap Design dan Develop, dilakukan perancangan gambar alat dan pembuatan kelayakan alat serta eksperimen pengguna. Alat peraga sederhana ini dirancang agar menciptakan situasi belajar yang menarik dan memotivasi serta dapat meningkatkan pemahaman konsep pada materi termodinamika. Produk akhir diharapkan dapat membantu peserta didik memahami materi lebih baik.

Keywords: Termoskop, alat peraga, termodinamika, media pembelajaran

Topic: Physics Education

[ABS-41]

Developing Project-Based Learning Tools with VAK Multi-Modality Differentiation to Enhance Students Conceptual Understanding

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Abstract

This research aims to develop project-based physics learning tools through VAK (Visual, Auditory, and Kinesthetic) multi-modality differentiation and examine their validity, practicality, and effectiveness in enhancing high school students conceptual understanding. The study employs a Research and Development (R&D) approach with the ADDIE model to develop learning tools accommodating diverse learning styles. Implementation occurred in a single tenth-grade high school class using a one-group pretest-posttest design. The developed materials include lesson plans, student worksheets, and multimodal learning resources incorporating Project-Based Learning stages that integrate VAK multi-modality differentiation. Students were organized in heterogeneous groups based on VAK modality preferences, with roles assigned according to modality strengths: auditory students led the Start with the Essential Question phase, visual students predominated in Design a Plan for the Project, and kinesthetic students took primary responsibility during the Progress of the Project phase. The tools validity was assessed through expert validation using Aiken V formula, while practicality was measured via student and teacher responses, and effectiveness was analyzed through pretest-posttest comparison of conceptual understanding using N-gain scores. Results indicate that the developed learning tools are valid, practical with positive feedback, and effective in improving conceptual understanding. The VAK modality-based differentiated collaboration demonstrated positive dynamics with optimal contributions from each student according to their learning preferences, establishing this approach as a viable solution for accommodating diverse student characteristics in physics education.

Keywords: Adaptive- Differentiated Learning- Learning Style- PjBL- Physics Learning

Topic: Physics Education

[ABS-49]

Needs Analysis of a STEM-Based Problem-Based Learning Electronic Module in Fluid Mechanics to Enhance Students' Critical Thinking and Problem-Solving Skills

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Abstract

This study aims to determine the need for learning devices in the form of electronic teaching modules based on STEM Problem Based Learning to measure students' critical thinking and problem-solving abilities so that they can be known and there is follow-up from researchers to teachers in implementing learning. The needs analysis studied is the analysis of teaching module needs, analysis of Fluid material, analysis of critical thinking skills and students' problem-solving abilities. The subjects of this study were high school physics teachers who teach with the Merdeka curriculum and teach in grade 11. The participants in this study were around 10 teachers from different schools in several districts/cities in East Java and Central Java. The research method used is quantitative descriptive research. Data collection techniques used in this study consisted of observation, questionnaires and literature studies. The collected data were analyzed with appropriate instruments, with descriptive statistical analysis techniques. Based on the data analysis, the following results were obtained: 1) As many as 73.2% of physics teachers still have difficulty in developing teaching modules, but 92.4% stated that they were interested in creating modules that meet the criteria for electronic teaching modules based on STEM Problem Based Learning in the Merdeka curriculum- 2) Fluid material is important but difficult for students to understand- 3) Teachers experience obstacles in teaching aspects related to critical thinking and problem solving skills, with 65% of physics teachers experiencing difficulties in developing critical thinking skills and 62.8% experiencing obstacles in improving students' problem solving skills- 4) Teachers need teaching modules that support aspects of students' critical thinking and problem solving skills.

Keywords: STEM Problem based learning, Students^ critical thinking skills and problem solving skills.

Topic: Physics Education

[ABS-50]

Project Based Learning (PjBL) Integrated STEM Research Trend for Last 5 Years: A Bibliometric Analysis

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Abstract

STEM (Science, Technology, Engineering, and Mathematics) education is currently considered a priority which is one of the alternative learning approaches to develop 21st century skills. This study aims to examine the trends of project-based learning (PjBL) integrated with the STEM approach in physics learning. The method employed is bibliometric analysis, utilizing secondary data collected from the Scopus database, comprising 98 documents published between 2019 and 2024. The collected documents were then analyzed using the VOSviewer application. This study shows that the integration of PjBL and STEM can be applied to the context of science learning, especially physics. The results of this study are also still one of the trends and can be an option in implementing learning in schools and provide direction for the development of innovative learning models that are relevant to today's educational needs.

Keywords: bibliometric, STEM, project based, PjBL, physics learning

Topic: Physics Education

[ABS-67]

The relationship between conceptual understanding and problem solving abilities among Universiti Teknologi Malaysia^s undergraduates

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Abstract

This study investigates the relationship between conceptual understanding and problem-solving abilities in physics among undergraduates at Universiti Teknologi Malaysia (UTM). This study supervised by Prof. Dr. Fatin Aliah Phang. The research focuses on the topic of force and motion, aiming to determine whether a student^s conceptual grasp influences their ability to solve related physics problems. Conceptual understanding was measured using the Force Concept Inventory (FCI), while problem-solving skills were assessed through selected items from the SAT Physics Practice Test. A total of 60 students from Year 2 and Year 4 who had completed the mechanics course participated in the study. Descriptive analysis was used to determine students^ levels of conceptual understanding and problem-solving ability, while Pearson correlation analysis was employed to examine the relationship between the two variables. The findings provide insights into how these two cognitive domains are related within the context of physics learning.

Keywords: Conceptual Understanding, Problem Solving, Force and Motion
Topic: Physics Education

[ABS-74]

Pengembangan Permainan Simulasi "Bird Simulator" sebagai Media Pembelajaran untuk Penjumlahan Vektor

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Abstract

Penelitian ini bertujuan untuk menghasilkan permainan simulasi "Bird Simulator" yang layak digunakan sebagai media pembelajaran untuk penjumlahan vektor. Penelitian ini menggunakan metode R&D (Research and Development) dengan model pendekatan ADDIE (Analyze, Design, Develop, Implement, Evaluate). Permainan ini dikembangkan dengan menggunakan articulate storyline. Hasil dari permainan ini kemudian divalidasi untuk mengetahui kelayakannya oleh ahli materi, ahli media, dan ahli pembelajaran. Hasil akhir dari permainan ini kemudian diujicobakan kepada peserta didik. Vektor merupakan salah satu konsep yang dianggap sebagai pondasi dasar untuk mempelajari pokok bahasan lain dalam fisika. Salah satu faktor penyebab peserta didik mengalami kesulitan dalam memahami vektor adalah adanya miskonsepsi penggambaran konsep vektor yang tidak didasarkan pada aturan-aturan penjumlahan vektor yang benar. Selain itu, guru seringkali masih memakai media pembelajaran yang ketinggalan zaman. Media pembelajaran yang saat ini dipakai guru perlu diperbarui agar lebih efektif dan efisien dalam menyampaikan materi pembelajaran. Maka dari itu, dikembangkan permainan simulasi "Bird Simulator" sebagai media pembelajaran untuk penjumlahan vektor.

Keywords: media pembelajaran, permainan simulasi, penjumlahan vektor

Topic: Physics Education

[ABS-75]

Engineering Design Process in PjBL-STEM Teaching Materials to Improve Students Scientific Literacy Skills

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Abstract

The aim of this research is to develop teaching materials (lesson plan and student worksheet) based on Engineering Design Process through PjBL-STEM to improve students' scientific literacy that is valid, effective and practical. The type of research used is R&D with the ADDIE model. The validation sheet of teaching materials, scientific literacy test, and response questionnaire to the implementation of learning were used as instruments in this study. The subjects in this research were 33 tenth-grade students of MAN 3 Banda Aceh. The results showed that the validity of the teaching materials developed obtained a score of 3.5 and was in the valid category, The effectiveness of improving scientific literacy skills analyzed using the N-Gain test obtained a score of 0.736 with a high category, and practicality was in the very practical category. Based on these results, it can be concluded that the teaching materials developed are feasible to use to improve students' scientific literacy skills.

Keywords: Engineering Design Process, PjBL-STEM, Teaching Materials, Scientific Literacy

Topic: Physics Education

[ABS-80]

Pengetahuan dan Cabaran Penggunaan Teknologi Guru Pelatih dalam Pengajaran dan Pembelajaran Fizik

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Abstract

Penguasaan penggunaan teknologi dalam kalangan guru pelatih merupakan aspek penting seiring perkembangan pendidikan abad ke-21 serta keperluan Pelan Pembangunan Pendidikan Malaysia (PPPM) 2013-2025. Kajian ini bertujuan mengenal pasti tahap pengetahuan dan cabaran penggunaan teknologi dalam kalangan guru pelatih semasa pengajaran dan pembelajaran Fizik. Kaedah campuran (mixed method) digunakan, melibatkan pengumpulan data kuantitatif melalui soal selidik dan data kualitatif melalui temu bual separa berstruktur. Seramai 44 orang guru pelatih Fizik tahun 3 dan tahun 4 di Universiti Teknologi Malaysia (UTM) telah dipilih secara persampelan bertujuan. Instrumen soal selidik dibangunkan berdasarkan kerangka TPACK dengan tumpuan terhadap konstruk Pengetahuan Teknologi (TK), Pengetahuan Isi Kandungan (CK), Pengetahuan Pedagogi (PK) dan Pengetahuan Teknologikal Pedagogi Isi Kandungan (TPACK). Data kuantitatif dianalisis menggunakan statistik deskriptif dan inferensi, manakala data kualitatif dianalisis secara tematik. Dapatan kajian ini dijangka dapat memberikan gambaran tentang tahap penguasaan teknologi guru pelatih serta mengenal pasti cabaran utama yang dihadapi guru pelatih, khususnya dalam bidang Fizik.

Keywords: Guru pelatih, teknologi, TPACK, pengajaran Fizik
Topic: Physics Education

[ABS-90]

Needs Analysis of a Contact Angle Measurement Practicum to Support Students' Scientific Process Skills and Collaboration in Physics Education

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Abstract

Scientific process skills (SPS) and collaboration are essential for developing students' analytical abilities and preparing them for research and professional environments. The development of an innovative physics practicum is essential for enhancing students' SPS and collaborative competencies. One promising approach is the use of contact angle measurement, a technique for observing liquid-solid interactions, which can be applied in experiments to determine Earth's gravitational acceleration. This study aims to analyze the need for developing a practicum based on contact angle measurement that can improve the SPS and collaboration skills among physics education students. Data were collected through interviews with two lecturers and questionnaires to students from the Physics Education Study Program at Universitas Sebelas Maret and analyzed using both quantitative and qualitative methods. Based on the needs analysis, both lecturers and students need a practicum that enables students to engage directly in complex and contextual scientific investigations. Such a practicum has the potential to enhance critical thinking skills, technical abilities, and conceptual understanding of physics. The results showed that practicum based on contact angle measurement is not only innovative but also effective in developing students' SPS and collaborative skills.

Keywords: Need Analysis, Contact Angle Measurement, Practicum, Scientific Process Skills, Collaboration

Topic: Physics Education

[ABS-92]

Hubungan antara pencapaian Fizik dan kemahiran penyelesaian masalah matematik dalam kalangan pelajar

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Abstract

Subjek matematik sememangnya berkait rapat dengan subjek fizik kerana pengiraan matematik digunakan dalam penyelesaian masalah fizik. Kajian ini bertujuan untuk mengenal pasti hubungan antara pencapaian fizik dan kemahiran penyelesaian masalah matematik dalam kalangan pelajar. Kajian ini dijalankan di sebuah sekolah menengah yang terletak di daerah Kulai, Johor dan melibatkan seramai 30 orang pelaajr Tingkatan 4 yang mengambil pakej STEM A. Reka bentuk kajian yang digunakan ialah kajian kuantitatif berbentuk kolerasi dan instrumen kajian ini mengandungi lima soalan topik Gerakan Linear. Dapatan hasil dan data dianalisis menggunakan ujian kolerasi Pearson bagi mengenal pasti hubungan antara dua pemboleh ubah utama iaitu pencapaian Fizik dan kemahiran penyelesaian masalah matematik. Hasil kajian ini menunjukkan bahawa terdapat hubungan yang signifikan antara kedua-dua pembolehubah tersebut. Kajian ini memberikan implikasi penting kepada guru dalam merancang strategi pengajaran yang berkesan dalam meningkatkan pencapaian pelajar dalam subjek fizik melalui penguasaan kemahiran penyelesaian masalah matematik.

Keywords: Pencapaian Fizik, Kemahiran penyelesaian masalah matematik, Tingkatan 4
Topic: Physics Education

[ABS-95]

Investigating the Impact of Jigsaw Cooperative Model and Case Method on Undergraduate Students Physics Concept Understanding and Communication Skills

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Abstract

This study aims to investigate the impact of the jigsaw cooperative model and the case method on undergraduate students' understanding of physics concepts and their communication skills. This study used a quasi-experimental method with a pretest-posttest non-equivalent control group design to explore information on understanding of physics concepts. Understanding of physics concepts was measured using a reasoned multiple-choice test. While communication skills were measured using a self-assessment sheet. The sample of this study involved 40 undergraduate students who were divided into an experimental class and a control class. The results showed that the pretest data on understanding of physics concepts in both classes were not significantly different. However, the posttest data on understanding of physics concepts were significantly different with the N-Gain score of the experimental class (0.46) being higher than the N-Gain of the control class (0.29). Based on the results of the self-assessment, the average communication skills score of undergraduate students in the experimental class (76.29) was also higher than that of the control class (68.71). These results indicate that the implementation of the jigsaw cooperative model and the case study method can improve understanding of physics concepts and develop communication skills of undergraduate students.

Keywords: jigsaw cooperative model, case method, understanding of physics concepts, communication skills

Topic: Physics Education

[ABS-97]

Effectiveness of Using Simulations in Learning the Concepts of Force and Motion

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Abstract

This study examines the effectiveness of using computer simulations in enhancing students^ understanding of the concepts of force and motion in Physics at the secondary school level. The introduction of digital learning tools, particularly simulations, aims to address the challenges faced by students in comprehending abstract physical concepts, especially when traditional teaching methods fall short. The study utilizes a quasi-experimental design, measuring the mastery of these concepts before and after using simulations. Data were collected through pre-tests and post-tests involving a cohort of Form 4 students in Kulai, Malaysia. The research aims to determine if simulations, particularly those that visualize dynamic phenomena like momentum and collision, improve students^ grasp of physical principles and increase problem-solving skills. Results indicate that using simulations as a teaching tool significantly enhances students^ concept mastery, providing a more interactive and engaging way to understand complex Physics concepts.

Keywords: Simulations , Physics Education, Secondary Education, Momentum
Topic: Physics Education

[ABS-115]

Collaborative Learning in Physics: An Overview of the Group Investigation Approach and Its Impact on Learning Outcomes

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Abstract

This study is a Systematic Literature Review (SLR) which aims to evaluate the implementation of the Group Investigation (GI) model in physics learning in higher education. Eight selected articles from the Scopus, ERIC, and Google Scholar databases were thematically analyzed and visualized using VOSviewer. The results of the study show that the application of the GI model consistently contributes to the improvement of conceptual understanding, metacognitive skills, collaboration, argumentation, problem solving, and critical and creative thinking of students. The bibliometric visualization identified Group Investigation and PhET as key keywords reflecting the integration of collaborative learning and interactive technologies. However, the implementation of this model requires lecturer readiness, effective classroom management, and thorough process assessment. The study recommends the development of GI-based modules and educator training to support active and competency-oriented physics learning in the 21st century.

Keywords: Group Investigation, cooperative learning, systematic literature review

Topic: Physics Education

[ABS-120]

Fostering Pre-Service Vocational High School Teachers' Conceptual Understanding of the Lambert-Beer's Law in the Context of Electromagnetic Radiation-Solution Interaction

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Abstract

Chemistry education in Vocational High Schools (SMK) requires prospective teachers to possess a strong conceptual understanding, particularly of concepts applicable to analytical chemistry. One key concept in this field is Lambert-Beer's Law, which describes the relationship between electromagnetic radiation and the concentration of a substance in solution. This concept plays a vital role in spectrophotometric techniques, which are widely used for the quantitative analysis of various chemical compounds. To ensure that pre-service teachers do not merely memorize formulas procedurally but instead develop a deep conceptual understanding, effective learning strategies are needed to actively promote such comprehension. In this study, a PhET simulation of Lambert-Beer's Law was implemented in conjunction with an inquiry-based learning model. Through this approach, students were expected to explore and investigate the relationship between wavelength and the color of absorbed or visible light, as well as manipulate cuvette length and solution concentration to observe their effects on absorbance and transmittance. These activities aimed to guide students in drawing conclusions about the meaning of Lambert-Beer's Law as a representation of both physical and chemical interactions. The study adopted a quasi-experimental method with a one-group pretest-posttest design, involving 39 pre-service chemistry teachers enrolled in an Instrumental Analytical Chemistry course. The results indicated that PhET simulation supported by inquiry learning effectively fostered students' conceptual understanding of Lambert-Beer's Law as an interaction between electromagnetic radiation and chemical solutions. The N-gain value of 0.470 demonstrated the potential effectiveness of this approach in enhancing student learning outcomes. The results of the Wilcoxon Signed-Rank Test indicated a statistically significant difference between the pre-test and post-test scores ($p < 0.001$). These findings support the use of PhET simulation-based inquiry learning in helping teachers design lesson plans that facilitate student to master the Lambert-Beer's Law.

Keywords: Conceptual Understanding, Inquiry-Based Learning, Lambert-Beer's Law, PhET simulation

Topic: Physics Education

[ABS-127]

Development of Interactive Modules Based on Digital Simulation for Training National Science Olympiad (OSN) on Mechanics Material in Junior High School

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Abstract

This study aims to develop and evaluate an interactive digital simulation-based training module for the National Science Olympiad (OSN) in junior high school physics. The module was developed using the Research and Development (R&D) method following the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). It was designed as a web-based resource using Canva and integrated with simulations from GeoGebra and PhET to present physics concepts in a dynamic and interactive way. Validation by three experts from the Institut Teknologi Bandung resulted in an average score of 3,2 for content validity and 3,0 for media validity, both categorized as “very valid”. The module was then tested on twelve junior high school students from Serang Regency who were prospective OSN participants. The training showed moderate effectiveness, with an average N-gain score of 0.37. Feedback from the participants and a supervising teacher yielded practicality scores of 3,5 and 3,8, respectively, indicating the module is “very practical”.Based on these results, the module is considered effective, valid, and highly practical, making it suitable as a supporting tool for OSN science training at the junior high school level.

Keywords: training module- OSN- interactive simulation

Topic: Physics Education

[ABS-128]

The Effect of The Argument Driven Inquiry Integrated With STEAM Assisted by DMM to Improve Critical Thinking Skill on The Material of Sound and Light Waves

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Abstract

This study examines the effect of the Argument-Driven Inquiry (ADI) model integrated with STEAM and supported by Digital Mind Mapping (DMM) on students critical thinking skills in sound and light wave physics material. This study is motivated by the low critical thinking skills of students and the abstract nature of wave material, and is prone to cause misconceptions. The study used a quasi-experimental design with a control group pretest-posttest, and the research subjects were class XI students of SMAN 1 Singosari selected through a cluster random sampling technique. Critical thinking skills were measured using ten description questions that had been validated and had high reliability (Cronbach Alpha = 0,787). Data were analyzed using t-tests, effect size, and N-gain calculation. The results showed that the ADI-STEAM-DMM model significantly improved students critical thinking skills compared to conventional learning, with an effect size of 1,348 (very strong category). The experimental class N-gain was 0,703 (high category), while the control class was 0,555 (medium category). In the N-gain of materials and indicators, the experimental class showed higher results except for the strategy and tactics indicators. Students in both classes still had difficulty in questions related to advanced clarification and more complex strategies and tactics. In particular, control class students still have additional difficulties, especially with questions that require analytical thinking and argumentation. This study recommends the application of the ADI-STEAM-DMM model on other materials and cognitive domains in future research

Keywords: Critical Thinking Skill- Argument Driven Inquiry- STEAM- Digital Mind Mapping- Sound and Light Waves

Topic: Physics Education

[ABS-129]

Exploring the Role of Computational Thinking in Enhancing Problem-Solving and Creative Thinking: A Bibliometric and Systematic Literature Review

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Abstract

This study explores the role of Computational Thinking (CT) in enhancing problem-solving and creative thinking skills, with a specific focus on physics education. As technology advances and the demand for 21st-century skills increases, these abilities have become crucial in modern education. Through bibliometric analysis and a systematic literature review (SLR), this research aims to identify the impact of CT on cognitive skill development across various disciplines. Based on data from 182 articles published between 2015 and 2025, exclusively retrieved from the Scopus database, the study analyzes research trends, citations, authors, and relevant topics in the fields of CT, problem-solving, and creative thinking. The analysis reveals that CT significantly aids in solving complex problems with a more structured approach and promotes creative thinking in addressing existing challenges. To further explore its role in education, the study narrows down the analysis to 12 articles specifically focused on physics education. These 12 articles highlight how CT is applied in enhancing problem-solving and creative thinking in physics classrooms. The findings provide insights for educators, policymakers, and researchers to integrate CT into educational curricula, particularly in physics, to support the development of cognitive skills relevant to professional fields. The study suggests the importance of collaboration between the education sector and industry to maximize the potential of CT in shaping a generation capable of critical and creative thinking.

Keywords: Bibliometric Analysis- Computational Thinking- Creative Thinking- Problem-solving- Systematic Literature Review-

Topic: Physics Education

[ABS-137]

From Traditional to Intelligent Systems: Reviewing the Role of AI-Integrated IT Models in Advancing Physics Education in Higher Education

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Abstract

The rapid evolution of educational technology, particularly advancements driven by Artificial Intelligence (AI), has significantly reshaped the landscape of tertiary physics education. This Systematic Literature Review aims to critically examine the role and impact of AI-integrated technology-based learning models in enhancing university-level physics instruction. Employing the PICOS framework, the review focuses on empirical studies published between 2019 and 2024 that investigate AI-enhanced learning interventions in comparison to traditional and IT-based learning model non-AI. This review synthesizes findings related to conceptual understanding, critical thinking, and student motivation-three key outcomes in physics education. A comprehensive search was conducted across major academic databases, including Scopus, ScienceDirect, and Google Scholar, followed by a rigorous screening process based on predefined inclusion and exclusion criteria. The analysis reveals emerging trends in the adoption of intelligent systems such as adaptive learning environments, AI-driven simulations, and intelligent tutoring systems, which consistently demonstrate improvements in learning effectiveness and student engagement. However, the review also identifies notable research gaps, including the limited availability of longitudinal studies and the need for deeper integration with pedagogical frameworks. The study concludes with recommendations for future research and practical implications for educators and institutions seeking to leverage AI to advance physics instruction in higher education.

Keywords: Artificial Intelligence, IT-based Learning Model, Physics Education, Higher Education

Topic: Physics Education

[ABS-142]
Analysis of Future Physics Teachers Abilities Using STJ and Pedagogical Content Knowledge Approaches

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Abstract

This study aims to analyze the abilities of future physics teachers using the Situational Judgment Test (SJT) and Pedagogical Content Knowledge (PCK) approaches. The study measures the pre-service teachers' ability to handle various complex teaching situations and their capacity to integrate physics content knowledge with effective teaching strategies. Data were collected through SJT tests and PCK assessments from a group of future physics teachers at a prominent university. The results indicate that this combined approach is effective in identifying the strengths and weaknesses of future physics teachers, providing valuable insights for improving teacher education programs. These findings highlight the importance of developing analytical and pedagogical skills in physics teacher training curricula to enhance the quality of physics education in secondary schools.

Keywords: Prospective Physics Teacher- Situational Judgment Test (SJT)- Pedagogical Content Knowledge (PCK)

Topic: Physics Education

[ABS-153]

The Basic Physics Learning Tools Based on STEAM to Improve Students Literacy and Numeracy Skills

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Abstract

The aims of this study was to develop a basic physics learning tools based on STEAM (Science, Technology, Engineering, Arts, and Mathematics) to improve students literacy and numeracy skills. This research method used the research and development (RnD) ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) and conducted at physics education, Syiah Kuala University (USK), Aceh, Indonesia with 50 students. The learning tools developed is a Semester Learning Plan (RPS) equipped with PowerPoint (PPT) based on STEAM, with the results of media expert validation with a score of 85 (very good), material expert score 80 (very good), and learning expert score 83 (very good). The results of this study showed that the data was normally distributed, homogeneous, and hypothesis were accepted (literacy: t = 2,372 > 0,022) and (numeracy: t = 7,518 > 0,000). Then, a pre-test and post-test were conducted related to instrument literacy (validation test: product moment, 10 valid and reliable: alpha cronbach (0,847- very high degree)). Numeracy (validation test: point biserial 10 valid and reliable: KR20/21 (0,753 > 0,708- high degree)). The increasing literacy score (12.05%) and increasing numeracy score (9.68%) were obtained. Thus, STEAM-based basic physics learning tools can improve students literacy and numeracy skills.

Keywords: Basic physics- Learning tools- Literacy skills- Numeracy skills- STEAM

Topic: Physics Education

[ABS-154]
Active Learning with Multi-Representation Support for Deep Conceptual Understanding of One-Dimensional Kinematics

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Abstract

Many students experience difficulties in understanding kinematics concepts in depth. This study aims to determine whether students taught using active learning (AL) with multiple representations (MR) have a higher level of deep concept understanding than those taught using conventional learning (CL) methods. The study employed a quasi-experimental design with a nonequivalent control group design. The research was conducted on 68 undergraduate physics education students at a university in East Java, Indonesia (34 students in each of the control and experimental groups). Conceptual understanding was measured using 23 multiple-choice questions with justifications. Data analysis involved descriptive analysis, difference tests, n-gain calculations, and d-effect size calculations. The results showed that students^ deep understanding of concepts in AL with MR learning was higher than that of students in CL learning, with high n-gain in the experimental class and moderate n-gain in the control class. Although the d-effect size of both classes was in the high category, AL with MR was more helpful for students in comprehensively understanding concepts. However, future research has the potential to develop learning by emphasizing MR in a dynamic format, not limited to a static format.

Keywords: Active learning, multi representation, deep conceptual understanding, kinematics

Topic: Physics Education

[ABS-155]

Exploring the Development and Effectiveness of Physics Simulation-Based Learning Media within Blended Learning Environments: A Systematic Literature Review

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Abstract

The digital era demands technology-based learning to improve physics education, often seen as abstract and complex. Computer-based physics simulations effectively visualize intricate concepts, enabling interactive exploration and enhancing understanding. This research investigates the development of physics simulation-based learning media within a blended learning approach, identifying simulation types and integrated physics topics. A Systematic Literature Review (SLR) analyzed articles published from 2020 to 2025. From an initial 200 relevant articles, 12 were selected based on inclusion criteria. Findings show that physics simulation-based media effectively enhances students' conceptual understanding, particularly in topics like mechanics and waves. These media promote deeper understanding through interactive, practical methods, increasing student engagement and aiding comprehension of complex physics concepts. Network visualization highlights PhET Simulations, MATLAB, interactive media, and Android applications as key simulation tools. Various physics topics, including optics, quantum physics, and elasticity (Hooke's Law), have been successfully integrated. This integration in blended learning not only facilitates conceptual understanding and higher-order reasoning but also fosters independent learning and critical thinking, establishing it as a transformative strategy for 21st-century physics education.

Keywords: Physics Simulation- Blended Learning- Interactive Learning Media- Systematic Literature Review (SLR)

Topic: Physics Education

[ABS-156]

The Effect of Contextual Teaching Approach on Cognitive Learning Outcomes and Student Responses in the Topic of Light

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Abstract

This study examines the effect of contextual teaching approach (CTA) on cognitive learning outcomes and student responses to light. This study also analyzes the planning, implementation, and evaluation of learning using CTA. The method used was quantitative descriptive, which involved a pre-test and post-test to measure cognitive learning outcomes and a questionnaire to assess students' responses to this approach. The research subjects were 35 junior high school students who studied light using CTA. The instruments used included a pre-test, a post-test, a questionnaire, and evaluation sheets for lesson planning, implementation, and evaluation. The lesson planning analysis showed an average score of 3.75 for the lesson plan and student worksheets, categorized as good. In the learning implementation, aspects such as introduction, core activities, closing, time management, and classroom atmosphere scored an average of 3.70, also rated good. The learning evaluation, including the test and answer key, also scored an average of 3.70, categorized as good. Regarding cognitive learning outcomes, the average student pre-test score was 50%, while the post-test increased to 80%. The average N-gain score reached 0.7, indicating a significant increase in students' understanding of the light material. This study's implications show that CTA effectively improves cognitive learning outcomes and student engagement. This approach can improve the quality of learning in various subjects, especially in science.

Keywords: Contextual Teaching Approach- Cognitive- Learning Outcomes- Student Responses

Topic: Physics Education

[ABS-157]

Needs Analysis of Android-Based Ethnophysics Learning Media on Traditional Dances of North Maluku

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Abstract

Ternate has various traditional dances passed down from generation to generation as a regional identity. One of the efforts to preserve local culture is by integrating traditional dances into Physics learning through the ethnophysics approach. This study aims to identify the need for Android-based ethnophysics learning media to be used in Physics education. The needs analysis focuses on students at SMA N 4 Ternate. The data collection method employed is a quantitative approach with purposive sampling techniques. The sample consists of 66 students and 3 Physics teachers, who provided data through observation, interviews, and the completion of a questionnaire. The results of the needs analysis from the students and Physics teachers regarding the Android-based ethnophysics learning media, which incorporates traditional dances from North Maluku for the Physics subject, indicate that such media is indeed needed by both students and Physics teachers at SMA N 4 Ternate.

Keywords: Ethnophysics- Android- Learning media- Needs analysis

Topic: Physics Education

[ABS-158]

Design and Calibration of a Low-Cost Resonance Frequency Meter Arduino-based for Educational Laboratories

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Abstract

Measuring the resonance frequency of sound plays a crucial role in physics education, particularly in understanding wave and resonance phenomena. However, obtaining accurate and affordable frequency measurement tools remains a challenge in many educational laboratories. This study aims to develop a resonance frequency measurement device based on the Arduino Uno microcontroller and the MAX4466 sound sensor, utilising a sound generator application as the audio source, along with a straightforward calibration process. The hardware setup comprises the sound sensor, an HC-SR04 ultrasonic sensor, the Arduino Uno, and a Bluetooth speaker system. Frequency data detected by the sensor are processed using the Arduino IDE and transmitted in real-time to the PLX-DAQ application for recording and analysis in spreadsheet format. Calibration is performed by comparing sensor readings with reference frequencies (110, 288, 341, 426, 512, and 1024 Hz) generated by the sound application, employing linear regression to enhance measurement accuracy. Testing results reveal that the device achieves a resonance frequency measurement accuracy of approximately 99.82% \pm 0.18% after calibration. These findings confirm that the developed instrument is reliable for automatic, real-time resonance frequency measurements, offering a practical and cost-effective solution for physics laboratories and educational settings.

Keywords: Arduino- Resonance Frequency Measurement- MAX4466 Sensor- Physics Education- Low-Cost Educational Instrument

Topic: Physics Education

[ABS-161]

Identification of Deterministic, Intermediate, and Probabilistic Thinking in Terms of Gender, Cumulative Grade Point Average, and Mathematical Ability

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Abstract

The transition from classical physics to quantum physics is not merely a shift in content, but also involves a transformation in students' conceptual understanding and modes of thinking-from deterministic to probabilistic thinking. One of the causes of misconceptions in quantum physics concepts is that students tend to retain deterministic ways of thinking. This study focuses on identifying the types of thinking adopted by students during quantum physics lectures, specifically regarding the concept of wave-particle duality of light. A total of 221 students enrolled in quantum physics courses participated in this study. Based on the data collected through a multiple-choice test instrument on the concept of wave-particle duality, it was found that most students demonstrated intermediate thinking, while only a small portion continued to rely on deterministic thinking

Keywords: quantum, classical, deterministic, probabilistic, intermediatic

Topic: Physics Education

[ABS-174]

The Effect of STEAM-Integrated PBL-C Model with Formative Assessment on Improving Students' Scientific Literacy Skills on Static Fluid Topics

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Abstract

The application of the PBL-C model integrated with STEAM with Formative Assessment to improve students' scientific literacy skills is still rare. This study investigated the influence of the PBL-C STEAM AF model on the scientific literacy ability on the topic of static fluids. This study uses a Quasi Experiment Non-equivalent Pretest-Posttest Control Group design. The subject of the study was grade XI students of SMA Negeri 1 Singosari, Indonesia which consisted of an experimental class and a control class. A scientific literacy test instrument with a reliability of Cronbach's Alpha of 0.741 was used in this study. The data were analyzed using the Mann-Whitney, N-gain, and Cohen's d-effect size tests. The results showed that the two classes had significantly different improvements in scientific literacy skills. The PBL-C STEAM AF model is able to increase students^ scientific literacy in the experimental class higher than in the control class. The effect of the application of the Experiment-Control pair model resulted in a "Large" category in the improvement of scientific literacy. In addition, each static fluid subtopic in the experimental class experienced an increase in the "High" category. In the experimental class, the subtopic of Archimedes' law gained the highest increase as students of the experimental class made miniature products of ships. In the experimental class, each indicator of scientific literacy ability increased in the "High" category. Indicators of evaluating and designing scientific investigations obtained the highest increase, as students of experimental classes carried out product design and practicum activities.

Keywords: scientific literacy, static fluid, PBL-C, STEAM, formative assessment

Topic: Physics Education

[ABS-180]

Enhancing Vocational High School Students' Higher Order Thinking Skills through E-Module of Bar Force Analysis in Simple Frame Constructions

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Abstract

The advancement of the Industrial Era 5.0 necessitates that vocational education integrate technology into the learning process in ways that align with the demands of the workforce. This requirement implies that vocational students must not only possess practical skills but also demonstrate higher order thinking skills (HOTS), which should be supported by strong literacy competencies. These skills are essential for solving technical problems in a logical and analytical manner. One notable issue arises within the Expertise Competency of Building Modeling and Information Design, where students exhibit low HOTS performance in the subject of Engineering Mechanics. This is particularly evident in topics involving bar forces in simple frame constructions, which require a solid understanding of physics and engineering concepts derived from mathematics and science. This study aims to examine the effectiveness of vocational literacy based e modules in enhancing students HOTS in the aforementioned competency area. A quasi experimental research design was employed, involving two groups an experimental group using the e-module and a control group utilizing presentation-based media. Data were analyzed using ANCOVA to control for students initial ability levels. The results indicate a statistically significant difference between the two groups (Fhitung = 8.463 > Ftabel = 3.99- p = 0.005), with the experimental group achieving higher average HOTS scores. The e module has proven effective in strengthening vocational literacy, as it contextualizes material within civil engineering practices and demonstrates potential for sustainable implementation as an interactive, project based instructional resource.

Keywords: Literacy Vocational, E Module, High Order Thinking Skill

Topic: Physics Education

[ABS-187]

Bridging the Gap in Physics Education: A Study on Higher-Order Thinking Skills Among High School Students

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Abstract

Higher Order Thinking Skills (HOTS) play a crucial role in physics education. However, international assessments such as PISA and TIMSS indicate that Indonesian students still struggle to develop these skills. Interviews with high school teachers in Duri, Riau, reveal that physics instruction in schools primarily focuses on low-level problems, leaving students untrained in solving analytical and evaluative challenges. This study aims to analyze the level of higher-order thinking skills among high school students in the concept of rotational dynamics using questionnaires and cognitive tests. The results show that students^ higher-order thinking skills remain low, particularly in linking concepts and applying understanding in problem-solving contexts. In conclusion, more effective teaching strategies are needed to enhance these skills, such as implementing problem-based learning and inquiry-based approaches to create deeper and more meaningful learning experiences.

Keywords: High order thinking skills (HOTS)- Learning Motivation- Physics Learning

Topic: Physics Education

[ABS-202]

Rancang Bangun Alat Peraga Momentum Sudut Gyroskop Roda

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Abstract

Penelitian ini merancang dan membangun alat peraga gyroskop roda untuk memvisualisasikan konsep momentum sudut pada pembelajaran fisika SMA. Metode Research and Development (R&D) digunakan dengan model 4D (Define, Design, Develop), dibatasi hingga tahap Develop. Pada tahap Define, dilakukan studi literatur, observasi lapangan, dan wawancara guru-siswa untuk mengidentifikasi kebutuhan media konkret. Hasil analisis menunjukkan bahwa konsep momentum sudut sulit dipahami tanpa visualisasi konkret, dan keterbatasan media untuk menunjang minat dalam pemahaman pembelajaran fisika karena belum tersedianya di tingkat sekolah menengah. Tahap Design meliputi pembuatan sketsa prototipe, pemilihan material, dan alur rancangan tiap komponen. Tahap Develop mencakup fabrikasi komponen, perakitan prototipe akhir, dan penyusunan buku panduan pengguna. Alat peraga ini sederhana, interaktif, dan dirancang untuk memperkuat pemahaman konsep momen inersia, kecepatan sudut, dan hukum kekekalan momentum sudut melalui pengalaman langsung. Diharapkan menjadi alternatif media pembelajaran yang aplikatif dan mudah digunakan dalam pembelajaran fisika.

Keywords: alat peraga- momentum sudut- gyroskop roda- fisika- model 4D- R&D

Topic: Physics Education

[ABS-213]
Students' experiences in laboratory activities

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Abstract

During experiment students experienced various aspects. However, many students assume that experiments are limited to determining the value of physical quantities. In order to explore the student experience, here we perform three different experiments to determine the acceleration of gravity i.e. using a simple pendulum, a picket fence and a free-falling object. All experiments are conducted using a computer-based setup. The findings indicate that students gained substantial experience through more complex experiments.

Keywords: acceleration of gravity, pendulum, picket fence, video

Topic: Physics Education

[ABS-224]

Ethnophysics through Marble Games: A Learning Trajectory Design to Reduce Kinematics Misconceptions

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Abstract

Kinematics has consistently been identified as a challenging area in physics education due to its abstract nature and students' reliance on everyday reasoning. Despite formal instruction, misconceptions about motion, velocity, and acceleration persist among primary teacher education students. Previous studies on concept remediation have often neglected cultural relevance, creating a gap in meaningful learning approaches. This study aimed to identify misconceptions among primary teacher education students and design a culturally responsive learning trajectory using the ethnophysics approach through traditional marble games. The research followed a design research methodology in the preliminary phase, involving a literature review, diagnostic assessment using selected items from the Force Concept Inventory, and development of a hypothetical learning trajectory (HLT). Fifty first-semester students from diverse academic backgrounds participated in the diagnostic test. The results revealed widespread misconceptions across six kinematic concepts, with correct responses falling below 30%. These findings informed the design of an HLT that leveraged marble games to contextualize kinematic principles such as distance, displacement, speed, and acceleration. The approach enabled students to relate abstract concepts to tangible experiences, fostering conceptual change. The study concluded that integrating ethnophysics with traditional games presents a promising strategy to reduce misconceptions and enhance physics understanding in culturally meaningful ways.

Keywords: Ethnophysics- Kinematics- Misconceptions- Marble games- Learning trajectory- Physics education

Topic: Physics Education

[ABS-231]

Development of an Interactive Learning Website Using a Deep Learning Approach on Thermodynamics Material

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Abstract

The integration of information technology into education has transformed the way instructional content is delivered, enabling more interactive, contextualized, and meaningful learning experiences. This study aims to design and develop an interactive web-based learning platform incorporating a deep learning approach to support the teaching of thermodynamics. The deep learning framework in this context emphasizes deep conceptual understanding, critical thinking, and the application of knowledge in real-world situations. The research adopts a Research and Development (R&D) methodology using the ADDIE model, which includes five stages: analysis, design, development, implementation, and evaluation. Data collection instruments comprised a student needs analysis questionnaire, interview protocols, and user response questionnaires, all of which were validated by subject matter and media experts prior to deployment. The study was conducted at SMAN 44 Jakarta, involving 193 senior high school students. The results indicate that the developed interactive website effectively enhances science learning quality by integrating deep learning principles. This research contributes to the advancement of technology-enhanced learning media aligned with 21st-century educational demands.

Keywords: interactive learning, website, deep learning, thermodynamics, senior high school

Topic: Physics Education

MATERIAL PHYSICS

[ABS-2]

Analysis of Characteristics Comparison between New Brake Lining and 100-hour Flight Cessna 208B

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Abstract

Brake lining is part of the brake system that creates the friction needed in the braking process. The purpose of this study was to compare the characteristics of the new brake lining with the brake lining with 100 flight hours. The method used was experimental with chemical composition, hardness, and wear testing. The test results showed that the results of the chemical composition test of the new brake lining material, Cleveland brand type 66-033 metallic, consisted of 77.489% Cu- 15.81% Fe- 6.047% Si- 0.305% Mn- 0.34% Ni. Meanwhile, after being used for 100 flight hours, it changed to 95.9% Fe, 0.33% C, 0.8% Cu, 0.235% Si, 0.468% Mn, 0.235% Al, 0.151% Mo, and 0.774% Cr. The brake lining used for 100 flight hours has been contaminated with Al, Si, Mo, Cr, and C. The hardness of the brake lining after 100 flight hours is 207 HB compared to the hardness of the new brake lining 79.65 HB. This increase in hardness is caused by overheating, contamination of lubricant elements, and rapid cooling process after braking. The difference in average wear between the brake lining used for 100 flight hours and the new brake lining is small, namely 0.000038 mm3/kg.m. Routine maintenance plays an important role in maintaining the performance of the brake lining and the brake system so that they function efficiently and prevent excessive wear.

Keywords: brake lining- brake system- chemical composition- hardness- wear

Topic: Material Physics

[ABS-8]

Energy Gap Analysis of Ba0.25Sr0.75TiO3 Thin Film on Glass Indium Tin Oxide (ITO) Substrate

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Abstract

Ba0.25Sr0.75TiO3 thin film on Indium Tin Oxide (ITO) glass substrate has been successfully made by Chemical Solution Deposition (CSD) method with 0.5 M solubility assisted by 3000 rpm spin coating, and annealing at 550 &#8451- with temperature speed of 100 &#8451-/hour held for 8 hours and decreased temperature. Indium Tin Oxide (ITO) glass substrate with glass thickness of 1.1mm and resistivity of ~20 ohms/sq. This thin film was tested for optical properties using UV-Vis Spectrophotometer with a range of 230-850 nm and resulted in an energy gap of 2.29 eV. Energy gap analysis of Ba0.25Sr0.75TiO3 thin film on glass Indium Tin Oxide (ITO) substrate is very important because this film is the forerunner of light sensor.

Keywords: Ba0.25Sr0.75TiO3, Energy Gap, light sensor,

Topic: Material Physics

[ABS-9]

A Point-symmetrical Position for Vibration Measurement of Analytical Sieve *Shakers*

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Abstract

A sieve shaker or a sieving apparatus translates the mechanical action of separating coarser, solid particles into finer grains in sectors such as pharmaceuticals and materials engineering. Segregating particles according to their desired sizes enables a more comprehensive and precise analysis. The process of sifting is conducted by utilizing specific mesh types and sizes. The movement of the filtering process is determined by the vibrations generated by the sieve shaker. The sieve shaker requires calibration to ensure the measurement accuracy of the sieving process. Accurate measurements provide the fundamental basis for ensuring the quality and safety of the product. The ISO 16063 part 21 is a standard for secondary vibration calibration. However, the back-to-back method mentioned in the standard is challenging to apply directly to calibrate the sieve shaker due to the unique shape of its body component. Therefore, in this study, we adopt a point-symmetrical position applied in primary vibration calibration in order to perform vibration measurements produced by the sieve shaker. The standard accelerometer B&K 8035 is used as a reference transducer to measure the amplitude of the sieve shaker. The measurement was conducted for the displacement range of 0.2 up to 3.00 mm p-p with the highest measurement uncertainty of 2%.

Keywords: vibration, calibration, accelerometer, sieve shakers

Topic: Instrumentation and Computational Physics

[ABS-13]

Physicochemical Characterization of CaO Derived from Pearl Oyster Shells (Pinctada maxima) via Thermal Processing for Potential Biomedical Applications

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Abstract

The thermal transformation of calcium carbonate (CaCO3) into calcium oxide (CaO) from marine biogenic materials such as Pinctada maxima shells presents strong potential for biomedical material development. This study investigates the physicochemical properties of shell powder calcined at temperatures ranging from 700C to 1100C for 6 hours. Characterization was conducted using organoleptic tests, EDX, FTIR, SEM, and XRD. Organoleptic evaluation confirmed the powder to be odorless, white, and fine in texture. EDX analysis showed a marked increase in CaO content, peaking at 99.68% at 1100C, indicating successful thermal decomposition of CaCO3. FTIR results showed the disappearance of carbonate (CO32-) and C-H bands and the emergence of O-H and Ca-O bands, confirming the formation of CaO. XRD analysis revealed a phase transition from aragonite and calcite (orthorhombic) to CaO (cubic), along with a decrease in crystallinity from 56.95% to 48.32%. SEM analysis indicated irregular particle morphology with the largest average size (2638.77 nm) at 1100C. These transformations in structure and composition demonstrate the relevance of biophysical material, particularly its potential in bone regeneration applications. This study provides fundamental insights into the conversion of marine shell waste into bioactive material for future biomedical use.

Keywords: Biomaterials, Calcination, Calcium Oxide, Pinctada maxima, Physicochemical Properties,

Topic: Material Physics

[ABS-15]

UTILIZATION OF TiO2-DOPED ACTIVATED CARBON FROM TEAK WOOD SAWDUST FOR PURIFICATION OF USED COOKING OIL

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Abstract

The intensive application of cooking oil poses environmental issues and health concerns. Research has been conducted to reduce of free fatty acids, water content, density, pH, viscosity, and refractive index of used cooking oil using TiO2-doped activated carbon produced from teak wood sawdust. Carbon was activated using a 10% ZnCl&#8322- solution before water and ash content measurements. Doping was carried out via solid-state synthesis with TiO&#8322-:activated carbon mass ratios of 9:100, 14:100, 18:100, and 22:100. The doped activated carbon underwent XRD characterization. Used oil was tested for water content, free fatty acids, pH, density, refractive index, viscosity, and clarity using UV-vis spectroscopy and FTIR. Activated carbon showed 3.60% water and 0.69% ash content. XRD results indicated a reduction in crystal size from 38.89 nm to 26.8 nm after TiO&#8322- doping. In treated oil, water content decreased from 0.38% to 0.15%, viscosity from 38 cP to 32 cP, refractive index from 1.69 to 1.5, density from 0.6613 to 0.588, and free fatty acids from 1.39% to 0.15%. UV-vis absorbance dropped from 3.06 to 2.88. The 14:100 mass ratio showed the best performance, indicating that TiO&#8322--doped activated carbon is an effective adsorbent to restore the quality of used cooking oil.

Keywords: Used cooking oil, activated carbon, TiO2, Purification, adsorbent

Topic: Material Physics

[ABS-16]

Bioplastic Reinforced by Microcrystalline Cellulose via Sonication-Assisted Solvent Blending: Mechanical and Morphological Properties

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Abstract

The properties of polylactic acid (PLA) are encouraging as a bioplastic that could substitute conventional petroleum-based plastics. The objective of this research is to enhance the mechanical properties of PLA for a broader range of applications by incorporating Microcrystalline Cellulose (MCC) as a filler. Solvent blending is employed in conjunction with sonication to incorporate MCC into the PLA matrix. The MCC composition varies in 0 and 10wt%, and the sonication time was varied by 0, 5, 10, and 15 min. The results of mechanical testing on composite PLA sheets, which included the tensile test (ASTM D638) and puncture test (ASTM 2582), indicated that the presence of MCC can enhance tensile strength and puncture resistance. The efficacy of the sonication was demonstrated for five minutes. This is due to the effective dispersion of MCC in PLA, which leads to an increase in the tensile strength and puncture resistance of PLA. The morphological image shows that the MCC dispersion after five minutes of sonication is more homogeneous than at other durations.

Keywords: bioplastic, polylactic acid, microcrystalline cellulose

Topic: Material Physics

[ABS-17]

Influence of Electroless Coating on Bottom Ash Reinforcement in Aluminum Matrix Composites: A Study of Microstructure and Mechanical Properties

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Abstract

Aluminum Matrix Composites (AMC) are widely applied in aerospace, transportation, and mining industries. Bottom Ash (BA), a coal industry by product, can serve as a reinforcement material in AMC. However, poor wettability during fabrication can weaken interfacial bonding and reduce mechanical performance. This issue can be mitigated by applying surface coatings to the reinforcement particles with the Electroless Coating (EC) method. This research investigates the utilization of Bottom Ash (BA) as reinforcement in Aluminum Matrix Composites (AMC) based on the Al-6061 alloy, with and without EC treatment. The process of making AMC was carried out using the stir casting method with variations of BA addition of 2%wt and 4%wt. Material characterization includes hardness testing, tensile strength testing, and metallographic observation. The results show that EC increases wettability, reduces porosity, and strengthens the interfacial bond. AMC with 2%wt bottom ash with electroless coating achieved a tensile strength of 122.6 MPa and a hardness of 45.7 BHN, significantly increased compared to without addition. At 4%wt bottom ash with electroless coating, the highest tensile strength of 128.2 MPa and hardness of 48.5 BHN were achieved, although without EC, the 4%wt fraction reduced strength due to agglomeration and the brittle intermetallic phase Al5FeSi. The EC treatment on bottom ash particles enhances their wettability and bonding with the Al-6061 matrix, leading to reduced porosity and minimized particle agglomeration.

Keywords: Aluminum Matrix Composites- Bottom Ash- Electroless Coating- Wettability- Intermetallic Phase

Topic: Material Physics

[ABS-19]

Experimental Study on the Influence of Variation in Thickness and Solution Temperature on the T6 Heat Treatment Process on the Dimensional Stability of Al-6061

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Abstract

Aluminum spare parts are widely used in various fields of manufacturing and industry such as automotive, medical, and aerospace. The final production stage involves heat treatment, controlled heating or cooling in the solid state to modify the materials microstructure and mechanical properties. However, heat treatment can generate residual stresses that lead to shape deformation and dimensional instability. If dimensional instability occurs, the finished manufactured material will be rejected. The manufacturing method regarding the dimensional stability of AA-6061. Specimen formation with thickness variations of 2, 4, and 6 mm, followed by T6 heat treatment with solution treatment temperature variations of 540 C, 550 C, and 560 C. Dimensional stability testing using the CMM (Coordinate Measuring Machine) method. From the above explanation, it is known that research on the effect of T6 heat treatment with variations in specimen thickness and solvent temperature on the dimensional stability of AA-6061 has not been widely conducted. This study aims to obtain the right parameters to produce optimal mechanical properties without experiencing damage to the material. At thickness variations of 2 mm, 4 mm, and 6 mm, In the thickness variations of 2 mm, 4 mm, and 6 mm, the thicker the specimen, the larger the area value. Specimens with a thickness of 6mm at a temperature of 560 C have a larger area value compared to specimens with a thickness of 2 mm and 4 mm. Therefore, the 6 mm thick specimen at 560 C has the highest dimensional instability. At a dissolution temperature of 560 C with a thickness of 6 mm, the dimensional instability is higher compared to specimens with dissolution temperatures of 540 C and 550 C. Uncontrolled parameters, especially variations in heating and cooling rates, generate residual stresses that cause dimensional instability.

Keywords: Al-6061- CMM (Coordinate Measuring Machine)- Dimensional Stability- Heat Treatment T6

Topic: Material Physics

[ABS-23]

Preparation of micro-sized cellulose from rice husk using ball mill and acid hydrolysis method

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Abstract

Cellulose is an environmentally friendly natural polymer material that is most abundant in nature. Cellulose material processing is increasingly being carried out in various applications because of its attractive properties. Using cellulose in very small sizes (micro/nano) can potentially increase its performance, especially in developing micro/nano cellulose-based biocomposites. This study focuses on the preparation of micro-sized cellulose from rice husk by using ball-mill and acid hydrolysis methods. Ball mill strongly grinds the cellulose mechanically at very high rpm. Acid hydrolysis mainly removes the amorphous part of the cellulose. Examination using Scanning Electron Microscope (SEM) SU3500 shows that the obtained products have microcrystalline structure (microcrystalline cellulose/ MCC). Micro-sized cellulose obtained using Ball mill looks rougher, more uniform, and smaller in size compared to that obtained using acid hydrolysis. This may indicate that ball mill produces micro-sized cellulose-containing impurities. These impurities can come from bleaching agents and cellulose residues.

Keywords: cellulose- acid hydrolysis- ball mill- micro-sized cellulose- rice husk

Topic: Material Physics

[ABS-26]

EFFECT OF HYDROTHERMAL REACTION TIME ON THE EFFECTIVENESS OF ZINC OXIDE PHOTOCATALYST IN DEGRADING METHYL ORANGE

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Abstract

Textile waste pollution containing synthetic dyes such as methyl orange (MO) is a serious problem because it is difficult to degrade naturally, so it requires an effective waste treatment method. This study aims to analyze the effect of reaction time on the size of zinc oxide (ZnO) nanoparticles and their efficiency in the photocatalysis process of textile waste. Samples were synthesized using hydrothermal method with time variations of 4, 8, and 12 hours. Characterization was conducted using XRD to determine the crystal structure, lattice parameters, and crystallite size- FTIR to identify functional groups- SEM to observe surface morphology and diameter distribution- and UV-Vis spectrophotometer to evaluate the degradation efficiency. XRD results showed a hexagonal wurtzite crystal structure with the largest crystallite size of 51.30 nm at 8 hours and the smallest of 43.99 nm at 4 hours. FTIR spectra indicated the formation of Zn-O groups at wave numbers 700-450 cm^-1, with the highest absorbance at 12 hours (532.36 cm^-1). SEM showed elongated rod morphology with more uniform size distribution at 12 h (standard deviation 44.92). The highest MO degradation efficiency was achieved in the 12 h sample at 90.78%.

Keywords: Hydrothermal- Methyl Orange- Zinc Oxide

Topic: Material Physics

[ABS-29]

Impact of Adhesive Composition on the Quality of Charcoal Briquettes from Corn Cob Biomass Waste as Renewable Energy

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Abstract

The global energy crisis urges the environmentally friendly development of sustainable alternative energy. In recent decades, research has focused on using biomass waste as a renewable energy source. Corn cobs are abundant biomass waste and can be modified into charcoal briquettes. This study aimed to analyze the effect of tapioca flour adhesive composition on the density, compressive strength, elastic modulus, and energy value of charcoal briquettes. Manufacturing charcoal briquettes from corn cob waste use the carbonization method at 300C. The briquette-making process begins with manufacturing corn cob powder, charring, mixing, molding, and analysis of briquette characteristics. Briquettes were analyzed by measuring density, compressive test, elastic modulus, and calorific value analysis. Density measurement using analytical scales and calipers, compressive test and elastic modulus analysis with tensilon, and heat analysis with a bomb calorimeter. The analysis results stated that the amount of adhesive composition is directly proportional to the density, compressive strength, and elastic modulus of charcoal briquettes (the coefficient of determination R2 value is close to one). At the same time, it is inversely proportional to its calorific value. The highest density, compressive strength, and elastic modulus are in the 45% adhesive composition, namely 0.818 g/cm3, 3.6188 MPa, and 95.281 MPa, while the highest calorific value of the briquettes is in the 5% adhesive composition, namely 6.693 kcal/g. Therefore, the adhesive composition affects the quality of charcoal briquettes in terms of density, compressive strength, elastic modulus, and calorific value. However, the balance of the briquette composition must be considered to obtain ideal briquettes with optimal performance in practical applications.

Keywords: density, compressive strength, elastic modulus, calorific value, biomass energy

Topic: Material Physics

[ABS-30]

Impact of Ultrasonication Time on the Electrical Properties of Polyvinyl Alcohol/Zinc Oxide/MXene/Cellulose Nanocrystal Composites for Electronic Applications

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Abstract

This study investigates the impact of ultrasonication time on the electrical properties of Polyvinyl Alcohol, Zinc Oxyde, MXene, and Cellulose Nanocrystral (CNC) composites for use in electronic devices. The goal was enhance the electrochemical performance of biodegradable materials for sustainanble electronics. Composites were prepared by incorporating MXene and CNC into PVA ZnO matrix, with varying ultrasonication durations. Electrical properties, including current density and specific capacitance, were evaluated using cyclic voltammetry, while structural analysis was performed via Xray diffraction and scanning electron microscopy. The results showed a significant increase in both current density and specific capacitance as ultrasonication time increased, with value reaching 0.2727 A/cm for current density and 0.646 F/g for specific capacitance after 60 minutes of ultrasonication. These improvements were attributed to better nanoparticle dispersion and enhanced charge transport pathways. The findings demonstrate that ultrasonication is an effective method for optimizing the performance of biodegradable composites in energy storage application.

Keywords: Cellulose Nanocrystal, Electrical Properties, Energy Storage, MXene, Polyvinyl Alcohol, Ultrasonication, Zinc Oxide

Topic: Material Physics

[ABS-39]
Plasma Electrolytic Oxidation of Pure Zirconium in Chromium Containing Electrolyte

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Abstract

Plasma Electrolytic Oxidation (PEO) -is an effective surface modification technique for producing oxide coatings on metal substrates. Various types of particle additives are commonly added to the electrolyte to enhance the properties of the resulting coatings. In this study, chromium (Cr) was incorporated into the PEO coating on pure zirconium (Zr) by introducing a dissolved Cr-containing additive into the electrolyte. The PEO treatment was conducted in an electrolyte composed of 30 g/L NaAlO2, 30 g/L KOH, 10 g/L ethanol, and 10 g/L K2CrO4, at a current density of 50 mA/cm2 for durations of 3, 5, and 10 min. The electrolyte temperature was maintained at 10C. The surface morphology and elemental composition of the coatings were analyzed using scanning electron microscopy (SEM). The phase composition was determined through X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS). Electrochemical performance was evaluated using potentiodynamic polarization (PDP) and electrochemical impedance spectroscopy (EIS). The coating thicknesses for the samples treated for 3, 5, and 10 min were 3.10, 5.91, and 6.55 micrometer, respectively. XRD analysis revealed that the dominant phase was tetragonal ZrO2. Energy-dispersive X-ray spectroscopy (EDS) confirmed the presence of Cr in the oxide layer, with Cr content increasing with treatment duration, reaching 2.73 atomic percent after 10 min. The presence of Cr was further verified by XPS, which indicated that Cr was likely present in the form of its oxides. Interestingly, the PDP results showed that the coating formed after 5 minutes of treatment exhibited the best corrosion resistance, with a corrosion current density of 2.437 x 10-10 A/cm2. Further detailed results and discussions are presented in the full paper.

Keywords: Plasma Electrolytic Oxidation, zirconium, corrosion resistance

Topic: Material Physics

[ABS-51]
Analysis of Capacitance Resistance Membran Polymethylmetacrylate-Mesogen Reactive Diacrylate

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Abstract

Membrane composite polymer liquid crystal of Polymethyl Methacrylate with Mesogen Reactive Diacrylate (PMMA-RMDiacrylate) has been successfully synthesized. This research report of the synthesized and characterizations of PMMA-RMDiacrylate and analysis of capacitance and resistance. The puspose this research is study of capacitance and resistance of membrane composite polymer PMMA-RMDiacrylate for membrane electrolyte in fuel cell system. Synthesized membrane composite polymer of PMMA-RMDiacrylate using methods of UV exposure to polymer solutions and addition of a Benzoyl Peroxide (BPO) initiator. Membrane composites polymer PMMA-RMDiacrylate were made with RM257 weight percent variations of 20%, 30%, and 40%. Membrane composite polymer PMMA-RMDiacrylate was characterized by FTIR that absorption peaks appear at wave numbers 2927 cm-1 indicating the-CH3 functional group, 1722 cm-1 indicating the C=O functional group, 1602 cm-1 indicating the presence of aromatic groups, 1248 cm-1 indicating the C-O-C group, 1060-1144 cm-1 indicating the C-O functional group. Texture and morphology analysis of membrane composite polymer of PMMA-RMDiacrylate showed effect of variations concentrations of RMDiacrylate. Analysis crystallinity by XRD results showed that the composite membrane polymer PMMA-RMDiacrylate is semicrystalline and sharp peaks appear as an indicator of phase crystallinity in the PMMA-RMDiacrylate membrane. Electrical properties of composite membrane of PMMA-RMDiacrylate using an LCR meter shows an increase in capacitance, resistance in sensors with 30% and 40% RMDiacrylate variations showed a decrease. It can be seen that the increasing concentration of RMDiacrylate in membrane composite polymer of PMMA-RMDiacrylate has good electrical properties.

Keywords: methyl methacrylate- reactive mesogen RMDiacrylate- membrane composite polymer- capacitance- resistance

Topic: Material Physics

[ABS-54]

Analisis Energi Gap Film Tipis Ba0,875Sr0,125TiO3 di atas Substrat Kaca Indium Tin Oxide (ITO) dan Substrat Si (100) Tipe P

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Abstract

Abstrak. Lapisan tipis Ba0,875Sr 0,125TiO3 di atas substrat kaca Indium Tin Oxide (ITO) dan Substrat Si (100) Tipe P telah berhasil dibuat dengan metode Chemical Solution Deposition (CSD) dengan kelarutan 0,5 M yang dibantu dengan spin coating 3000 rpm, dan annealing pada temperatur 550&#8451- dengan kelajuan suhu 100 &#8451-/jam yang ditahan selama 16 jam dan suhu pendinginan hingga suhu kamar. Substrat kaca Indium Tin Oxide (ITO) dengan ketebalan kaca 1,1 mm, resistivitas ~20 ohm/sq dan resistivitas Si Tipe P ~10 ohm/sq. Lapisan tipis ini diuji sifat optiknya menggunakan Spektrofotometer UV-Vis dengan rentang 230-850 nm dan menghasilkan celah energi sebesar 2,06 eV di atas substrat ITO dan celah energi sebesar 2,4 eV di atas substrat Si (100) Tipe P. Analisis celah energi film tipis Ba0,875Sr 0,125TiO3 di atas substrat kaca Indium Tin Oxide (ITO) dan di atas substrat Si (100) tipe P sangat penting dilakukan karena film ini merupakan cikal bakal sensor suhu .

Keywords: Analisis energi gap- Film tipis- Ba0,875Sr0,125TiO3- Substrat ITO- Substrat Si (100)

Topic: Material Physics

[ABS-55]

Analisis Celah Energi pada Film Tipis Ba0,375Sr0,625TiO3 di atas Substrat Kaca Indium Tin Oxide (ITO) dan Substrat Si (100) Tipe P

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Abstract

Film tipis Ba0,375Sr0,625TiO3 berhasil difabrikasi pada substrat kaca Indium Tin Oxide (ITO) menggunakan metode Chemical Solution Deposition (CSD) dengan larutan prekursor berkonsentrasi 0,5 M. Proses pelapisan dilakukan melalui teknik spin coating pada kecepatan 3000 rpm, diikuti dengan proses annealing pada suhu 550 C dengan laju pemanasan 100 C per jam selama 16 jam, kemudian didinginkan secara bertahap hingga suhu kamar. Substrat kaca ITO yang digunakan memiliki ketebalan 1,1 mm dan resistivitas sekitar 20 ohm per kuadrat, sedangkan substrat silikon tipe P memiliki resistivitas sekitar 10 ohm per kuadrat. Sifat optik film tipis dikarakterisasi menggunakan spektrofotometer UV-Vis pada rentang panjang gelombang 230 hingga 850 nm. Hasil pengukuran menunjukkan nilai celah pita energi sebesar 1,57 eV pada substrat ITO dan 2,51 eV pada substrat silikon tipe P. Analisis celah pita dari film tipis Ba0,375Sr0,625TiO3 pada kedua jenis substrat ini penting dilakukan karena material tersebut berpotensi sebagai kandidat utama untuk aplikasi sensor tekanan di masa mendatang.

Keywords: Analisis energi gap- Film tipis- Ba0,375Sr0,625TiO3- Substrat ITO- Substrat Si (100)

Topic: Material Physics

[ABS-56]

Analisis Celah Energi Lapisan Tipis Ba0,75Sr0,25TiO3 pada Substrat Kaca Indium Tin Oxide (ITO) dan Substrat Si (100) Tipe-P

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Abstract

Lapisan tipis Ba0,75Sr0,25TiO3 pada substrat kaca Indium Tin Oxide (ITO) dan Substrat Si (100) Tipe-P telah berhasil dibuat dengan metode Chemical Solution Deposition (CSD) dengan kelarutan 0,5 M yang dibantu dengan spin coating 3000 rpm, dan annealing pada suhu 550&#8451- dengan kelajuan suhu 100 &#8451-/jam yang ditahan selama 16 jam dan suhu pendinginan hingga suhu kamar. Substrat kaca Indium Tin Oxide (ITO) dengan ketebalan kaca 1,1 mm dan resistivitas ~20 ohm/sq serta resistivitas Si tipe-P ~10 ohm/sq. Lapisan tipis ini diuji sifat optiknya menggunakan Spektrofotometer UV-Vis dengan rentang 230 - 850 nm menghasilkan celah energi sebesar 2,84 eV di atas substrat Indium Tin Oxide (ITO) dan menghasilkan celah energi sebesar 2,24 eV di atas substrat Si (100) Tipe-P. Analisis celah energi pada lapisan tipis Ba0,75Sr0,25TiO3 pada substrat kaca Indium Tin Oxide (ITO) dan di atas substrat Si (100) Tipe-P sangat penting karena lapisan ini merupakan cikal bakal sensor tekanan.

Keywords: Analisis Energy Gap- Film Tipis- Ba0,75Sr0,25TiO3- Substrat ITO- Substrat Si (100) Tipe-P

Topic: Material Physics

[ABS-57]

Analisis Energi Gap Film Tipis Ba0,625Sr0,375TiO3 di atas Substrat Kaca Indium Tin Oxide (ITO) dan Substrat Si (100) Tipe P

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Abstract

Abstrak. Lapisan tipis Ba0,625Sr0,375TiO3 di atas substrat kaca Indium Tin Oxide (ITO) dan Substrat Si (100) Tipe P telah berhasil dibuat dengan metode Chemical Solution Deposition (CSD) dengan kelarutan 0,5 M yang dibantu dengan spin coating 3000 rpm, dan annealing pada temperatur 550&#8451- dengan kelajuan suhu 100 &#8451-/jam yang ditahan selama 16 jam dan suhu pendinginan hingga suhu kamar. Substrat kaca Indium Tin Oxide (ITO) dengan ketebalan kaca 1,1 mm dan resistivitas ~20 ohm/sq dan resistivitas Si tipe P ~10 ohm/sq. Lapisan tipis ini diuji sifat optiknya menggunakan Spektrofotometer UV-Vis dengan rentang 230-850 nm dan menghasilkan celah energi sebesar 2,89 eV di atas substrat ITO dan celah energi sebesar 2,42 eV di atas substrat Si (100) tipe P. Analisis celah energi film tipis Ba0,625Sr0,375TiO3 di atas substrat kaca Indium Tin Oxide (ITO) dan di atas substrat Si (100) tipe P sangat penting dilakukan karena film ini merupakan cikal bakal sensor suhu.

Keywords:

Topic: Material Physics

[ABS-63]

Characteristics of Briquettes Made from Nipah Palm Fronds (Nypa fruticans) and Galam Bark (Melaleuca leucadendron)

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Abstract

The utilization of nipah frond waste (Nypa fruticans) and galam bark (Melaleuca leucadendron) as materials for making briquettes has been carried out. Nipah fronds and galam bark were obtained from Bunipah Village, Banjar Regency, South Kalimantan. This study used an experimental method with a percentage variation of nipah frond and galam bark composition of 100:0, 75:25, 50:50, 25:75 and 0:100. The adhesive used was 20% resin, with a pressure of 200 kg/cm2 and was dipped in used cooking oil for 30 seconds. This study aims to determine the characteristics and quality of briquette combustion. The results showed that the characteristics of briquettes produced water content of 4.31-8.03%- ash content of 3.69-10.00%- bound carbon of 39.55-42.29%- calorific value of 6,854.71-7,689.51 cal/g, density of 0.78-0.83 g/cm3. While the quality of briquette combustion produced initial ignition time of 2.19-2.56 minutes- combustion duration of 91.47-129.24 minutes and combustion speed of 0.19-0.15 g/minute. Based on the test results, briquettes with a composition of 75:25 (75% galam bark: 25% nipah fronds) have the best characteristics and combustion quality compared to briquettes with other compositions.

Keywords: Briquettes, Nipah Palm Stems, Galam Bark, Resin, Waste Cooking Oil

Topic: Material Physics

[ABS-64]

Effect of Calcination Temperature and Holding Time on Crystal Structure and Size of Tetragonal ZrO2

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Abstract

This study investigates the synthesis of tetragonal zirconia (t-ZrO2) from natural zircon sand via alkali fusion, focusing on the effects of calcination temperature (800 C, 900 C, and 1000 C) and holding time (3, 5, 7, and 12 hours) on crystal structure and crystallite size. X-ray diffraction (XRD) analysis reveals that at 800 C, the lattice parameter a and unit cell volume initially decrease with increasing holding time, then increase, indicating a shift from stress relaxation and defect elimination to crystal growth and phase stabilization. In contrast, at 1000 C, both lattice parameter a and unit cell volume consistently decrease with longer holding times, reflecting enhanced atomic diffusion, reduction of oxygen vacancies, and stabilization of the tetragonal phase. Menawhile, crystallite size steadily increases with temperature and holding time, ranging from approximately 7 to 17 nm. These results indicate that holding time and temperature play crucial roles in the formation of t-ZrO2. Moreover, the crystallite size of t-ZrO2 increases nearly fourfold when the holding time is extended from 3 to 12 hours at 1000 C. The observed trends reflect the complex interaction between kinetic effects and thermodynamic stability in shaping the crystal structure and size evolution during alkali fusion synthesis.

Keywords: tetragonal zirconia,calcination temperature, holding time, phase transformation, crystal structure, crystallite size.

Topic: Material Physics

[ABS-69]
Structural Characterization of Tetragonal ZrO2 Derived from Zircon Sand: Crystal and Local Atomic Insights

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Abstract

Crystallographic analysis of ZrO2 powder derived from zircon sand was performed using ex-situ conventional X-ray powder diffraction (XRD) and synchrotron extended X-ray absorption fine structure (EXAFS) techniques. The ZrO2 powder was purified through alkali fusion and co-precipitation methods, utilizing zircon sand as the primary raw material. Phase analysis of the XRD data demonstrated that the as-synthesized powder, after calcination at 1000 C for 3 hours, yielded a pure tetragonal ZrO2 (t-ZrO2). Further structural analysis was conducted using the Rietveld refinement method, which provided the following lattice parameters: a = b = 3.5962(1) A, c = 5.1953(3) A, and unit cell volume V = 67.186(6) A3. The Zr-O shell in tetragonal ZrO2 was observed to consist of two distinct tetrahedra, designated as Zr-OI and Zr-OII. The EXAFS analysis of the local atomic structure around the Zr atoms revealed that the bond lengths for Zr-OI and Zr-OII were 2.112(7) A and 2.377(4) A, respectively. These findings provide valuable insight into the atomic-level structure of tetragonal ZrO2 derived from zircon sand.

Keywords: t-ZrO2, zircon sand, crystal structure, local structure

Topic: Material Physics

[ABS-100]

THE EFFECT OF PURIFICATION PROCESS ON COLOIDAL GOLD AND SILVER CAPPED BY ORGANIC MATERIALS AND ITS APPLICATION AS PLASMONIC BIOSENSOR

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Abstract

Nanotechnology is undergoing rapid development, where the use and modification of metal nanoparticles such as gold (AuNP) and silver (AgNP) are quite competitive in terms of their applications. These nanoparticles have unique optical property called the localized surface plasmon resonance (LSPR), which enables them to absorb and scatter light at specific wavelengths depending on their size, shape, and surrounding environment. This characteristic makes them ideal candidates as probes in biosensor applications due to their high sensitivity to minute environmental changes. Several previous studies have demonstrated the potential of metallic nanoparticles in biosensor. For example, Khan et.al. developed gold-nanoparticles-based biosensors for COVID-19 diagnosis, which utilize the LSPR properties of AuNPs to enable rapid, sensitive, and label-free detection of SARS-CoV-2 antigens, while Saha et.al also successfully to utilize nucleic acids capped on silver nanoparticles with antibacterial properties and use as probe for protein detection.

In usual, metal nanoparticles need capping agent to prevent aggregation and provide functional groups for further bio-conjugation. The synthesis of metal nanoparticle by chemical reduction method use organic materials such as citrate and 3-MPA which revealed high homogeneity, and ability in bio-material functionalization. This study aims to develop stable colorimetric biosensor probe based on gold and silver nanoparticle capped by citrate or 3-MPA. In our experiment, we synthesized and purified gold and silver nanoparticles by used of modified chemical reduction method and followed by high speed centrifugation process for purification in order to remove excess metal ions and unreacted precursors. The nanoparticles were characterized using UV-Vis spectroscopy, FTIR spectroscopy, and Transmission Electron Microscopy (TEM).

The optical properties from absorbance spectra of AuNP and AgNP show that AuNPs has a plasmonic peaks at 522 nm (Au-CA) and 526 nm (Au-MPA) together with indication of red-wine color, while AgNPs displayed brownish-yellow with plasmonic peaks at 426 nm (Ag-CA) and 430 nm (Ag-MPA). TEM images of colloidal both nanoparticles reveal spherical shape with diameter size around 31.3 nm for AuNPs and 38.7 nm for AgNPs. FTIR spectroscopies show different chemical interactions between the nanoparticles and the capping agents. The optimum purification conditions which indicate the stability and homogeneity of nanoparticles were 8000 rpm in 20 min for Au-CA, 8000 rpm in15 min for Au-MPA, 4000 rpm in15 min for both Ag-CA and Ag-MPA. TEM imaging confirmed homogeneous and stable distribution of nanoparticles after purification. Colorimetric assays were conducted on gold (Au) and silver (Ag) nanoparticles. For gold-based nanoparticles (AuCA and AuMPA), the addition of the avidin-biotin complex induced significant color changes, accompanied by a red-shift in the absorbance spectrum, indicating nanoparticle aggregation due to cross-linking interactions. In contrast, silver-based nanoparticles (AgCA and AgMPA) did not exhibit visible color changes upon complex addition- however, their absorbance spectra displayed peak shifts, suggesting the onset of subtle interparticle interactions without extensive aggregation. The outcomes of this colorimetric assay support the further development and utilization of gold and silver nanoparticles for biosensor applications.

Keywords: Gold Nanoparticle, Silver Nanoparticle, Citrate, 3-MPA, Localized Surface Plasmon Resonance, Purification.

Topic: Material Physics

[ABS-111]

Synthesis Strategy of Cs2SnI6 Perovskite by Modified Hot Injection Method and Its Potential Application for Optoelectronic Device

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Abstract

In recent years, the easy and environmentally friendly synthesis of lead-free perovkite materials has become a competitive topic for researchers especially related to the application in solar energy harvesting technology. Lead-free perovskite using tetravalent tin (Sn4+, Cs2SnI6) has attracted much attention compared to divalent tin (Sn2+, CsSnI3) because it is more stable and can be synthesized without using a glove box. The synthesis of this type of perovskite is often carried out using solution-based techniques because it allows for control of the size and shape of the perovskite. Previously, this type of perovskite was widely synthesized using a simple chemical solution method by reacting CsI and SnI4 at room temperature. However, this technique cannot control the size and shape of the perovskite. In the hot injection method, the size and shape of the resulting nanocrystals can be controlled by varying the reaction time between Cs-Oleate and the SnI4 complex at high temperatures.
The synthesis of Cs2SnI6 perovskite using the hot injection method is usually carried out in a low-pressure environment with an inert gas flowing. In this study, we synthesized Cs2SnI6 perovskite using the hot injection method with only N2 gas flowing. As a result, we obtain a dark brown paste precipitate that is green when irradiated with a 408 nm laser. Then we purified this precipitate using toluene and hexane (1:1). Furthermore, we performed characterization of Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), Ultraviolet-Visible Spectroscopy (UV-Vis), Photoluminescence Spectroscopy (PL), Fourier Transform Infrared (FTIR), and Raman spectroscopy.
The SEM results show that the Cs2SnI6 perovskite has a spherical shape with an average diameter of about 0.70 &#956-m for the unpurified sample and 0.84 &#956-m for the purified sample. The XRD results show that the formed Cs2SnI6 perovskite has a cubic crystal structure for both unpurified and purified samples. In addition, the results of chemical characterization with FTIR and Raman spectroscopy show differences in vibration frequencies for the samples without purification and after purification due to the influence of the solvent and ligands involved. The results of optical characterization with UV-Vis spectroscopy and Photoluminescence show two specific peaks in samples without purification and purification. However, there is found the shifted in the absorbance peak towards a larger wavelength (red shift).

Keywords: Lead-free perovskite, Cs2SnI6 synthesis, Hot injection technique, Purification effects

Topic: Material Physics

[ABS-114]

Effect of Cu Doping on the Formation of Metastable Al2O3 Nanoparticles Synthesized through Plasma Arc

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Abstract

We report the successful synthesis of Cu-doped metastable Al2O3 nanoparticles using a plasma arc technique, where Cu was introduced in situ via electrode erosion during high-temperature processing. The airflow rate of both plasma and carrier gas was introduced at 16 lpm and 5 lpm, respectively, to sustain the arc discharge and served as the primary oxidizing medium. The aluminum precursor was atomized, oxidized, and doped simultaneously at a feed rate of 6 g/min. EDX analysis and Rietveld refinement of XRD patterns confirmed Cu incorporation (2.1-4.0%) into the Al2O3 lattice. This Cu affects the difference in the increase of gamma-Al2O3 and theta-Al2O3, and decreases delta-Al2O3 phases at 14.1%, 8.1%, and 22.2%, respectively. These are changes due to the presence of minor Cu atoms occupying interstitial sites in the spinel lattice framework. The presence of polymorphic Al2O3 phase coexistence was also detected through SAED patterns, as exhibited by diffuse rings. The spatial distributions of Al2O3 phases revealed extending to the particle surface, suggesting the influence of uneven cooling rates during in-flight plasma processing, as shown by the Fast Fourier Transform examination of HR-TEM images. These findings demonstrate the role of minor Cu doping in tailoring metastable Al2O3 nanostructures through plasma arc, offering the functional properties for broader applications, with promise for scalable production of advanced materials.

Keywords: Metastable Al2O3- Cu dopant- Plasma arc- Polymorphic nanoparticles

Topic: Material Physics

[ABS-116]
A Comparative Analysis of Uncoated and PAN Nanofiber-Coated QCM Sensors for Volatile Organic Compound Sensing

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Abstract

Sensitive and selective detection of volatile organic compounds (VOCs) is crucial to support air quality monitoring and the implementation of sustainable development principles. In this study, a comparative study was conducted on the performance of a quartz crystal microbalance (QCM)-based gas sensor without coating (blank) and a QCM coated with electrospinning polyacrylonitrile (PAN) nanofibers. Five types of VOC gases were tested in this study, namely dimethylformamide (DMF), isopropyl alcohol (IPA), methanol, acetone, and tetrahydrofuran (THF). The test results showed that coating the QCM with PAN nanofibers significantly increased the sensitivity to all gases tested. QCM with PAN coating showed the highest sensitivity to methanol at 2.3539 Hz/ppm, followed by IPA (1.733 Hz/ppm), acetone (0.688 Hz/ppm), DMF (0.633 Hz/ppm), and THF (0.4647 Hz/ppm). In comparison, the sensitivity of QCM without coating to the five gases was 0.3386 Hz/ppm (methanol), 0.3496 Hz/ppm (IPA), 0.2624 Hz/ppm (acetone), 0.3186 Hz/ppm (DMF), and 0.4003 Hz/ppm (THF), respectively. These results indicate that the use of PAN nanofibers as a coating material improves sensor performance in detecting VOC gases, especially methanol and IPA, so it has the potential to be applied in a sustainable environmental monitoring system.

Keywords: Quartz crystal microbalance, PAN nanofiber, gas sensor, volatile organic compounds (VOC), sensitivity.

Topic: Material Physics

[ABS-118]
Thermoelectric properties of Epoxy/SWCNT/Polyaniline ternary nanocomposite

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Abstract

In this study, highly conductive single-walled carbon nanotubes (SWCNTs) were employed to establish a conductive network within an epoxy matrix, resulting in the formation of an epoxy/SWCNT nanocomposite with a 4 wt. percent SWCNT loading. To further enhance its electrical performance, the nanocomposite was subsequently incorporated with 3 wt. percent polyaniline (PANI). The thermoelectric (TE) properties of the nanocomposites, both before and after PANI addition, were systematically investigated over a temperature range of 243 K to 348 K. Additionally, power output was evaluated under temperature differentials of 25, 45, and 65 K, at conditions near and slightly above room temperature. Initially, the epoxy/SWCNT nanocomposite exhibited electrical conductivities of 7.51 S/m at 243 K and 9.18 S/m at 348 K, with corresponding Seebeck coefficients of 66 microV/K and 91 microV/K, respectively. The measured power outputs under &#916-T values of 25, 45, and 65 K were 6.20, 11.18, and 18.0 nW, respectively, using a small-leg TE module. Upon the incorporation of PANI, all key thermoelectric parameters, except for the Seebeck coefficient, exhibited notable improvements. The electrical conductivity significantly increased to 224.848 S/m at 243 K and 313.702 S/m at 348 K, while the Seebeck coefficients slightly decreased to 52 microV/K and 56 microV/K, respectively. Correspondingly, the power output demonstrated a general enhancement across all tested temperature differentials. These results clearly indicate that PANI effectively reinforces the thermoelectric performance of the epoxy/SWCNT nanocomposite, underscoring its potential as a promising filler for polymer-based thermoelectric materials

Keywords: TE Properties, Epoxy, SWCNT, Polyanniline, & Nanocomosite.

Topic: Material Physics

[ABS-119]

Analysis of Physical - Chemical Properties and Variation of Rare Earth Elements in Ciuyah Mud Volcano and Supported by SEM and XRD Data to Bolster Advanced Materials Industry in Indonesia

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Abstract

A mud volcano is a geological phenomenon that emerges on the earth's surface when mud material is ejected due to excess pressure, buoyancy, and temperature variations from beneath the earth's surface. Located in West Java, the Ciuyah Mud Volcano serves as a fascinating site for scientific exploration. With its unique characteristics and geological features, this mud volcano presents an intriguing opportunity for researchers to deepen their understanding of the earth's processes. The material ejected by mud volcanoes, including Ciuyah Mud Volcano, contains a wealth of minerals, elements, and salt potential crucial for scientific investigation or livelihoods. Of particular interest is the presence of rare earth elements, which are significant for research due to their potential as important raw materials for modern technology. Exploring these elements within the material of the mud volcano could provide valuable insights into the earth^s composition and inform future research endeavors. This study aims to determine the physical-chemical properties of a mud volcano using the electrical method with parameters such as EC and VWC of the mud, EC and TDS of water, as well as variations in the distribution of REE using XRF and ICP-OES tests. Additionally, the study aims to obtain the distribution of salt and metals using SEM and XRD tests. The results of the study indicate that Ciuyah Mud Volcano contains conductive minerals due to the high EC and VWC values in the mud samples, as well as elevated TDS and salinity levels. The XRF and ICP-OES tests reveal the potential presence of REE, with 12 elements discovered including Ce, Dy, Eu, Gd, Ho, La, Nd, Pr, Sm, Tb, Sc, and Y. SEM and XRD test results from the salt Ciuyah Mud Volcano sample show Halite and Helvite mineralogy with a hexagonal shape and large crystal grains. The potential REE could support the advanced material industry and clean energy in Indonesia, as well as identify salt potential and hot spring manifestations that can be utilized by local communities, including as beauty salt.

Keywords: Ciuyah Mud Volcano- rare earth elements- ICP-OES- SEM- XRD- XRF

Topic: Material Physics

[ABS-122]

COMPARATIVE STUDY OF THE USE GOLD AND SILVER NANOPARTICLES IN N-719 DYE TO THE PERFORMANCE OF DYE SENSITIZED SOLAR CELL (DSSC)

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Abstract

Dye Sensitised Solar Cell (DSSC) is a third-generation solar cell that has attracted significant attention because it can be fabricated at room temperature and works effectively in low light. One of the approaches taken to improve its performance is through the addition of metal nanoparticles such as gold (AuNP) and silver (AgNP). In previous study, Pujiarti et. al. show an increase in power conversion efficiency (PCE) from 4.18% to 5.14% after incorporating oleylamine-capped AuNPs into the N-719 dye layer, while Rahayu et. al. find that the addition of 5.66 wt.% AuNPs capped with dodecanethiol enhance the PCE from 1.58% to 2.77%, and a similar trend is observed with the incorporation of silver nanoparticles. Metal nanoparticles are known to have a unique optical property called Localized Surface Plasmon Resonance (LSPR) that occurs when light of a specific frequency causes a collective resonance of free electrons on the surface of metal nanoparticles. This phenomenon can enhance the intensity of the local electric field around the particles. The aims of our research is to compare the use of gold and silver nanoparticles capped by 3-Mercaptopropionic Acid (3-MPA) in N-719 dye to the performance of Dye-Sensitized Solar Cell (DSSC).
Metal nanoparticles were prepared using the chemical reduction method. Fabrication of DSSC was done by incorporating gold and silver nanoparticles into the dye solution, followed by immersion of the TiO2 photoanode and subsequent assembly of the cell. The characterization included UV-Vis spectroscopy, Photoluminescence spectroscopy, Fourier Transform Infrared (FTIR) spectroscopy, and Scanning Electron microscopy (SEM).
The absorbance spectra of N-719 dye with the addition of AuNP or AgNP in comparison to that of the reference dye show the overlap spectra between the intrinsic peaks of N-719 and the plasmonic peak come from AuNP or AgNP, which indicates that the nanoparticles are stable in the matrix of the dye. Photoluminescence spectra show emission peaks that were influenced by the presence of nanoparticles. The emission intensities show a noticeable variation with the incorporation of nanoparticles, indicating the effect of metal-dye interaction on the charge transfer process. FTIR characterization results show that the strength of the chemical bond formation between the dye with AuNP and AgNP was demonstrated by the changes of vibration molecular bonds of S and the band shift of -COOH. The results of SEM observations show that the film^s surface morphology became more homogeneous after the addition of AuNP or AgNP in the active layer of DSSC. Overall, this study provides insight into the potential of gold and silver nanoparticles to be incorporated into the DSSC devices to improve their work efficiency. This is expected to open up new opportunities in developing materials for next-generation solar cell applications.

Keywords: DSSC- Gold Nanoparticles- Silver Nanoparticles- Dye N-719

Topic: Material Physics

[ABS-124]

Effect of Annealing Techniques on the Thermoelectric Properties of Molybdenum Disulfide Thin Films Prepared by RF Sputtering

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Abstract

Innovation in renewable energy, such as thermoelectric technology, is key to meeting the growing energy demand without harming the environment. The use of thermoelectric materials in renewable energy systems enables the direct conversion of heat into electricity, thereby enhancing energy efficiency and sustainability. Molybdenum disulfide (MoS&#8322-), a transition metal dichalcogenide, shows great potential for applications in thermoelectric devices. The advancement of 2D material fabrication technologies supports the development of materials suitable for thermoelectric applications. One possible method is Physical Vapor Deposition (PVD), which can be implemented using the sputtering technique. Heat treatment of thin-film materials affects their structural, electronic, and thermoelectric properties. One effective approach for this treatment is annealing using a furnace. The MoS2 material is deposited using the Radio Frequency Sputtering under base pressure conditions below 2.2 x 10-3 Pa and a working pressure of 1.3 Pa. The deposition of MoS2 thin films was performed at room temperature with an argon gas flow of 53.5 sccm. The MoS2 thin films were deposited using the RF Sputtering method with a deposition time of approximately 30 minutes and a fixed power of 200 watts. After deposition, the MoS2 thin films underwent heat treatment using Quartz Tube Furnace before testing. Based on the test results, the thermoelectric characteristics were determined, including the resistivity and Seebeck coefficient . The resistivity of the MoS2 thin film was lowest when heated to 600 C, measuring 1.82 x 10-3 Ohm m at 50 C. The resistivity is inversely proportional to the measurement temperature on the ZEM3 machine. The Seebeck coefficient has a negative value, indicating that the MoS2 thin film contains charge carriers, with a value of -3.54 x 10-4 V / K at 50 C. Based on the resistivity and Seebeck coefficient values, the power factor was calculated as 1.29 x 10-4 W/mK2 at 50 C.

Keywords: MoS2, Quartz Tube Furnace , RF Sputtering, Thermoelectric, Thin Film

Topic: Material Physics

[ABS-130]
Karakterisasi Morfologi dan Komposisi Lapisan Ni-TiN-AlN-Al2O3 dengan Variasi Rapat Arus Pulsa

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Abstract

Penelitian ini dilakukan dengan membentuk lapisan komposit Ni-TiN-AlN-Al2O3 yang disintesis pada substrat tungsten karbida (WC) melalui metode elektrodeposisi. Tujuan utama dari penelitian ini adalah untuk menganalisis pengaruh variasi rapat arus pulsa terhadap morfologi dan komposisi lapisan yang dihasilkan. Proses pelapisan dilakukan dengan variasi rapat arus pulsa sebesar 0,3 , 0,4 , dan 0.5 mA/mm^2 selama 30 menit, dengan laju pengadukan 600 rpm pada suhu 40 C. Karakterisasi morfologi dan komposisi dilakukan menggunakan Scanning Electron Microscopy-Energy Dispersive Spectroscopy (SEM-EDS). Hasil karakterisasi menunjukkan bahwa rapat arus 0,4 mA/mm^2 menghasilkan struktur mikro terbaik, ditandai oleh permukaan yang homogen, distribusi partikel yang merata, serta minimnya cacat seperti aglomerasi dan retakan mikro. Sebaliknya, pada rapat arus 0,3 mA/mm^2 ditemukan permukaan kasar dengan aglomerat besar dan distribusi partikel yang tidak seragam, sedangkan pada arus 0,5 mA/mm^2 terjadi pertumbuhan partikel yang tidak terkendali akibat laju deposisi yang terlalu tinggi. Dengan demikian, dapat disimpulkan bahwa arus 0,4 mA/mm^2 merupakan parameter optimal untuk menghasilkan lapisan komposit dengan kualitas morfologi dan struktur mikro yang unggul, yang berpotensi meningkatkan kekuatan mekanik dan daya rekat lapisan.

Keywords: Lapisan komposit Ni-TiN-AlN-Al2O3, Elektrodeposisi, Rapat arus pulsa, Morfologi

Topic: Material Physics

[ABS-150]
Preparation and Characterization of the Magnetic Properties of Barium Hexaferrite via the Solid-State Reaction Method

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Abstract

Barium Hexaferrite is a magnetic material with significant potential for various industrial applications, including data storage devices, loudspeakers, and electromagnetic wave absorbers. This study aims to synthesize and characterize the magnetic properties of Barium Hexaferrite produced via the solid-state reaction method using mortar and High Energy Milling (HEM) techniques. Characterization was carried out using X-RayDiffraction (XRD), Scanning Electron Microscope (SEM), and Vibrating Sample Magnetometer (VSM). XRD results indicate that the hexagonal crystal structure of Barium Hexaferrite remains intact with stable lattice parameters. SEM analysis reveals a uniform particle morphology with sizes ranging from 2 to 4 micro meter. VSM testing shows that the sample prepared using the mortar technique (BHX-M) exhibits a saturation magnetization (Ms) of 51.03 emu/g, while the HEM technique (BHX-HEM) yields a value of 50.40 emu/g. The coercivity (Hc) of BHX-M is higher (0.32 T) than that of BHX-HEM (0.30 T), indicating that the synthesis technique influences the magnetic properties. This study confirms that the solid-state reaction method can produce Barium Hexaferrite with magnetic properties suitable for commercial applications and advanced technology.

Keywords: Barium hexaferrite, solid-state reaction, structure, morphology, magnetic properties

Topic: Material Physics

[ABS-151]

The effect of adding perlite to unfired and fired geopolymer concrete made from fly ash and perlite on pore distribution and compressive strength

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Abstract

Creep occurs in burned material
It made a decrease in yield strength and elasticity modulus
In this study five compositions of fly ash and perlite-based concrete geopolymer have been burned for 900 degree Celcius for 2 hours
The distribution of pore decreases for both unburned and burned concrete geopolymer is observed
One of the strength of concrete geopolymer indicator is compressive strength
Both of the results of compressive strength and the pore distribution are conducted through experimental study
Bet method has been used to measure pore volume of it
UTM machine has been used to calculate compressive strength
It is found that the addition of perlite to fly ash-based geopolymer concrete will increase the pore distribution value of unburned geopolymer concrete On the other hand, the summation of perlite to fly ash-based geopolymer concrete will decrease the pore distribution value of burned geopolymer concrete

Keywords: geopolymer compressive strength pore distribution passive fire protection

Topic: Material Physics

[ABS-166]
Tuning Ionic Conductivity and Stability in Perovskite-Derived Hydrides via Fluorine Substitution

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Abstract

The hydride ion (H-) conducting properties of SrMgH4, which adopts a BaZnF4-type perovskite-derived structure. The hydride ion conductivity of SrMgH4 was demonstrated to be a relatively high value of 5 x 10-5 S cm-1 at 200 oC. Fluorine substitution described as SrMgH4-xFx was also examined to enhance its stability against air. Samples were synthesized via mechanochemical, then the sample purity was verified by X-ray diffraction (XRD). Neutron diffraction (ND) at J-PARC BL09 SPICA was collected to provide structural information. Rietveld analysis using neutron powder diffraction data of SrMgHF3 (x=3) revealed the disordering of fluoride and hydride ions. While fluorine substitution reduced ionic conductivity, SrMgH2F2 and SrMgHF3 show enhanced air stability. These findings demonstrate how controlled anion disorder can optimize the balance between conductivity and stability in hydride-ion-conducting materials.

Keywords: Hydrides, ionic conductor, air stability

Topic: Material Physics

[ABS-169]
Accelerated Lattice Thermal Conductivity calculations for (\alpha-CX) (X=N, P, As) using a combination of Density Functional Theory, Machine Learning, and Molecular Dynamics

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Abstract

The growing potential of carbon pnictide (\alpha-CX) monolayers in optoelectronic and photovoltaic applications has sparked interest in their thermoelectric properties. One of the crucial properties in thermoelectric device performance is lattice thermal conductivity (LTC) which reflects how well the heat is conducted through phonons. However, accurate LTC calculations using conventional method such as density functional theory (DFT) are highly time consuming. To address this, a machine learning (ML) based approach was implemented to generate force fields that can be used in molecular dynamics (MD) simulations, which significantly reduces computational cost and data requirements. LTC was calculated for (\alpha-CX) using partial training data and a dataset consisting of different dimensions which consist of 20 random displacements. The result shows that for (\alpha-CX) ML models produced accurate LTC values while halving the data requirements and achieved up to six times faster calculations. This demonstrates the efficiency and reliability for thermoelectric property predictions in materials using ML based approach.

Keywords: (\alpha-CX) monolayers, density functional theory, machine learning, molecular dynamics, thermoelectric

Topic: Material Physics

[ABS-171]
Overview of Transparent Conductive Materials for Hybrid Perovskite Solar Cells

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Abstract

Transparent conductive materials (TCMs) are incomparable class of materials that have outstanding optical transmission of electromagnetic wave in the visible light spectrum combined with very high conductivity at room temperature. They are required components in optoelectronic devices, such as solar cells, touch screen and displays. TCMs are essential for light transmission, collection and transport of charge carriers in photovoltaics. TCM act crucial role in hybrid Perovskite Solar Cells (PSCs), influencing their stability, efficiency and cost-effectiveness. The most popular used TCMs are transparent conductive oxides (TCOs), such as indium tin oxide (ITO) and fluorine-doped tin oxide (FTO), but alternatives are being explored to address issues related to cost, flexibility, and material scarcity. Graphene, carbon nanotubes (CNTs), metal nanowires and conductive polymers are discussed as alternatives to TCOs in TCO-free perovskite solar cells. TCMs are also critical in tandem perovskite solar cells, where all-inorganic perovskite solar cell is combined with another solar cells. In this article will explore the fundamental optical and electrical properties of TCMs, highlight the challenges, innovations and potential future research directions.

Keywords: transparent conductive materials- hybrid perovskite solar cells- photovoltaics- transparent conductive oxide- graphene- carbon nanotubes- metal nanowires- conductive polimer- TCO-free perovskite solar cells- perovskite tandem solar cells.

Topic: Material Physics

[ABS-181]

Influence of Cr3C2-NiCr Coating Thickness on Corrosion Behavior of Carbon Steel in Alkali Chloride Atmospheres

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Abstract

The development of protective coatings against alkali-induced high-temperature corrosion is critical for extending the service life of components in aggressive environments such as boiler co-firing biomass. This study investigated the influence of Cr3C2-NiCr coating thickness on the corrosion performance of A516 carbon steel substrates exposed to alkali chloride vapor (NaCl + 55wt% KCl) at 600C for 100 hours. Coatings with approximate thicknesses of 150um and 20um were deposited via High Velocity Oxy Fuel (HVOF) spraying, using Cr3C2-NiCr as the coating material. Their degradation behaviors were evaluated through mass change measurements, corrosion rate analysis, and detailed microstructural characterization using field emission-scanning electron microscopy (FE-SEM) equipped with electron dispersive spectroscopy (EDS), X-Ray Diffraction (XRD), and surface hardness testing. The thicker coating exhibited a significantly lower corrosion rate (0.1495mm/y during the first 20 hours) than the thinner coating, which experienced rapid degradation and visible spallation after 40 hours. XRD analysis revealed that the surface of the thicker coating was dominated by Cr2O3 and NiCr2O4. In contrast, the thinner coating formed a more complex oxide mixture consisting of Cr2O3, Fe3O4, Fe2O3, and NiCr2O4, indicating a severe corrosion attack to the thinner coating and substrate. The underlying mechanisms of alkali salt vapor corrosion for both coating thicknesses are explained in this paper, offering understanding into microstructural of Cr3C2-NiCr coating on A516 carbon steel in corrosive high-temperature environments.

Keywords: alkali, Cr3C2-NiCr, corrosion, mechanisms, thickness

Topic: Material Physics

[ABS-182]
The influence of Mg Substitution at A and B-Sites on the Structural and Optical Properties of LaFeO3 Perovskites

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Abstract

LaFeO&#8323- with 0.1 Mg substitution at the A-site (La0.9Mg0.1FeO3) and B-site (LaFe0.9Mg0.1O3) has been successfully synthesized via the sol-gel method. The crystal structure, morphology, and optical properties of La0.9Mg0.1FeO3 and LaFe0.9Mg0.1O3 powders were characterized by X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and Ultraviolet-Visible (UV-Vis) Spectroscopy, respectively. Based on the Inorganic Crystal Structure Database (ICSD) No. 98-002-8255, the XRD patterns of both samples possess an orthorhombic structure with Pnma space group. Optically, substituting Mg at both A and B-sites influences the absorbance and reflectance in the wavelength range of 350-800 nm. Moreover, by the Tauc Plot, we have determined the optical band gap of La0.9Mg0.1FeO3 and LaFe0.9Mg0.1O3, which are 1.88 eV and 1.61 eV, respectively.

Keywords: LaFeO&#8323-, Mg substitution, A-site and B-site substitution, optical band gap, sol-gel method, perovskite structure

Topic: Material Physics

[ABS-184]
Nanopartikel Emas (Au): Sintesis dan Uji Sifat Absorbansi pada Temperatur Ruang

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Abstract

Penelitian ini bertujuan untuk mensintesis nanopartikel emas (Au) menggunakan metode one-step synthesis dengan memanfaatkan sinar UV untuk mereduksi ion HAuCl4 dalam larutan HEPES yang berperan sebagai agen reduksi. Proses sintesis nanopartikel emas dilakukan menggunakan cawan petri dengan dua variasi konsentrasi HAuCl4, masing-masing 0.0026 M dan 0.0001 M, sedangkan konsentrasi HEPES 0.1 M. Setelah itu, sampel disinari dengan sinar UV di dalam rak 1, 2, dan 3 UV chamber selama 10 menit. Karakterisasi dilakukan menggunakan spektrofotometer UV-Vis untuk mendapatkan spektrum absorbansi serta panjang gelombang (wavelength). Hasil sintesis HAuCl4 dengan konsentrasi 0.0026 M menunjukkan warna ungu kemerahan, menandakan pembentukan nanopartikel emas (AuNP). Sementara pada konsentrasi 0.0001 M, larutan tetap bening transparan tanpa rona kemerahan, menandakan hampir tidak ada pembentukan partikel emas. Hasil spektrum UV-Vis mengkonfirmasi bahwa pada sampel 0.0026 M menunjukkan puncak SPR pada rentang 530-540 nm. Sedangkan pada sampel dengan konsentrasi 0.0001 M tidak menunjukkan adanya puncak SPR.

Keywords: HAuCl4, Emas, Nanopartikel, UV-Vis, HEPES

Topic: Material Physics

[ABS-185]
Microstructure, Hardness, and Corrosion Resistance Analysis of Cu-40Zn-xSn Prepared by Gravity Die Casting Process

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Abstract

Brass is an alloy consisting of a mixture of copper and zinc. In this study, the type of brass used is naval brass with a Cu content of 60% and Zn of 40%. Naval brass has good strength and good corrosion resistance. Naval brass applications are usually used in the manufacture of marine equipment such as ship propellers. However, naval brass is included in copper alloys that easily react, dissolve, and corrode in seawater conditions. Corrosion that occurs in brass alloys is called dezincification. Dezincification can be avoided by adding elements, one of which can be used is tin (Sn). This study was conducted to determine the effect of adding tin (Sn) on the microstructure, hardness, and corrosion resistance of Cu-40Zn brass alloys. For sample preparation, the gravity die casting process was carried out with variations in the addition of Sn elements, starting from 0 wt.% Sn, 0.5 wt.% Sn, 1 wt.% Sn, and 1.5 wt.% Sn. After that, the casting results will be homogenized at a temperature of 800&#8451- for 2 hours. After being homogenized, the samples were cut for several tests, namely composition testing, microstructure observation, hardness testing, and corrosion testing. From the results of the research conducted, the addition of Sn elements can affect the microstructure, because the addition of Sn elements encourages the formation of the &#946- phase. The results of the hardness test showed an increase in the hardness value along with the addition of Sn elements, namely 134.22 VHN, 151.64 VHN, and 162.1 VHN. Further, it can be concluded that the addition of Sn elements can increase the hardness value of brass alloys. In the corrosion test, the corrosion rate values were obtained at 0.3354 mmpy, 0.1956 mmpy, and 0.2362 mmpy along with the addition of Sn elements. Finally, it can be concluded that the addition of Sn elements affects the corrosion resistance of brass alloys.

Keywords: Brass, Dezincification, Microstructure, Hardness, Corrosion Resistance

Topic: Material Physics

[ABS-189]

Impact of post heat treatment on the Crystallinity of hydroxyapatite Synthesized from Limestone and the adhesion of various Gram Positive and Gram Negative Bacteria

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Abstract

The study investigates the impact of post-heat treatment on the structural properties of hydroxyapatite (HA) and its effect on bacterial adhesion, specifically against Escherichia coli and Staphylococcus aureus. Hydroxyapatite was synthesized via a hydrothermal method using natural limestone as the calcium source. The samples were calcined at 700C, 900C, and 1100C for 1 hour. Comprehensive characterization was conducted using X-ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), and Scanning Electron Microscopy (SEM). The results showed that near-stoichiometric and highly crystalline HA was obtained at 900&#61616-C. Higher calcination temperatures resulted in increased grain size and significant surface morphological changes. These surface modifications altered the interfacial characteristics of HA, which significantly reduce affects the adhesion of both E. coli and S. aureus. The study demonstrates that post-heat treatment not only improves the crystallinity of HA but also performance of hydroxyapatite for biomedical applications.

Keywords: Hydroxyapetite, heat treatment, bacteria adhesion, material characteritationPlease Just Try to Submit This Sample Abstract

Topic: Material Physics

[ABS-195]
Intrinsic and Extrinsic Spin Hall Conductivity of BaPb_{0.75}Bi_{0.25}O_{3}

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Abstract

Charge-to-spin conversion is an important physical property in the spintronics field. One of the physical phenomena that provides charge-to-spin is the spin Hall effect. A quantity that determines the spin Hall effect is the spin Hall conductivity which can be obtained from the material^s intrinsic Berry curvature and impurity scatterings. In this work, we aim to obtain the spin Hall conductivity of BaPbO3BaPbO3 (BPO) and one of its Bi-doped version of crystal BaPb0.75Bi0.25O3BaPb0.75Bi0.25O3 (BPBO) by using density functional theory with the relativistic effect considered and Wannier function calculations. We find the sum of BPBO intrinsic spin Hall conductivity from our computational calculation and extrinsic spin Hall conductivity from contributions of impurity skew scattering and side jump to be 5.74 · 103ℏ2eSm5.74 · 103ℏ2eSm where the extrinsic contribution dominates the intrinsic contribution.

Keywords: Density functional theory- Spin Hall conductivity- Berry curvature

Topic: Material Physics

[ABS-198]
Morphological, Crystal Characterization, and Magneto-Thermal of Superparamagnetic Iron Oxide Nanoparticles (SPION) from Natural Sand based Coprecipitation Sono-Chemical

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Abstract

Superparamagnetic Iron Oxide Nanoparticles (SPION) have been widely studied for biomedical applications, especially in the field of imaging and cancer therapy. However, studies on the magneto-thermal characteristics of SPION synthesized from natural sources such as iron sand are still limited, especially related to the heating efficiency in an alternating magnetic field. This study has successfully synthesized magnetite-based SPION from natural sand using a sonochemical coprecipitation method, combined with polyaniline and activated carbon to improve magneto-thermal performance. The characterization results using SEM showed nanoparticle morphology with a size between 103.32-121.23 nm. FTIR analysis confirmed the presence of Fe-O functional groups in tetrahedral and octahedral positions, as well as the presence of hydroxyl groups. XRD showed a crystalline structure of magnetite with a crystallite size of 22.6 nm based on the Scherrer method and Rietveld analysis. The UV-Vis spectrum shows two characteristic absorption peaks and a direct band gap value of 2.10 eV and an indirect band gap of 3.24 eV. Magneto-thermal testing shows a temperature increase of up to 13oC under the influence of an alternating magnetic field, indicating the great potential of this material in cancer hyperthermia therapy applications.

Keywords: SPION- Iron Sand- Sono-Chemical Coprecipitation- Magneto-Thermal

Topic: Material Physics

[ABS-199]

Comparative Study of Electrochemical CO2 Reduction Using Electrodes made of Metal Nanoparticles deposited on a Metal Substrate

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Abstract

Electrochemical reduction of carbon dioxide (CO2RR) is one of the straightforward methods to convert CO2 into valuable products or fuels while simultaneously reducing greenhouse gas emissions. Integration with solar or other renewable energy electricity may offer a promising pathway to a sustainable fuel economy. However, CO2RR occurs simultaneously with other reduction reactions, particularly the hydrogen evolution reaction (HER), which decreases the efficiency of CO2RR. In this presentation, we will report the investigation results on several electrodes made of metal nanoparticles deposited on a metal substrate for CO2RR. The Sn, Ni, and Cu nanoparticles were electrodeposited onto five different types of metal substrates, namely Cu, Sn, Ni, Zn, and stainless steel. CO2RR was carried out in 0.25 M KHCO3 electrolyte solution. The electrochemical performance of the electrodes was evaluated using cyclic voltammetry (CV) in a CO2-free and CO2-saturated electrolyte solution. The measurement results showed different electrocatalytic properties and CO2RR depending on the electrode, which is related to the suppression of the dominant HER reaction. The electrodes made of the combination of Cu and Sn showed a remarkable CO2RR current density in the CO2 saturated electrolyte solution, suggesting increased CO2RR activity. On the contrary, electrodes composed of Ni tended to promote more HER. These findings emphasise the crucial importance of selecting an appropriate electrode made of metal nanoparticles deposited on a metal substrate to improve the efficiency of CO2RR.

Keywords: CO2 electroreduction, CO2RR, cyclic voltammetry, hydrogen evolution reaction, metal nanoparticles.

Topic: Material Physics

[ABS-200]
Structural and Electronic Properties of Manganese-Doped Superparamagnetic Iron Oxide Nanoparticles Derived from Natural Iron Sand

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Abstract

The development of functional materials based on metal oxides is increasing along with the need for advanced materials for technological, environmental, and medical applications. Indonesia, especially West Nusa Tenggara, has great potential in utilizing iron sand as a natural source of magnetic minerals such as magnetite (Fe3O4) and hematite (Fe2O3). This study has successfully synthesized superparamagnetic Fe3O4 (MF1) and manganese-doped Fe3O4 (Mn0.25Fe2.75O4/MF2) materials from local iron sand using a modified coprecipitation method. The synthesis process involves magnetic separation, dissolution with HCl, precipitation using NH4OH, and doping with MnCl3. Characterization using XRD, FTIR, and UV-Vis shows that both materials have a cubic spinel structure with significant changes in lattice parameters and crystallite size after Mn doping. FTIR spectrum confirmed the presence of O-H, C-O, Fe-O, and Mn-O functional groups, while UV-Vis results showed a decrease in the gap energy from 3.11 eV to 3.07 eV and a decrease in the Urbach energy from 0.131 eV to 0.074 eV. These findings indicate that Mn substitution successfully improves the crystallinity quality and modifies the electronic properties of Fe3O4, thus potentially being applied in the fields of photocatalysis and optoelectronics.

Keywords: SPION- Manganese Doping- Iron Sand- Energy Gap- Crystal Structure

Topic: Material Physics

[ABS-203]

Analisis Pengaruh Variasi Konsentrasi Dopan ZnO, FeO, MnO, dan MgO Terhadap Sifat Optik Sistem Kaca P2O5-CaO serta Perbandingan dengan Sistem Kaca P2O5-Cangkang Telur

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Abstract

Fosfat Pentaoksida (P2O5) merupakan bahan pembentuk kaca yang banyak diteliti selama satu dekade terakhir karena memiliki sifat fisik unggul, seperti suhu transisi rendah, koefisien pemuaian termal tinggi, dan konduktivitas listrik baik. Penambahan dopan logam oksida seperti ZnO, FeO, MnO, dan MgO dapat memodifikasi struktur jaringan kaca serta meningkatkan sifat optiknya. CaO sebagai komponen modifier berperan penting dalam menurunkan titik lebur dan memperkuat jaringan kaca. Sumber CaO konvensional dapat digantikan oleh limbah cangkang telur yang mengandung kalsium karbonat, sehingga menjadi alternatif bahan baku yang lebih ekonomis dan ramah lingkungan. Penelitian ini bertujuan untuk menganalisis pengaruh variasi konsentrasi dopan ZnO, FeO, MnO, dan MgO terhadap sifat optik sistem kaca P2O5-CaO serta membandingkannya dengan sistem kaca P2O5-cangkang telur. Sintesis kaca dilakukan dengan metode melt-quenching. Karakterisasi sifat optik menggunakan spektrofotometri UV-Vis, sedangkan analisis morfologi dan komposisi unsur menggunakan SEM-EDX. Hasil SEM-EDX menunjukkan keberadaan unsur O dan P sebagai komponen utama, serta Ca dari CaO murni maupun cangkang telur. Dopan yang digunakan juga terdeteksi, menunjukkan pencampuran bahan yang merata melalui proses milling.

Keywords: Kaca Fosfat, Logam Oksida, Kalsium Oksida, Cangkang Telur, Sifat Optik

Topic: Material Physics

[ABS-208]

ANALISIS CELAH ENERGI OPTIK NANOROD ZnO YANG DITUMBUHKAN PADA Zn FOIL MENGGUNAKAN TEKNIK HIDROTERMAL

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Abstract

Sintesis nanorod ZnO telah berhasil dilakukan menggunakan teknik hidrotermal pada substrat Zn foil. Proses sintesis dilakukan pada suhu 95∘∘C dengan variasi waktu pertumbuhan selama 4, 8, 12, 16, 20, dan 24 jam. Sampel hasil sintesis dikarakterisasi menggunakan spektrofotometer UV-Vis untuk memperoleh data reflektansi difusi. Berdasarkan perhitungan menggunakan metode Kubelka-Munk dan plot Tauc, nilai celah energi nanorod ZnO berada pada rentang 3.16-3.19 eV. Celah energi terbesar dimiliki sampel 4 dan 20 jam (3.19 eV), sedangkan sampel lainnya menunjukkan nilai konstan sebesar 3.16 eV. Hal ini mengindikasikan bahwa struktur optik ZnO relatif stabil pada durasi pertumbuhan 8-24 jam. Sehingga, variasi waktu hidrotermal mempengaruhi ketebalan, morfologi permukaan, dan distribusi defek alamiah yang berimplikasi pada sifat optik nanorod ZnO.

Keywords: ZnO, Nanorod, Hidrotermal, Kubelka-Munk, Band Gap , Sifat optiky to Submit This Sample Abstract

Topic: Material Physics

[ABS-212]
Effect of Holding Time on the Phase Formation and Microstructure of Mullite Synthesized at 1200C

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Abstract

Mullite is a crucial ceramic material known for its excellent thermal and mechanical stability making it a promising candidate for high temperature applications. This study aims to evaluate the effect of holding time variation on the phase formation and microstructural evolution of mullite synthesized at 1200C. The precursor powders were sintered for 2 4 and 6 hours and the samples were characterized using X ray Diffraction XRD and Scanning Electron Microscopy SEM. XRD analysis revealed that the holding time variation had no significant effect on the diffraction patterns indicating that mullite phase formation occurred consistently from the earliest holding time of 2 hours. However SEM observations of the 2 hour sample showed coarse and inhomogeneous particle morphology suggesting incomplete crystal growth. These results indicate that while the mullite phase forms early during sintering the refinement and development of the microstructure are still influenced by the duration of heat treatment.

Keywords: Mullite- Holding time- Microstructure morphology

Topic: Material Physics

[ABS-215]

ZIF-8 modified with N-doped Carbon Dots using the direct mixing method at room temperature

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Abstract

Modification of ZIF-8 with N-CDs through the direct mixing method at room temperature was successfully carried out. XRD confirmed the formation of the N-CDs crystal structure with ZIF-8, characterized by an amorphous peak at 24.83. SEM showed heterogeneous particles with an average diameter of 14 &#956-m. EDX confirmed the composition of C (34.82%), N (37.25%), O (12.60%), and Zn (14.90%), confirming that the samples contained the precursor components utilized. These findings prove N-CDs can be used as a modifier of ZIF-8 without damaging its basic structure, although their abundance affects the material's morphology.

Keywords: ZIF-8, N-CDs, Direct mixing method, Metal-organic frameworks (MOFs), Morphological modification

Topic: Material Physics

[ABS-217]

Analysis Pore Volume and Compressive Strength of Fly Ash and Perlite Concrete Geopolymer at 900 Degree Celcius

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Abstract

Burned material experiences a decrease in yield strength and elasticity modulus
In this study five compositions of fly ash and perlite-based concrete geopolymer have been burned for 900 degree celcius for 2 hours
The volume of pore decreases for both unburned and burned concrete geopolymer
One of the strength of concrete geopolymer indicator is compressive strength
Both of the results of compressive strength and the pore size are conducted through experimental study
Bet method has been used to measure pore volume of it
UTM machine has been used to calculate compressive strength
It is found that there is a decline trend of pore volume and is the same trend with compressive strength of five compositions of fly ash and perlite-based concrete geopolymer

Keywords: geopolymer compressive strength pore volume passive fire protection

Topic: Material Physics

[ABS-222]
Structure-Property Relationship in Ce-Doped ZnO for Photocatalytic Applications under UV Light

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Abstract

Zinc oxide (ZnO)-based photocatalysts are promising materials for environmental remediation; however, their efficiency can be further enhanced through structural modification. In this study, nanostructured ZnO was engineered via cerium (Ce) doping at concentrations of 0%, 1%, and 2% using a green, microwave-assisted biosynthesis method with Pandanus amaryllifolius leaf extract. Characterization results confirmed that Ce doping successfully narrowed the band gap, reduced crystallite size, and produced uniform nanoflower-like morphologies. Among the samples, 1% Ce-doped ZnO exhibited the highest photocatalytic activity, achieving a degradation efficiency of 98.46% for methyl orange under UV light irradiation. This improvement is attributed to the electron-trapping ability of Ce ions, which suppresses electron-hole recombination and enhances the generation of reactive oxygen species. These findings suggest that Ce-doped ZnO synthesized through a sustainable route offers a highly efficient photocatalyst for UV-driven wastewater treatment.

Keywords: ZnO - cerium doping - photocatalyst - methyl orange -biosynthesis

Topic: Material Physics

[ABS-226]
The Physical Characteristics of Activated Carbon-Derived Sugarcane Bagasse/FeF3 Composite

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Abstract

Sugarcane bagasse is one of the major agricultures wastes that is enormously produced in agro-industrial complex in Indonesia. Considering the carbon content of this bio waste as well as the cost-effective in the preparation, sugarcane bagasse is an ideal candidate to fabricate an activated carbon that has a potential to be used in energy storage applications. This study presents a pyrolysis technique to fabricate activated carbon derived from sugarcane bagasse (SBAC) combined with FeF3 composite (SBACF) after a complete activation process. SBAC was prepared by applying a two-step technique that is pyrolysis and subsequential chemical activation process. The SBACF composite was fabricated by applying planetary dry ball-milling technique. The BET measurement indicated a preferable physical characteristic of SBAC properties regarding the adsorption, including high specific surface area and pore volume. The specific surface area of the composite^s material has a large surface area of 1749-1940 m2 g-1 with total pore volume of 1.05 - 1.17 cm3 g-1. This high surface area of this composite properties is comparable to most of the activated carbon produced from another bio waste source, fulfilling the criteria often expected for commercial use. The results of SEM characterization show surface structure of the SBAC/FeF3 composite is amorphous, characterized by a variety of particle shapes and sizes. The Raman spectroscopy examination of these composites indicates that the ID/IG ratio are 0.91 to 0.97. The low ID/IG ratio indicates that the carbon structure maintains a high level of order. This result suggested that the additional FeF3 strategy could significantly enhance the physical properties of the SBAC which has potential to be used for energy storage application such as supercapacitor and battery electrode where a large surface area is one of the essential features.

Keywords: Physical characteristic, activated carbon, sugarcane baggase, FeF3, composite

Topic: Material Physics

[ABS-227]

The Impact of Freezing Treatment on Physicochemical Characteristics of Oil Palm Kernel Shell-Derived Activated Carbon

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Abstract

Advancing high-performance, sustainable electrode materials is crucial for next-generation lithium-ion capacitors (LICs). This study presents an effective and simple strategy of applying freeze pretreatment at -60 Derajat C to biomass-derived activated carbon. Structural, physisorption, and electrochemical analyses reveal that freezing significantly restructures the pore structure of the activated carbon, leading to enhanced microporosity (increasing from 45.3 persen to 57.1persen) and a higher specific surface area (686.73 m kuadrat per gram). X-ray diffraction (XRD) investigation shows enhanced graphitic arrangement, while (Brunauer-Emmett-Teller) BET and isothermal statistics verify the shift toward more confined and accessible pores. These physical modifications directly translate into superior electrochemical performance of the activated carbon (AC), as demonstrated by increased capacitance and improved ion transport, as validated by cyclic voltammetry (CV). These results affirm that strategic thermal control during synthesis is significantly improved AC properties, providing a practical and scalable method for optimizing carbon-based LIC electrodes. This work exemplifies the transformative potential of process refinement in advancing energy storage technologies with real practical applications.

Keywords: freezing, palm kernel shell, activated carbon, electrochemical performance

Topic: Material Physics

INSTRUMENTATION AND COMPUTATIONAL PHYSICS

[ABS-9]

A Point-symmetrical Position for Vibration Measurement of Analytical Sieve Shakers

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Abstract

A sieve shaker or a sieving apparatus translates the mechanical action of separating coarser, solid particles into finer grains in sectors such as pharmaceuticals and materials engineering. Segregating particles according to their desired sizes enables a more comprehensive and precise analysis. The process of sifting is conducted by utilizing specific mesh types and sizes. The movement of the filtering process is determined by the vibrations generated by the sieve shaker. The sieve shaker requires calibration to ensure the measurement accuracy of the sieving process. Accurate measurements provide the fundamental basis for ensuring the quality and safety of the product. The ISO 16063 part 21 is a standard for secondary vibration calibration. However, the back-to-back method mentioned in the standard is challenging to apply directly to calibrate the sieve shaker due to the unique shape of its body component. Therefore, in this study, we adopt a point-symmetrical position applied in primary vibration calibration in order to perform vibration measurements produced by the sieve shaker. The standard accelerometer B&K 8035 is used as a reference transducer to measure the amplitude of the sieve shaker. The measurement was conducted for the displacement range of 0.2 up to 3.00 mm p-p with the highest measurement uncertainty of 2%.

Keywords: vibration, calibration, accelerometer, sieve shakers

Topic: Instrumentation and Computational Physics

[ABS-32]

Optimizing of active noise control for acoustic calibration: influence of control speaker distance and algorithm

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BRIN

Abstract

A controlled environment with minimal background noise is required for acoustic calibration procedure. To achieve this, a study to develop a sound insulation box equipped with active noise control system has been done. This study compares two adaptive algorithm, Least Mean Squares and Filtered-x Least Mean Squares. For the Filtered-x Least Mean Squares method, the secondary path is modelled by impulse response utilizing maximum length sequence signal. The effectiveness of each method is evaluated based on the reduction of the noise signal. The result shows that Least Mean Squares method is easier to implement, however the Filtered-x Least Mean Squares method provides a better noise reduction within the frequency range. Furthermore, the effect of varying the distance between the control speaker and the error microphone is also investigated. The experiment result shows that the Filtered-x Least Mean Squares method is better suited for application where the distance between the control speaker and error microphone may vary.

Keywords: ANC, noise, calibration

Topic: Instrumentation and Computational Physics

[ABS-37]

Implementation of Multivariate Prediction Based on Long-Short Term Memory of Machine Learning Techniques for Photovoltaic Solar Panels

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Abstract

The precise prediction of photovoltaic performance metrics depending on sunlight intensity and ground temperature is essential for the monitoring and management of photovoltaic power plant (PLTS) systems. In this presentation, we will show the implementation of a machine learning (ML) method based on multivariate prediction, which is well known as the Long Short-Term Memory (LSTM) technique. The technique was used to predict 300 future time steps based on historical sensor data, consisting of the current, voltage, and power of the solar panel, as well as the sunlight intensity and ground temperature. The dataset consists of 2,370 time-series records of those five key variables, which were normalized using the Min-Max Scaling technique and structured into sequences of 30-time steps. The LSTM model was built with a single LSTM layer containing 64 units, followed by two Dense layers. The model was trained over 50 epochs and validated using an 80:20 train-test split. Model performance was evaluated using the Mean Absolute Error (MAE) and compared against a tolerance threshold of 10% of each features range. The evaluation results demonstrated that four out of the five features exhibited MAE values below the established threshold. However, it is worth noting that the Voltage output feature exhibited greater variability and noise. The present work thereby shows the viability of this LSTM technique for predictive monitoring of photovoltaic or solar panel system.

Keywords: LSTM- Time Series- Extended Forecast- MAE- Photovoltaic

Topic: Instrumentation and Computational Physics

[ABS-43]

Rancang Bangun Landslide Early Warning System (LEWS) Berbasis Wireless Sensor Network Menggunakan ESP32 dan LoRaWAN

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Abstract

Tanah longsor merupakan salah satu bencana alam yang berdampak besar terhadap lingkungan, ekonomi, dan keselamatan manusia, sehingga diperlukan upaya mitigasi yang efektif. Penelitian ini mengusulkan rancangan sistem Landslide Early Warning System (LEWS) berbasis Wireless Sensor Network (WSN) dengan tujuan untuk melakukan pemantauan kondisi tanah secara real-time di daerah rawan longsor. Sistem ini menggunakan tiga node sensor, masing-masing dilengkapi dengan sensor akselerometer MPU9250 untuk mendeteksi pergerakan tanah dan sensor capacitive soil moisture untuk mengukur kadar air dalam tanah. Komunikasi antar node dilakukan menggunakan protokol LoRaWAN yang memungkinkan pengiriman data jarak jauh dengan konsumsi daya rendah. Data dari seluruh node dikirimkan ke base station, lalu diteruskan ke server melalui koneksi WiFi menggunakan protokol MQTT. Di sisi server, data disimpan dalam database dan ditampilkan secara real-time melalui website berbasis framework Laravel. Selain itu, sistem dilengkapi dengan fitur peringatan dini melalui aplikasi Telegram untuk memberikan notifikasi kepada pengguna jika terdeteksi kondisi berbahaya.

Keywords: Landslide Early Warning System, Wireless Sensor Network, LoRaWAN, ESP32, MPU9250, Soil Moisture, MQTT, Laravel

Topic: Instrumentation and Computational Physics

[ABS-76]

Optimizing E-Nose Performance for Coffee Aroma Detection through Sample Heating and Machine Learning Integration

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Abstract

Accurate aroma detection is crucial for classifying coffee varieties such as Arabica and Robusta, particularly in applications requiring rapid and cost-effective quality control. This study investigates the effect of sample heating on the performance of a low-cost electronic nose system for aroma-based coffee classification. The system employs an array of metal oxide gas sensors from the MQ series combined with machine learning algorithms, including Support Vector Machine (SVM) and 1-Dimensional Convolutional Neural Network (1D-CNN). Coffee samples were analyzed under various thermal preconditioning scenarios to evaluate the impact of temperature on sensor responsiveness and classification accuracy. Experimental results revealed that moderate heating significantly enhanced the release of volatile organic compounds, leading to stronger sensor signals and improved differentiation between coffee types. Under optimal heating conditions, classification accuracy increased by up to 15% compared to ambient analysis, with the 1D-CNN model achieving the highest performance. These findings demonstrate that thermal treatment is a viable strategy to enhance sensitivity and reliability in low-cost aroma detection systems. Integrating controlled heating with machine learning models offers a promising approach for improving coffee aroma recognition in research settings and industrial quality control.

Keywords: Electronic Nose, Aroma Detection, Sample Heating, Classification, Machine Learning

Topic: Instrumentation and Computational Physics

[ABS-77]

Optimization of Support Vector Machines and Window Sampling for E-Nose-Based Classification of Black and Green Tea Aroma

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Abstract

Aroma classification is critical for quality assurance and authentication in the global tea industry, where traditional sensory evaluation remains limited by subjectivity and inefficiency. This study aims to optimize both sampling window duration and Support Vector Machine (SVM) classifier performance for the objective, rapid classification of black and green tea aromas using a low-cost electronic nose (E-Nose). The custom-built E-Nose, integrating eight MQ-series gas sensors, measured volatile profiles from Indonesian black and green tea samples across three sampling windows-30, 60, and 90 seconds. For each sample, statistical features were extracted from sensor responses, and classification was performed using SVM models with linear and radial basis function (RBF) kernels. Model selection and validation employed leave-one-out cross-validation and grid-based hyperparameter tuning. Results show that a 60-second sampling window is sufficient for near-perfect classification (accuracy &#8805-97.5%), with the linear SVM achieving perfect separation at 90 seconds. Principal Component Analysis (PCA) confirmed clear feature-based separation of tea classes. These findings demonstrate that rapid, objective, and reliable tea aroma authentication can be achieved using simple machine learning models and short sampling durations with a low-cost E-Nose

Keywords: Electronic nose- tea aroma- classification- sampling window- Support Vector Machine
Topic: Instrumentation and Computational Physics

[ABS-85]
Theoretical Study of CO2CO2 Hydrogenation to HCOOH on Subnanometer PdZn Cluster

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Abstract

PdZn alloys have been potentially used as catalysts in various hydrogenation reactions, with each atom having significant roles in binding hydrogen and CO2CO2 molecules. In this work, we conducted density functional theory (DFT) calculations to investigate the catalytic performance and reaction mechanism of CO2CO2 hydrogenation to formic acid on a small, unsupported Pd5ZnPd5Zn subnanocluster. Two reaction pathways are examined: the formate (HCOO) and carboxyl (COOH) routes. In the initial stage of CO2CO2 as well as H2H2 adsorption, the molecules are adsorbed strongly with notable orbital hybridization between CO2CO2, hydrogen, and PdZn atoms, suggesting an activated and well-suited condition for subsequent hydrogenation process. The preferred adsorption of all intermediates in the elementary reactions were investigated. Overall, intermediates in the formate pathway exhibit more stable adsorption and lower activation energies compared to those in the carboxyl pathway, making it the more favourable route in this system. These findings offer insights for designing efficient catalysts by utilizing subnanometer clusters to promote appropriate reaction intermediates.

Keywords: subnanometer cluster, CO2CO2 hydrogenation, Density Functional Theory, heterogeneous catalyst

Topic: Instrumentation and Computational Physics

[ABS-103]

Estimation of Gravitational Lens Parameters at Intermediate Redshifts Using Convolutional Neural Networks (CNN)

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Abstract

Strong gravitational lensing serves as a powerful astrophysical probe, enabling studies of dark matter, galaxy structure, and cosmological parameters. The number of strong gravitational lensing candidates at the galaxy scale is expected to reach O~10^{5} with ongoing and future wide-field galaxy surveys. Current modeling techniques largely depend on conventional fitting-such as least squares or maximum likelihood using Markov Chain Monte Carlo (MCMC)-which, despite their effectiveness, are computationally expensive and demand manual inspection. This motivates the development of faster yet accurate parameter estimation techniques. In this work, we construct a representative training dataset and develop an efficient Convolutional Neural Network (CNN) to estimate crucial lens parameters: the Einstein radius, axis ratio, and position angle. We utilize data from Public Data Release 3 (PDR3) of the Hyper Suprime-Cam Subaru Strategic Program (HSC-SSP). Lens galaxies are selected in the range $0.3<z<0.9$ following the strong-lens probability distribution. Preliminary results indicate that both the selection of the loss function and the regularization strategy markedly influence model performance. SpatialDropout outperforms standard dropout for regularization. Furthermore, prediction accuracy and convergence speed depend heavily on the distribution of the training data, thereby informing the optimal choice of loss function.

Keywords: Strong gravitational lensing, Convolutional Neural Networkc (CNN), Lens parameter estimation

Topic: Instrumentation and Computational Physics

[ABS-106]

Hybrid DAE-GAN Model with U-Net Architecture for Seismic Signal Denoising

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Abstract

Seismic information is crucial in geophysical research, yet its quality is often affected by various types of disturbances that complicate the analysis of subsurface structures. This study introduces a novel solution using deep learning to reduce noise in three-component seismic data. The proposed architecture is a combination of a Denoising Autoencoder (DAE) and a Generative Adversarial Network (GAN). A U-Net model is used as the Generator to reconstruct a noise-free signal from noise-affected data. On the other hand, a CNN-based Discriminator model serves to distinguish between the reconstructed signals and the original clean signals. The loss function for the Generator is a combination of Mean Squared Error (MSE) to ensure accurate reconstruction and an Adversarial Loss to maintain realistic statistical characteristics. Thus, the resulting signal is not only free from disturbances but also retains the original characteristics of seismic data. This model was trained and tested using data from the STEAD (STanford EArthquake Dataset). The model^s quality was evaluated using quantitative metrics such as Signal-to-Noise Ratio (SNR), RMSE, and PRD on a separate test set. The test results show that this model can significantly increase the SNR and produce a clean signal that is visually and spectrally (using STFT) very similar to the original signal. This method holds great potential for enhancing automation and efficiency in the seismic data pre-processing workflow.

Keywords: Seismic denoising, Optuna, Autoencoder, Hybrid CNN-LSTM, Hyperparameter optimization

Topic: Instrumentation and Computational Physics

[ABS-117]

CFD-Based Evaluation of Heat Transfer Behavior for Air, Water, and Molten Salt in a Multi-Region Heat Exchanger

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Abstract

This study presents a comprehensive computational fluid dynamics (CFD) investigation of transient heat transfer performance in a conjugate heat transfer (CHT) multi-region heat exchanger model using OpenFOAM 12. To assess their relative heat transfer characteristics, three candidate working fluids-air, water, and molten salt-were evaluated under identical mass flow rate conditions (0.1 kg/s). A constant inlet-outlet temperature difference was imposed, and the transient behavior of heat transfer rates was analyzed over an extended simulation period of up to 5000 seconds using the PIMPLE algorithm. Results show that water and molten salt exhibit exceptionally stable heat transfer rates with very large thermal time constants (&#964- &#8776- 10&#8311- s), confirming their high thermal capacities and low thermal responsiveness. In contrast, air demonstrates a much lower time constant and pronounced early-stage decay in heat transfer due to its lower density and heat capacity. An exponential decay model was successfully fitted to quantify thermal stabilization rates and long-term heat transfer behavior. The findings highlight the critical influence of fluid thermal properties on the transient performance of heat exchangers and provide valuable insights for optimal working fluid selection in thermal management applications.

Keywords: conjugate heat transfer, OpenFOAM, multi-region heat exchanger, molten salt, transient heat transfer

Topic: Instrumentation and Computational Physics

[ABS-141]

An Internet of Things system design and implementation for monitoring carbon dioxide, methane, humidity, and temperature

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Abstract

An Internet of Things (IoT) system was designed and fabricated as a data acquisition system for monitoring the concentrations of carbon dioxide gas, methane gas, humidity, and temperature. An MQ-135 sensor was utilized to measure carbon dioxide concentration, a TGS2611 sensor for methane, and an SHT11 sensor for humidity and temperature. These three sensors were connected to a NodeMCU ESP32 microcontroller and Wi-Fi module. Specifically, the MQ-135 sensor was connected via input 1, the TGS2611 sensor via input 2, and the SHT11 sensor was connected to the data and clock pins. Data from the three sensors was acquired and processed by the NodeMCU ESP32. The results were then transmitted to three destinations: a serial monitor, a 20x4 I2C LCD, and the Wi-Fi module for transmission to a server computer. On the server computer, software was developed, including programming for the NodeMCU ESP32 using the Arduino IDE, database management with MySQL, and a web application for displaying the measurement results on a website in real-time. A comparative test was conducted between the IoT system and a standard measuring instrument to ensure that the developed system could accurately measure the concentrations of carbon dioxide gas, methane gas, humidity, and temperature.

Keywords: IoT, MQ-134, NodeMCU ESP32, SHT11, TGS2611.

Topic: Instrumentation and Computational Physics

[ABS-147]

Sensor Characterization for Self Service Medical Check Up Machine

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Abstract

Cardiovascular disease is the leading cause of death in the world, causing 41 million deaths each year, or 74% of global deaths from non-communicable diseases (NCDs) such as hypertension, diabetes, and obesity, therefore, early detection and monitoring of NCD risk factors are very important. This study aims to develop an integrated device called ATKM, which combines a tensiometer, glucometer, and BMI-fat analyzer. The study was conducted in three stages, starting with the characterization of sensors to measure blood pressure, blood glucose, and body fat composition. The sensors used include the MPX5050GP pressure sensor, the BPW34 optical sensor with 940 nm NIR-LED, the HC-SR04 and JSN-SR04T proximity sensors, and the load cell sensor. The MPX5050GP sensor showed a coefficient of determination (R^2) of 1 and a sensitivity of 0.012. The BPW34 sensor showed an (R^2) of 0.8736 with a sensitivity of -0.0013. The HC-SR04 and JSN-SR04T proximity sensors showed (R^2) values of 0.9996 and 0.9997, and sensitivities of 0.9943 and 0.9831, respectively. The load cell sensor achieved an (R^2) of 1 and a sensitivity of 1.0056. Overall, the results show that all sensors have good sensitivity and accuracy, making them suitable for integration into ATKM devices.

Keywords: Tensiometer, Glucometer and BMI-Fat Analyzer

Topic: Instrumentation and Computational Physics

[ABS-148]
Modeling Granular Mixtures with Simple Rules: A Student Project in Agent-Based Simulation

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Abstract

In this project, we used simple computer rules to simulate how mixtures of small solid particles (like sand or grains) behave. These mixtures can include different shapes and sizes of particles, and their behavior can be hard to predict. Our model uses a method called agent-based modeling, where each particle is treated like a small “agent” that follows rules based on its properties-such as size, shape, and surface roughness. Instead of using complicated physics equations, we used probabilities to decide how particles interact. We tested our model using real data from experiments with mixed particles, focusing on how they form piles. Our results show that even with simple rules, the model can still show realistic particle behavior. This approach could help create faster simulations for science and engineering.

Keywords: Agent-Based Model, Granular Materials, Computation, Angle of Repose

Topic: Instrumentation and Computational Physics

[ABS-165]

Early Detection of Seismic Signal Anomalies Using Raspberry Pi 5 and Lightweight Machine Learning Models

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Abstract

Real-time detection of anomalous seismic signals is critical for maintaining the reliability of monitoring systems, particularly in environments prone to anthropogenic interference and instrumental instability. This paper presents a lightweight edge computing framework built on the Raspberry Pi 5 and AI-Kit, designed to identify signal anomalies onsite. Seismic data streams in MiniSEED format were segmented and processed to extract statistical and spectral features (e.g., RMS, kurtosis, and Power Spectral Density). Unsupervised learning models, including Isolation Forest and a lightweight Autoencoder, were deployed to detect deviations without the need for labeled datasets. Experimental evaluations using data from the TOJI station showed effective anomaly identification with low inference latency and minimal resource consumption, underscoring the systems suitability for deployment in resource-constrained seismic networks.

Keywords: Seismic anomaly detection, Raspberry Pi 5, real-time monitoring, AI-Kit, unsupervised learning, anthropogenic noise, embedded system, Isolation Forest, Autoencoder

Topic: Instrumentation and Computational Physics

[ABS-172]

Effect of magnetic anisotropy on spin-current driven by resonant dynamics of skyrmion lattices

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Abstract

We study the generation of spin currents in a skyrmion-hosting material lacking inversion symmetry through a microwave-driven resonance mechanism. We analyze the roles of magnetic anisotropy and polarized microwaves using micromagnetic simulation. Our results reveal two distinct skyrmion phases, designated as SkX type-I and SkX type-II, that emerge at low (Kz < 0.1 meV) and high (Kz > 0.1 meV) magnetic anisotropy, respectively. These two phases exhibit fundamentally different spin dynamics. In SkX type-I, the resonant frequency of the breathing mode lies between the clockwise and counterclockwise gyration modes of Bloch-type skyrmions at very low anisotropy and crosses over the counterclockwise mode at Kz ~ 0.04 meV. In contrast, SkX type-II exhibits unique excitation characteristics, notably the absence of the clockwise mode, while counterclockwise modes persist at both low and high frequencies. This highlights the important roles of magnetic anisotropy on spin dynamics. Moreover, the induced spin excitations generate spin currents with unconventional characteristics under polarized microwave excitation. Specifically, low-energy in-plane excitation produces strongly enhanced spin currents under left-handed circularly polarized microwaves, but these currents are suppressed when right-handed circular polarization is applied, regardless of the sign of the Dzyaloshinskii-Moriya interaction. These findings may provide new insights into the complex interplay between magnetic anisotropy and microwave polarization in resonantly driven spin-current generation.

Keywords: Skrymion- Spin dynamics- Spin-current- Micromagnetic simulation

Topic: Instrumentation and Computational Physics

[ABS-221]

Computational Implementation of Linear Reference Elbow (LRE) Method for Optimal Cluster Determination in k-Means Algorithm

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Abstract

The selection of the optimal number of clusters (k) in the K-Means algorithm still relies on the subjective visual elbow method or computationally intensive techniques like the Gap Statistic. LRE was developed to address this issue through an objective and efficient geometric approach. The aim of this research is to provide an automated Python-based solution for determining the optimal k quickly and reproducibly, particularly for industrial applications. The LRE method calculates the orthogonal distance between the points of the WCSS curve and the reference line connecting the first and last points, then selects the k with the maximum distance. LRE successfully processed a sample dataset at a speed 110 times faster than the Gap Statistic method for the same dataset, while the Elbow method could not be timed due to its subjective nature. This significant difference is particularly evident in algorithmic complexity, where LRE maintains linear time complexity (O(n)), while bootstrap-based methods like the Gap Statistic experience exponential time increases. Testing on two benchmark datasets showed that LRE produced consistent outputs. The deterministic nature of this algorithm eliminates the subjective variability that is the main drawback of manual approaches.

Keywords: automated clustering, elbow method, K-Means, computational efficiency

Topic: Instrumentation and Computational Physics

[ABS-229]

Development of an Acoustic Emission Inspection Using Wavelet Scattering Method for Investigating the Shearing Process in Microforming

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Abstract

Real-time defect detection is increasingly vital for in-process quality inspection systems, with automation being employed to address intricate and challenging cracks in small-scale products. Acoustic emission, a non-destructive technique, enables the rapid detection of crack initiation.
Micro-blanking is a critical process in advanced manufacturing. It produces miniaturized components with high precision for applications in electronics, medical devices, and micro-electro-mechanical systems (MEMS).
This study utilized a proprietary 5 kN micro-forming machine to investigate acoustic emissions generated during the micro-blanking process. The materials tested included 0.1 mm SK-5 steel, 0.5 mm magnesium plate, and 0.5 mm copper plate, representing a range of mechanical properties and applications. Fast Fourier Transform (FFT) was applied to analyze frequency domain characteristics, while wavelet scattering transform provided a detailed exploration of time-frequency patterns, capturing non-linear and transient signal features.
The experimental and data scattering analysis revealed that the acoustic emission (AE) signal from the 0.5 mm copper plate exhibited a lower amplitude than the surrounding noise, making detection challenging. In contrast, the 0.5 mm magnesium plate signals demonstrated improved identification capabilities. Among the tested materials, 0.1 mm SK-5 steel exhibited the highest signal amplitude, facilitating superior recognition and offering a robust basis for future feature comparison analyses

Keywords: Acoustics Emission- micro forming- crack monitoring- energy saving

Topic: Instrumentation and Computational Physics

EARTH PHYSICS AND SPACE SCIENCE

[ABS-7]

Magnetic Susceptibility and Heavy Metal Elements in Sand from Batakan Beach

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Abstract

Batakan Beach is a beach located in Panyipatan District, Tanah Laut Regency. The beach was inaugurated in 2019 by the Tourism Office and continues to be managed until now. The coast of the beach is surrounded by white to cream-colored sand. This study aims to determine the magnetic susceptibility value and heavy metal content in the sand of Batakan Beach, Panyipatan District, Tanah Laut Regency. This study was conducted at 1 location with 6 sample points on Batakan Beach using the environmental magnetism method with the Bartington MS2 susceptibility meter and X-Ray Fluorescence (XRF). The average magnetic susceptibility value ranged from 6 x 10^-6 m3/kg to 14.43 x 10^-6 m3/kg. Heavy metals contained in sand samples on Batakan Beach, several elements have passed the heavy metal threshold in sand at this location such as Al, Ti, V, Cr, Fe, and As. At this location, the correlation coefficient value varies at each point. Strong correlations are Fe, Al, Ni, Cr, Eu and Ti.

Keywords: Magnetic proxy, heavy metal, beach, correlation

Topic: Earth Physics and Space Science

[ABS-60]

A Study of the Variability of Hαα Emission Line Parameters in ππ Aqr as a Be Star

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Abstract

B-emission (Be) star is a B type star which shows emission line in its spectrum, especially Hαα, caused by the disk surrounding it. One of the Be stars, ππ Aqr, is a binary Be star in constellation Aquarius which shows variability of double peak Hαα emission line caused by the disk around the primary component. We aim to study physical phenomenon which occurred in the disk of ππ Aqr star based on its spectral data from 2004 to 2024, retrieved from Bess database, by analyzing the variability of its Hαα emission line parameters: the Violet-to-Red peak ratio (V/R), emission-to-continuum ratio (E/C), Equivalent Width (EW), Full Width at Half Maximum (FWHM), and peak separation. The variation of V/R ratio from 2004 to 2019 shows period of 84.1 days which corresponds with orbital period of the binary system, indicating binary system plays a direct role in the shape of the disk. The EW and E/C increase, indicating rising disk activity until 2024. Peak separation roughly suggests expansion in Hαα region in the disk. However, we found that in 2024, the V/R variability shows longer period which disagrees with the previous data. Therefore, we need further spectrum data to confirm this.

Keywords: Be star, ππ Aqr, Spectrum Variability, Line Parameter

Topic: Earth Physics and Space Science

[ABS-65]

Identification of Natural Asphalt (Asbuton) Using the Electrical Resistivity Tomography Method

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Abstract

The deterioration of main roads in Indonesia is often attributed to the poor performance of petroleum-based asphalt under extreme temperatures, which can reach up to 50 C in tropical environments. This type of asphalt tends to deform or peel under such conditions, particularly during peak daytime hours. In response to this issue, Buton natural asphalt (AsButon), sourced from Buton Island, presents a viable alternative due to its superior thermal resistance, maintaining structural integrity at temperatures up to 60 C. To optimize the utilization of AsButon, a comprehensive exploration and resource inventory is required. Electrical Resistivity Tomography (ERT), a widely used geophysical method for shallow subsurface investigations, is proposed for delineating AsButon deposits. AsButon demonstrates a distinct resistivity signature lower than surrounding lithologies such as limestone and sandstone, yet higher than clay making it a suitable target for ERT based detection. Accordingly, ERT offers a non-invasive, efficient, and reliable approach for detecting and characterizing AsButon deposits, contributing to the sustainable development and exploitation of natural asphalt resources in Indonesia.

Keywords: AsButon- Electrical Resistivity Tomography- Sandstone

Topic: Earth Physics and Space Science

[ABS-91]

Estimating Seeing Values From Various Refractive Index Structure Parameter Models at Mauna Kea, Hawaii

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Abstract

Astronomical seeing is the disturbance of astronomical images due to atmospheric turbulence, which affects the quality of astronomical observations through telescopes. Evaluation of seeing conditions is important in observatory site selection, but observations are in situ and limited to certain areas. This study utilizes ERA5 reanalysis data in the form of wind speed at various atmospheric layers (110.9 m to 32,400 m) to model seeing indirectly. By applying the Hufnagel-Valley model, the wind speed profiles are converted into the structure of atmospheric refractive index (C_n^2) and Fried parameter (r_0), which represent the magnitude of seeing. The analysis results show that wind speed variations between atmospheric layers have a significant correlation to the degradation of seeing quality. This approach has the potential to be an alternative method in identifying ideal observatory locations based on global atmospheric data.

Keywords: Seeing- Atmospheric Turbulence- ERA5- Refractive Index- Fried Parameter

Topic: Earth Physics and Space Science

[ABS-101]
Optimization Residual Network for Spiral Galaxy Spin Direction Classification

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Abstract

Spiral galaxies are identified as Z-spiral or S-spiral based on their spin directions. This spin direction relates to the galaxy formation. Hence, the distribution between Z-spiral and S-spiral galaxies offers significant insights into galaxy formation and evolution. Recently, large survey programs, such as the Dark Energy Spectroscopic Instrument (DESI) Legacy Imaging Survey and Hyper Suprime-Cam Subaru Strategic Program (HSC SSP), have been providing huge amounts of high-quality data on galaxies. Hence, the galaxy morphology classification cannot be done conventionally by visual inspection, and machine learning plays a prominent role in this classification process. This study investigates the use of Residual Network (ResNet) for classifying spiral galaxies using data from the DESI and HSC SSP. We use the ResNet-34 model by using a data augmentation procedure based on several criteria during the training process. This architecture model achieves a robust accuracy of up to 90% in the data testing process. This performance shows great potential for large-scale galaxy surveys, where conventional methods of visual inspection are ineffective.

Keywords: Spiral galaxies, Galaxy spin direction, Machine learning, Galaxy classification

Topic: Earth Physics and Space Science

[ABS-110]

Correlation Analysis of Solar Radiation and Cloud Parameters: A Case Study at Jambi Climatological Station Using Ground Observation and Reanalysis Data

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Abstract

Accurate quantification of solar radiation is essential for renewable energy planning and climate research. Automatic Solar Radiation System (ASRS) offers direct measurements of Global Horizontal Irradiance (GHI), Diffuse Horizontal Irradiance (DHI), and Direct Normal Irradiance (DNI). Spatial reanalysis Data products such as Solcast provide valuable data for regions lacking ground-based observations. Surface solar radiation is significantly influenced by atmospheric cloud properties, particularly cloud cover, as measured from ground observations, and cloud opacity derived from reanalysis data.

This study analyses statistical relationship between solar radiation observation parameters obtained from ASRS, Solcast , cloud cover and cloud opacity. Data used were hourly observations in 2023 at the Jambi Climatological Station. Pearson correlation, Spearman correlation, and partial correlation analyses were used to determine linear and nonlinear dependencies between variables. The results showed that GHI, DNI, and DHI parameters obtained from ASRS and Solcast exhibited highest correlation of 0.72 using Pearson and 0.70 using Spearman. At the same time, cloud cover observed in ground observation and cloud opacity of Solcast also showed a significant relationship with Pearson of 0.67 and Spearman of 0.69. Partial correlation analysis, controlling for cloud effects, revealed a strong intrinsic relationship between GHI and DHI from ASRS at 0.76 and GHI and DHI in Solcast reanalysis data at 0.72, indicating an important relationship between global radiation components and diffuse radiation.

These results highlight fundamental interconnection between global radiation components and diffuse radiation. These findings highlight critical role of cloud conditions in modulating surface solar radiation and confirm value of reanalysis products for solar resource assessment and operational forecasting, particularly in cloudy regions such as Jambi, Indonesia. Integrating surface observations with reanalysis data enhances the reliability of solar radiation modelling. It supports the development of more effective forecasting strategies for energy and climate applications in regions with similar climatic characteristics.

Keywords: ASRS, Cloud Cover, Cloud Opacity, Correlation, DHI, DNI, GHI, Ground, Observation, Solar Radiation, Solcast, Reanalysis Data

Topic: Earth Physics and Space Science

[ABS-126]
Preliminary Calculation of Intermediate Mass Black Hole Detection using Microlensing in Globular Cluster

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Abstract

Intermediate-mass black holes (IMBHs) are the key to understanding the formation of supermassive black holes (SMBHs), that are typically found in centers of massive galaxies. In general definition, IMBHs are black holes masses ranging from 10^2M_\odot to 10^5M_\odot. Black hole seeding theory suggests that IMBHs formed at high redshifts (z \geq 10) through gravitational collapse of Population III stars, direct collapse of protogalaxy clouds, or stellar collisions inside high-density clusters. These IMBHs evolve into SMBHs through accretion and mergers. However, not all of these IMBHs are successful in forming SMBH. Those that fail are hypothesized to be observable in the local universe, particularly in globular clusters and dwarf galaxies. IMBHs have yet to be definitively detected, however several strong candidates have been located in the cores of globular clusters. This study looks into the possibility of detecting IMBHs via microlensing events in globular clusters located near the direction of the Galactic Center. This work describes the early selection of globular cluster candidates based on criteria including mass, core-collapse status, extinction, and the number of background stars. Six globular cluster candidates were selected by this process: Pal 6, Djorg 2, NGC 6553, NGC 6626, NGC 6638, and NGC 6656. Preliminary statistical calculation of microlensing probability is also presented.

Keywords: Intermediate-mass black hole, globular cluster, microlensing

Topic: Earth Physics and Space Science

[ABS-131]
Soil Physicochemical Properties and Magnetic Grain Morphology of The Batujaya Archaeological Site

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Abstract

The Batujaya archaeological site, located in Karawang, is one of the oldest archaeological sites in Indonesia. Anthropogenic activities in and around the area may alter the soil characteristics. This study investigated several physicochemical properties of soils within and outside the site, including bricks used in the site's structures. Notably, soils inside the site exhibited lower magnetic susceptibility (chiLF) values compared to those outside, while bricks showed higher chiLF values than soils. All samples had chiLF values above 10 x 10-8 m3kg-1, indicating the dominance of ferrimagnetic minerals. Bivariate analysis revealed a positive correlation between chiLF and chiFD (%) for soils within the site, suggesting pedogenic magnetic minerals, whereas soils outside the site showed a negative correlation, implying anthropogenic sources. The electrical conductivity (EC), total dissolved solids (TDS), and pH of the soils ranged from 50-2080 uS/cm, 44-1746 mg/L, and 4.6-10.1, respectively. Scanning electron microscopy (SEM) analysis revealed magnetic grains with hedral and spherule shapes, featuring various surface textures. Inductively coupled plasma optical emission spectroscopy (ICP-OES) analysis showed that the samples were dominated by aluminum (Al) and iron (Fe). Moreover, arsenic (As) and tin (Sn) were detected in soils within the site but not in those outside.

Keywords: magnetic susceptibility, Batujaya, physicochemical properties, magnetic mineral, archaeology

Topic: Earth Physics and Space Science

[ABS-132]

Fuzzy Logic-Based Classification of Crescent Moon Images Using Brightness and Thickness Parameters

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Abstract

Accurate observation of the crescent moon holds significant importance in both astronomical research and calendrical determinations, such as the Islamic lunar calendar. However, detecting the thin crescent under bright sky conditions remains a challenging task due to its low contrast and subtle visual features. This study presents a novel fuzzy logic-based approach for classifying the visibility of crescent moon images obtained at the Observatorium Universitas Ahmad Dahlan (UAD). The methodology involves image preprocessing and fuzzification based on two key perceptual parameters: brightness and arc thickness. Brightness is categorized into low, medium, and high, while thickness is classified as thin, medium, and thick. A fuzzy inference system, developed in Python, is employed to evaluate and classify the images using triangular membership functions. The defuzzification process determines the visibility status of the crescent moon in one of three categories: not visible, maybe visible, and highly visible. Based on the analysis of 61 crescent moon images, 18 were classified as not visible, 11 as maybe visible, and 32 as highly visible. These results represent an important step toward the development of image recognition procedures using machine learning. Such recognition is essential for assessing crescent moon visibility under challenging daylight conditions and contributes to enhancing observational consistency in crescent moon detection for both calendrical and astronomical purposes.

Keywords: crescent moon, fuzzy logic, image processing, astronomical observations

Topic: Earth Physics and Space Science

[ABS-143]

Analysis of the Relationship Between Microtremor Dominant Frequency and Topographic Features

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Abstract

The relationship between surface topography and dominant frequency obtained from microtremor measurements offers valuable insight into seismic site conditions. This study aims to analyze how variations in topographic features influence the spatial distribution of dominant frequencies. Microtremor data were collected across multiple points with diverse topographic settings, including ridges, slopes, and valleys. The Horizontal-to-Vertical Spectral Ratio (HVSR) method was employed to determine the fundamental frequency at each measurement point. The results show a clear trend: valley areas tend to exhibit higher dominant frequency values, while lower values are associated with ridge-like features. This suggests that topographic configuration may play a significant role in the amplification and resonance behavior of seismic waves, likely due to variations in subsurface sediment geometry induced by surface morphology. The findings highlight the potential of using microtremor analysis as a rapid and non-invasive tool to assess subsurface conditions and their relationship to surface features. This approach can contribute to better seismic hazard assessment and land use planning, especially in areas where detailed geotechnical data are not available.

Keywords: -

Topic: Earth Physics and Space Science

[ABS-159]

Spatio Temporal Monitoring of Land Surface Temperature in Rubber and Oil Palm Plantations: A Google Earth Engine-Based Analysis

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Abstract

Land conversion to rubber and oil palm plantations impacts local Land Surface Temperature (LST). This study aimed to monitor spatio temporal LST changes in rubber and oil palm plantations in Tanah Laut Regency, South Kalimantan, using Google Earth Engine (GEE). Objectives included comparing LST between these plantations and forests, and examining LST vegetation relationships. The methodology involved processing Landsat satellite imagery via GEE to extract LST and Normalized Difference Vegetation Index (NDVI). Results typically indicate that conversion of forests to both oil palm and rubber plantations consistently resulted in increased LST. Forests exhibited the lowest LST, followed by rubber plantations, then mature oil palm, with young oil palm plantations showing the highest LST increases (up to 3.4 oC warmer than forests for young oil palm). Over a 20 years period in Tanah Laut regency, an average daytime surface temperature increase of 1.05 oC was observed, linked to land cover changes. A negative correlation between LST and NDVI is commonly observed, signifying that denser vegetation is associated with lower temperatures. In conclusion, plantation development elevates LST. This research provides crucial data for sustainable land management and climate adaptation strategies in Tanah Laut, highlighting the thermal consequences of specific agricultural LULCC.

Keywords: Suhu Permukaan Lahan- Perkebunan Karet- Perkebunan Kelapa Sawit- Google Earth Engine- Perubahan Tutupan Lahan

Topic: Earth Physics and Space Science

[ABS-160]

Preliminary Results: P-wave Seismic Tomography Beneath of Java Subduction Zone, Indonesia

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Abstract

Java Island, a volcanic island in Indonesia, is shaped by the movement of tectonic plates beneath it. The complex process of subduction beneath Java Island, involving the Indo-Australian Plate being forced beneath the Eurasian Plate, results in frequent volcanic eruptions and earthquakes. This movement creates immense pressure and friction, leading to seismic activity. The history of past earthquakes and tsunamis near Java Island serves as a reminder of the devastating potential of tectonic activity in the region. The people of Java are accustomed to living with the constant threat of volcanic eruptions and earthquakes, but also appreciate the beauty and resources it brings. Efforts to monitor and predict potential seismic events are being made to improve disaster preparedness in Java and surrounding regions. This study uses ISC-EHB catalogue data recorded in the 1964-2018 period which has 28,545 earthquake events recorded by 512 earthquake recording stations consisting of 590,880 phase P. Resolution testing with various speed grids shows that the resolution is medium with a size of 100 km x 100 km x 100 km provides the most optimal results in the inversion process. The tomographic inversion results provide a good overview of the subsurface structures in the Earth's crust and mantle to a depth of 450 km below the Java. There is a high velocity anomaly up to a depth of 300 km which is possibly related to the subduction of the Java More detailed subsurface information from this research can be used as input for mapping disaster-prone areas to help support disaster mitigation in the area.

Keywords: Java, Tomography, ISC-EHB data.

Topic: Earth Physics and Space Science

[ABS-162]

Investigation of Deep Aquifers in the Catchment Area of Haruman Peak, Malabar Mountains, Using the Audio-Magnetotelluric (AMT) Method

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Abstract

Haruman Peak, located in the Malabar Mountains in the southern region of the Bandung Basin, plays a significant role as a recharge area for the Bandung-Soreang Groundwater Basin. This recharge function is supported by the area^s dense vegetation, high rainfall, and steep slopes that direct surface water toward the basin. Previous studies using the DC-resistivity method identified a shallow aquifer in the Puncak Haruman area at depths of less than 40 meters. This study aims to explore the presence of deeper aquifers using the Audio-Magnetotelluric (AMT) method.
AMT data acquisition was carried out at six measurement points located in the northern section of a suspected fault zone. The data were processed through 1D inversion to produce resistivity models, which were interpreted to determine subsurface lithology and identify aquifer layers. The results indicate that the subsurface of the Haruman Peak area consists of soil, Malabar-Tilu Volcanics (Qmt), and Waringin-Bedil Andesite of the Old Malabar Formation (Qwb). Aquifer layers were identified with resistivity values ranging from 5 &#937-m to 308 &#937-m, at various depths: MB-02 (805 m), MB-03 (97 m), MB-04 (1,456 m), MB-05 (140 m, 459 m, and 2,080 m), and MB-06 (530 m). It is inferred that deep aquifers at MB-03, MB-05, and MB-06 contribute significantly to groundwater in the southern Bandung Basin.

Keywords: Deep Aquifer, Audio Magnetotelluric, Haruman Peak, Bandung Basin

Topic: Earth Physics and Space Science

[ABS-168]
Preliminary Study on Magnetic Anomaly Analysis in Parongpong, West Java, Indonesia: Implications for Landslide Risk Mitigation

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Abstract

Parongpong, West Java, Indonesia, lies within moderate to high landslide zones due to its steep volcanic topography, active tectonic setting, and extreme rainfall patterns. This preliminary study integrates magnetic anomaly analysis with regional geological data to identify subsurface factors contributing to slope instability. Ground-based magnetic surveys were conducted across moderate to high-risk zones, comprising 82 measurement stations. Areas with low magnetic anomalies indicate a correlation between subsurface weathering and potential landslide triggers. The study demonstrates the utility of magnetic surveys as a preliminary tool for landslide hazard mapping, providing actionable insights for land-use planning and early-warning systems. Further integration of geotechnical and hydrological data is recommended to enhance risk assessment models.

Keywords: Magnetic anomaly, landslide area, Parongpong

Topic: Earth Physics and Space Science

[ABS-175]

Geometrical Influence on the Orthogonal Ratio of the Earth Ambient Vibration Evaluated by Particle Dynamics Method

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Abstract

Ground vibration signals recorded by low-frequency multi-channel geophones provide information about the physical characteristics of a medium. Using the passive seismic method, vibrations are measured in three channels: horizontal and vertical directions. Since the characteristics of mediums, such as sediment thickness and soil hardness, are contained in low-amplitude ambient vibrations, further data selection is required to remove spikes in the signals induced by active sources. This work is necessary to reveal the characteristics that reflect the medium's physical condition from the signal. Conventionally, signal processing is based on the Horizontal-to-Vertical Signal Ratio (HVSR) calculation. The information obtained, such as sediment thickness and sub-surface shear velocity (vs30), as well as the amplification factor and seismic vulnerability, are crucial for geotechnical applications. This data can be extracted from HVSR analysis. However, a complete understanding of the complex vibration signal shape related to the medium and geological conditions is not fully understood. To gain a deeper understanding of the mechanism, numerical modeling is performed using a particle dynamics method. The vibration pattern of chosen particles on the surface is studied, and its relation to the geometry of the fixed base region is investigated. The simulation results show systematic changes in signal form when processed with a similar HVSR method as a response to the shape of the fixed base.

Keywords: Horizontal-to-Vertical Signal Ratio- Shear wave velocity- Particle dynamics modeling

Topic: Earth Physics and Space Science

[ABS-190]
Prediction of X-ray solar flare based on active region evolution

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Abstract

Accurate, timely warnings of solar flares are vital for safeguarding satellites, power grids, and HF communications. We develop a supervised machine-learning classifier that predicts, 24-hours in advance, whether an active region will produce a C-, M-, X-class flare or remain quiet, by ingesting two-day time-series of heliographic longitude, McIntosh and magnetic classifications, area and spot count. Trained on January 1998-June 2018 events and validated on an independent July 2018-March 2025 set, the model reaches 66.5% overall accuracy (precision = 0.70, recall = 0.66, F1 = 0.68). Skill is highest for the dominant no-flare class (F1 = 0.82) but drops for rarer M (F1 = 0.26) and X (F1 = 0.13) flares, reflecting severe class imbalance. These results benchmark the current limits of feature-based flare forecasting and motivate future work on balanced training strategies and physics-informed predictors to improve detection of high-impact events.

Keywords: solar flare- prediction- space weather- machine learning

Topic: Earth Physics and Space Science

[ABS-196]

Dimensionality analysis of the volcano region derived from Magnetotelluric Data

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Abstract

In many cases, three-dimensional resistivity structures are often approximated by two-dimensional models without checking the dimensionality of the structure prior to perform the modeling. However, such approximation can be misleading if the structure is purely 3-D where electromagnetic fields cannot be separated into TE and TM modes. Then, a dimensionality analysis is important in order to get the general feature of the structure in particular in 3-D structure as expected in volcanic area. There are many methods to analyze dimensionality such as Groom-Bailey decompositions, which assume that the regional structure is two-dimensional, and Bahr^s method. Here, we examine the dimensionality mainly by the phase tensor and induction vector, which do not assume regional two-dimensional structure at all. We map the phase tensor diagrams as a function of the coordinate angle and the induction vector. The parameter “beta” and “alpha” are also used as an index for the three-dimensionality of the structure. In this paper, we have also examined the effect of regional three-dimensional structure to the 2-D model. The synthetic and real magnetotelluric data obtained from Kusatsu volcano, Japan and Papandayan volcano were used in this study.

Keywords: Volnaco, Resistivity, Magnetotelluric

Topic: Earth Physics and Space Science

[ABS-197]

Analysis of Landslide Susceptibility Zones Post-2022 Cianjur Earthquake Based on 2D Resistivity Modeling And Geospatial Data

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Abstract

The 2022 Cianjur earthquake caused severe damage, including significant landslides in Cijedil Village, Cugenang District, Cianjur Regency. This study aims to identify the slip plane as one of the factors triggering landslides using the Wenner-Schlumberger configuration of the geoelectric resistivity method. Additionally, this study models the landslide susceptibility zoning in Cianjur Regency through a geospatial approach based on probabilistic statistics using the frequency ratio method. This method is used to analyze the relationship between causative parameters and historical landslide occurrences to generate a more accurate landslide susceptibility map.
The results of geoelectric analysis from three survey lines on the Cijedil slope indicate that the slip plane depth ranges from 5 to 15 meters. This depth data is then integrated as one of the parameters in the frequency ratio modeling to improve the accuracy of landslide susceptibility zoning. This approach introduces a novelty in susceptibility zoning studies, which typically rely solely on spatial data. The geospatial modeling results show that the obtained zoning has a high level of accuracy, with an AUC validation value of 0.892. The high-susceptibility area covers 5.92% of the total region, with more than 25% of landslide events detected in this zone. The findings of this study are presented in a thematic map titled “Landslide Susceptibility Zoning in Cianjur Regency, West Java,” which is expected to serve as a reference for landslide disaster mitigation efforts in the region.

Keywords: slip surface, frequency ratio, geographic information, resistivity geoelectric, landslide susceptibility zone

Topic: Earth Physics and Space Science

[ABS-204]

Hypocenter Determination and Uncertainty Analysis Using the Reciprocal Fast Marching Wavefront Modeling (RFMW)

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Abstract

Accurate determination of earthquake parameters is vital for seismologists due to their potential hazards and the importance of risk mitigation. Among these parameters, the hypocenter location is especially critical, as it significantly influences seismic tomography and inversion processes.
This study introduces a novel approach for hypocenter localization based on the Reciprocal Method of Fast Marching Wavefront Modeling (RFMW). This method models seismic wavefronts by solving the eikonal equation through the Fast Marching Method (FMM).
We evaluate the effectiveness of RFMW in locating hypocenters within highly heterogeneous subsurface media and in addressing the nonlinear aspects of wave propagation. Additionally, we investigate how hypocenter accuracy is affected by the spatial configuration and distribution of seismograph stations.
The RFMW approach was applied to determine several hypocenters beneath Lake Toba in North Sumatra. Results reveal a strong correlation between the seismograph network configuration-particularly station spacing and distribution-and the accuracy of hypocenter localization. Interestingly, increasing the number of seismographs did not significantly enhance accuracy, highlighting the importance of optimal station placement.

Keywords: Hypocenter accuracy- Wavefront modeling- Reciprocal method- Fast Marching Method

Topic: Earth Physics and Space Science

[ABS-206]
Damage Assessment of the 2022 Cianjur Earthquake using Satellite-based Damage Proxy Map

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Abstract

On 21 November 2022, an earthquake struck Cianjur, West Java, Indonesia, with the epicentre approximately 11 kilometres southwest of Cianjur and a shallow depth of 10 kilometres. This earthquake is believed to have originated from the Cimandiri Fault, which is characterised by a strike-slip mechanism, although it is likely that other as yet unidentified faults contributed to the event. This seismic event caused widespread damage to buildings and infrastucture, resulting in loss of life, injuries, and displacemen of residents. To approximate damage areas caused by the earthquake by the earthquake, we used the damage proxy map (DPM) method using Sentinel-1 Synthetic Aperture Radar (SAR) imagery. Two Sentinel-1 data acquired on 11 and 23 November with ascending path and VV polarisation, were used to analyse changes in the area before and after the earthquake. The results show that the DPM method is effective in identifying areas affected by the earthquake, with the most severe damage concentrated in the Cugenang area. The accuracy of these findings was validated through a comparison between the damaged areas identified by the DPM method and field surveys conducted by the Centre for Volcanology and Geological Hazard Mitigation (PVMBG). This study demonstrates the ability of DPM to efficiently support post-earthquake damage assessment and has the potential to serve as a reference for disaster response and mitigation planning.

Keywords: Damage Proxy Map- Cianjur earthquake- Synthetic Aperture Radar

Topic: Earth Physics and Space Science

[ABS-207]

One Dimensional Modelling of Magnetotelluic Data using Deep Learning Based Inversion and its application to delineate the fault structure

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Abstract

The problem in the inversion of Magnetotelluric data has occurred due to its nonlinear and ill-posed nature. Local minimum during inversion and relying on reliable initial models were found in the existing gradient-descent approaches. To overcome this problem, we proposed a modelling of Magnetotelluric method based on deep learning inversion. This approach directly builds an end-to-end mapping from apparent resistivity and phase data to resistivity anomaly model. The implementation of the proposed method contains two stages: training and testing. During the training stage, the weight sharing mechanism of fully convolutional network is considered, and only the single anomalous body model samples are used for training, which greatly shortens the modelling time and reduces the difficulty of network training. The unknown combinatorial anomaly model can be reconstructed from the Magnetotelluric data using the trained network. The proposed method is tested in both synthetic and field data. The real Magnetotelluric data obtained from the fault system were applied in this inversion. By Comparison to the existing inversion, the results show that the deep learning-based inversion method proposed in this paper is computationally efficient and has high imaging accuracy.

Keywords: Machine learning, Magnetotelluric, Resistivity, fault system

Topic: Earth Physics and Space Science

[ABS-209]

Hydrogeophysical Characterization of Groundwater Distribution in the Upper Citarum River Basin Using DC Resistivity Method

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Abstract

Groundwater is a critical natural resource increasingly impacted by population growth, land-use changes, and intensive industrial activities, including those within the Citarum River Basin (CRB), Indonesia. Over the past decade, the CRB has undergone a significant transformation, from one of the most polluted rivers to a progressively cleaner system. These surface water improvements are hypothesized to correlate with subsurface groundwater conditions. This study investigates the depth and spatial distribution of the groundwater table in the Upper Citarum Basin using the Direct Current (DC) resistivity method with a Schlumberger array configuration. Geophysical data were acquired along four survey lines across the Citarik and Cikeruh sub-watersheds using an AGI SuperSting R8/IP resistivity meter. The acquired data were processed with AGI EarthImager 2D software to produce two-dimensional resistivity profiles of the subsurface. The results delineated three major resistivity zones: (1) low-resistivity zones (2-6 Ohm m), interpreted as saturated clay layers- (2) medium-resistivity zones (6-15 Ohm m), associated with sandy clay deposits- and (3) high-resistivity zones (15-35 Ohm m), corresponding to compact, relatively dry clay. The groundwater table was identified at depths ranging from approximately 0.6 to 17 meters. These findings offer a preliminary hydrogeological framework of the Upper Citarum Basin, providing a valuable baseline for future groundwater monitoring and sustainable water resource management.

Keywords: Groundwater, Resistivity, Upper Citarum River, Hydrogeophysical survey

Topic: Earth Physics and Space Science

[ABS-210]

Characterization of Fractured Rajamandala Carbonate Reservoir Induced by the Dynamics Activity of Cimandiri Fault West Java

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Abstract

The Rajamandala Formation, an Oligo-Miocene carbonate rock formation in West Java, is known for its groundwater scarcity due to very low porosity (tight porosity). However, tectonic stress activities along the Cimandiri Fault likely create significant induced fracture zones, contributing to productive aquifers in areas close to the fault contact. To characterize the aquifer system and the subsurface groundwater flow patterns within these fault zones, we conducted 2D Self-Potential (SP) imaging and Long-Offset Resistivity Tomography, supported by isotope analysis and dissolved mineral analysis.

The results of this study provide a comprehensive understanding of groundwater potential and subsurface flow patterns, both in karst's porosity and voids formed by limestone dissolution and in fracture zones influenced by Cimandiri Fault stress activities. Hopefully, this research will contribute to strategic solutions for addressing groundwater scarcity in the Rajamandala Formation region.

Keywords: Rajamandala carbonate, fractured reservoir, resistivity tomography, isotope analysis, dissolved mineral analysis

Topic: Earth Physics and Space Science

[ABS-218]

Rainfall Climatology Associated with Cyclonic and Non Cyclonic Events in Indonesia New Capital Based on IMERG and IBTrACS

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Abstract

The new capital city of Indonesia (IKN) is vulnerable to extreme rainfall events influenced by large-scale atmospheric systems, including tropical cyclones originating from the western Pacific Ocean. Extreme rainfall can occur even during the dry season when tropical cyclones occur. This study aims to analyze the contribution of tropical cyclones to rainfall in IKN. This study utilizes tropical cyclone track data from the International Best Track Archive for Climate Stewardship (IBTrACS) and daily rainfall data from IMERG from 2000 to 2024. Rainfall separation was carried out using the Objective Synoptic Analysis Technique (OSAT) by applying a 500 km radial buffer from the cyclone centre and a temporal window of plus minus 3 days around the peak intensity of each cyclone. Initial results have successfully separated spatially and temporally cyclone related and non cyclone related rainfall throughout IKN. This separation provides a solid basis for further analysis of the climatology of tropical cyclone rainfall in IKN, including long term trends, spatial distribution, and the influence of key atmospheric parameters such as relative humidity and sea surface temperature on tropical cyclone related rainfall. The results of this study are expected to support disaster risk reduction strategies and climate resilience planning in IKN.

Keywords: Tropical cyclone, Extreme rainfall, IMERG, IBTrACS, Indonesia New Capital

Topic: Earth Physics and Space Science

[ABS-219]

Assessment of Subsurface Structures for Geothermal Exploration in Curup, Indonesia, Using Satellite-Derived Gravity Anomalies

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Andalas University

Abstract

The Suban Curup area in Rejang Lebong, Bengkulu Province, Indonesia, is a tourism destination and lies along the subduction zone of the western Sumatra magmatic arc, near the Ketaun fault segment and the active Kaba Volcano. These geological features suggest significant geothermal energy potential, although comprehensive mapping efforts remain limited. This study utilizes satellite-derived gravity data from the GGMPlus 2013 model, comprising 1,937 data points acquired from Curtin University (Perth) and TU Munich (TUM). The Bouguer anomaly was calculated using a refined field correction approach based on full-scale topographic gravity data from the SRTM2 model. Regional and residual anomalies were separated through two-dimensional radial spectral analysis and continuous upward continuation techniques. The results indicate that the average thickness of the sedimentary layer in the study area exceeds 100 meters, suggesting the presence of shallow subsurface structures. These findings provide a foundation for subsequent 3D modelling of density contrasts, taking into account the regional geological context of Curup. The analysis reveals patterns of intrusive igneous rocks with high-density contrast, the Merapi magma chamber with low-density anomalies, and fault segment boundaries marked by abrupt density changes. The outcomes of this study are expected to inform and support local government initiatives in developing geothermal power infrastructure in the region.

Keywords: Geothermal, gravity, Inversion modeling, Ketaun segment, Kaba volcano

Topic: Earth Physics and Space Science

[ABS-248]

Techno Economics Analysis of Off-Grid Photovoltaic (PV) Systems in a Remote Area in Indonesia for Rural Village Electrification

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Abstract

Indonesia is an archipelago country with over 17,000 islands spread across the equator with abundance resource of solar energy potential. However, due to its challenging geographical and terrain, many rural villages in Indonesia remains without electricity access. Hence it inhibits people in such remote islands to increase their social economic welfare. In efforts to reach out the last miles of 100% electrification coupled with the Energy Transition Pathway to achieve Net Zero Emission by 2060, utilizing the renewable resources such as solar energy is the key solution. This paper aims to assess the off-grid photovoltaic (PV) systems for rural village electrification in Indonesia. The study focusses on analysing various configuration, namely diesel generator as the base scenario, solar PV only, solar PV with battery, solar PV with diesel, and solar PV with battery and diesel. The levelized cost of energy (LCOE) approach is utilized to assess the cost-competitiveness of the off-grid PV systems compared to the diesel generator as a typical rural electrification solution in Indonesia. The study uses Homer software to model and evaluation these different scenarios.

Keywords: Rural Electrification, Off-Grid, Remote Area, Solar Photovoltaic, Levelized Cost of Electricity (LCOE)

Topic: Energy and Environmental Physics

ENERGY AND ENVIRONMENTAL PHYSICS

[ABS-38]

Experimental investigation of the effect of piston mass on charging efficiency in the compressed air-gravity energy storage

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Abstract

The intermittent electricity production from solar energy causes an increase in the need for energy storage technology. This research aims to determine the effect of piston mass on the charging efficiency of compressed air-gravity energy storage (CA-GES) in solar power plant applications. This research was conducted through experiments with a CA-GES prototype connected to an energy source from a solar power plant. The mass of the piston varied by 0.3 kg, 0.7 kg, and 2 kg, and the solar power source varied by 8 V and 10 V electric voltage, with the target pressure on the CA-GES tank side of 2 bar. The results showed that the highest efficiency of 68% was obtained at an input voltage of 8V and a piston mass of 2 kg. As the piston mass increases, the charging efficiency increases, which means increasing the electrical energy stored in the CA-GES energy storage system.

Keywords: solar energy- compressed air-gravity energy storage (CA-GES)- piston mass- charging- efficiency

Topic: Energy and Environmental Physics

[ABS-40]
Rainfall Changes in the Northern Region of Aceh

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Abstract

Abstract. The Northern Region of Aceh (Aceh Bagian Utara) is located at the northern tip of Sumatra Island, with coordinates bordered by the Indian Ocean to the west and the Malacca Strait to the north. Previous studies reported that rainfall (RF) during the 2010-2019 period increased compared to the 2000-2009 period. However, these studies did not explain whether this increase is significant or when the change began. This study aims to address these questions. Rainfall data for a 30 year period (1995-2024) were obtained from the Sultan Iskandar Muda Meteorological Station and the Aceh Climatology Station. The data were analyzed using various statistical methods, allowing for comparison of the results from each method. The analysis revealed that the data were not normally distributed, and therefore, non-parametric statistical methods were used for further analysis. The Mann-Kendall test yielded a Z value of -0.018, which is within the acceptance region of Ho, indicating that no significant trend in rainfall changes was found. Robust regression resulted in a trend line equation with a relatively small slope, with a coefficient of determination 0.3676. The 5-year Moving Average graph shows a slight increase in rainfall after 2012. However, this increase is not strong enough to be considered a permanent trend. Based on the three analytical approaches, it is concluded that no significant trend in annual rainfall increase or decrease was observed in the Northern Region of Aceh during the period of 1995-2024. The observed annual fluctuations are more influenced by natural atmospheric variability, such as extreme ENSO and IOD events, and other equatorial atmospheric instabilities, making it impossible to definitively determine when the increase in rainfall began.

Keywords: Climate Change, ENSO, IOD, Mitigation, Adaptation, Mann-Kendall

Topic: Energy and Environmental Physics

[ABS-44]

Analysis of Lenard's Effect on The Sedudo Siraman Tradition in Beauty Aestetics Myth

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Abstract

Sedudo waterfall is believed to have mystical powers. The sedudo siraman tradition has always been carried out routinely at the beginning of the month of syuro by the people of Nganjuk since the time of the Majapahit Kingdom. The myth of eternal youth as a result of the siraman ritual at Sedudo waterfall is logical if there is scientific evidence. The lenard effect occurs in the phenomenon of electric charge separation when water is separated aerodynamically. The resulting lenard ions are negatively charged and float in the air. The resulting air can change the way the brain works because blood flow and serotonin level increase. Analysis of the light spectrum, electron kinetic energy, and radio frequency are associated with positive human emotions so that they have an impact on youth. Systematic literature review is used in qualitative research of the ethnophysical type so that the concept appears concrete and easy to understand.

Keywords: lennard's effect, siraman tradition, myth

Topic: Energy and Environmental Physics

[ABS-53]

Analysis The Future of Palm Tree Plantation Tower For Telecommunication Purpose

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Abstract

The collaborative product research program activities of this faculty are in the form of utilizing and analyzing the future of palm plantation system as a development of clean and affordable energy. The concept of this activities of intelligent processing of the future of palm plantation system by utilizing fruit, fronds and harvest residues gradually into a source of clean energy that is up to date. The processing of the future of palm plantation system uses a series of information technologies such as a platform, including the Internet of Things, Big Data, Cloud computing in physics and artificial intelligence in mathematics in programming data to process and transform it to the efficient and comfortable information system for users. Finding a solution of which is economical and sustainable, a virtual power plant is formed from diesel generators with a capacity of 5.6 MW and a waste of palm tree plants as power generating plant with a capacity of 1 MW have been created. With the aim of introducing and familiarizing this information technology system using multiple devices such as smartphones and personal computers to farmers and entrepreneurs of the future of palm plantation system, it is hoped that it can improve the conditions and processing capabilities to become a profitable business in terms of cost and technological efficiency as it is required by Islamic banking and telecommunication stakeholders. The research instrument uses data from the Ministry of Forestry for statistical data and the sample used is the use of a system prototype. The Research Team has conducted preliminary observations and interviews regarding the need for an information technology infrastructure to be implemented in Jambi Province, in order to improve the welfare of Islamic entrepreneurs of the future of palm plantation system. The final result of the first year^s research is the information technology system for the future of palm plantation system.

Keywords: Internet of Things, Big Data, Cloud computing,artificial intelligence, welfare

Topic: Energy and Environmental Physics

[ABS-66]

Interactions of Terrestrial and Marine Heatwaves in the Coastal Zone of Southern Java

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Abstract

Coastal regions are increasingly exposed to extreme thermal events both on land and at sea, including terrestrial heatwaves (THWs) and marine heatwaves (MHWs), under intensified climate variability. Along the southern coast of Java, MHWs are influenced by intraseasonal, interannual, and broader regional-to-global variability, including patterns in the Indian and Pacific Oceans. While MHWs have been relatively well studied, THWs remain poorly documented in this region. This study investigates the frequency and overlap of THWs and MHWs along the southern coast of Java, particularly in Pameungpeuk, West Java, from 2000 to 2022. Using satellite-based sea surface temperature and ground-based air temperature data, we identified 23 co-occurring events, with durations often exceeding 10 days. MHWs peaked during the rainy season, while THWs were more frequent in transitional months. Notable meteorological anomalies accompany these extremes: reduced surface wind speeds, increased land temperatures (up to 1.4oC), and varying humidity responses-positive during MHWs and negative during THWs. These patterns highlight the complexity of land-sea thermal interactions and underscore the need for integrated climate risk assessments in coastal regions.

Keywords: Java Island, Climate change, Terrestrial heat waves, Marine heat waves, Interannual variability

Topic: Energy and Environmental Physics

[ABS-70]
Electrodeposition of Trimetallic PtSnNi and its Application as Electrocatalyst in Ethanol Electrooxidation

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Abstract

Platinum (Pt) is widely used as an electrocatalyst in fuel cells due to its high catalytic activity. However its high cost and susceptibility to poisoning limit its practical applications. To overcome these limitations, trimetallic catalysts such as PtSnNi offer improved catalytic performance through synergistic effects. Tin (Sn) enhances ethanol electrooxidation (EOR) by modifying the electronic structure of Pt and facilitating oxygen containing species adsorption. Nickel (Ni), when combined with Sn, promotes CC bond cleavage and CO desorption from the Pt surface. In this study, PtSnNi electrocatalysts were synthesized on a Cu substrate via potentiostatic electrodeposition. The resulting catalysts were characterized using SEM, EDX, and XRD, while electrochemical performance was evaluated via EIS, CV, LSV and CA. The deposited PtSnNi formed cluster like structures with partial agglomeration and an avarage particle size of 337.33 nm. EDX confirmed elemental compositions of Pt (70.31%) Sn (28.85%) and Ni (0.84%), and XRD revealed a hexagonal crystal structure. The catalyst demonstrated excellent electrochemical properties with a low charge transfer resistance (4.94 ohm), high catalytic activity (29.66 mA/cm2), a tafel slope of 140 mV/dec, and good long term stability. These results confirm the potential of PtSnNi as a promising electrocatalyst for ethanol electrooxidation.

Keywords: Electrodeposition, electrocatalyst, ethanol electrooxidation, PtSnNi

Topic: Energy and Environmental Physics

[ABS-88]

Three plausible ways to improve performance of seawater battery for low budget electrical energy storage system (EESS) in particular for developing countries

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Abstract

It is known that renewable energy sources are growing fast in cities to mitigate greenhouse gas emissions in response to climate change and fossil resource challenges. Seawater batteries offer an attractive alternative for EESS due to the abundance and low budget of seawater, especially for coastal regions and developing countries. However, their performance often suffers from low energy density, poor cycle life, and corrosion issues. We consider here three plausible ways to improve SWB performance in the near future. Nonetheless, further research is recommended. Among other things discussed here, we also present a summary of cost-benefit analysis for implementing in-situ seawater battery for EESS, as there are interests on such a SWB technology especially in recent years.

Keywords: Renewabel Energy, Seawater, EESS, Battery, SWB performance

Topic: Energy and Environmental Physics

[ABS-89]

Development Of Pyrolysis Chamber Heating System with Temperature Control Based on ESP32 for Oil Production from Plastic Pet Waste

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Abstract

Plastic waste, particularly polyethylene terephthalate (PET), poses a growing environmental concern due to increasing household consumption of plastic-based products. Pyrolysis presents a promising thermochemical conversion method to recycle PET waste into valuable products, such as fuel oil. This study focuses on the development of an efficient and controlled pyrolysis chamber heating system utilizing the ESP32 microcontroller platform to monitor and regulate temperature in real-time, ensuring process stability and consistent product quality. Experimental testing was conducted to evaluate the system^s performance under controlled conditions. The results demonstrate that the system successfully converts PET waste into pyrolysis oil with characteristics suitable for vehicle fuel. This approach highlights the potential of smart temperature-controlled pyrolysis as a sustainable and efficient solution for mitigating PET plastic waste and generating alternative energy sources.

Keywords: Pyrolysis, PET Waste Conversion, Electric Furnace, Temperature Control, ESP32

Topic: Energy and Environmental Physics

[ABS-102]
Synthesis, Characterization, and SCAPS-1D Simulation of FASnI3FASnI3 and CsSnI3CsSnI3 as Active Layers in Perovskite Solar Cells

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Abstract

Tin-based perovskites have gained significant attention as promising lead-free perovskite solar cells (PSCs) due to environmental concerns. Among tin-based perovskites, formamidinium tin triiodide (FASnI3FASnI3) and cesium tin triiodide (CsSnI3CsSnI3) exhibit strong potential for efficient solar energy harvesting, owing to their favorable optoelectronic properties. This study investigates the synthesis and characterization of FASnI3FASnI3 and CsSnI3CsSnI3 perovskites using a one-step precursor deposition method. X-ray diffraction (XRD) analysis confirms the orthorhombic phase of FASnI3FASnI3, while CsSnI3CsSnI3 exhibits peaks corresponding to SnI2SnI2 and Cs2SnI6Cs2SnI6. Optical characterization reveals bandgaps of 1.42 and 1.28 eV for FASnI3FASnI3 and CsSnI3CsSnI3, respectively, with the CsSnI3CsSnI3 demonstrating extended absorption toward longer wavelengths. The photovoltaic performance of Sn-based PSCs with an architecture of ITO/PEDOT:PSS/perovskite/C60C60/Ag was simulated using the SCAPS-1D code. The FASnI3FASnI3-based device achieved a power conversion efficiency (PCE) of 19.2% (VOCVOC = 0.95 V, JSCJSC = 28.27 mA/cm2cm2, FF = 71.04%), while the CsSnI3CsSnI3-based cell showed a PCE of 18.64% VOCVOC = 0.77 V, JSCJSC = 31.38 mA/cm2cm2, FF = 77%). These findings highlight the potential of Sn-based perovskites for high-performance, eco-friendly photovoltaic devices.

Keywords: Tin-based perovskite, FASnI3FASnI3, CsSnI3CsSnI3, bandgap, crystal structure, SCAPS-1D.

Topic: Energy and Environmental Physics

[ABS-104]

Structural Integrity Assessment of a Pyrolysis Incinerator Chamber Using FEM in Support of Green Environmental Technologies

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Abstract

The background of this study is the increasing demand for sustainable waste management solutions, which has accelerated the development of pyrolysis incinerators as part of green environmental technologies. These systems require a structurally robust primary chamber capable of withstanding high thermal and mechanical loads. Conventional designs often fail under such conditions, necessitating further analysis to ensure durability and safety. This study employs Finite Element Analysis or FEA to evaluate the structural performance of the primary chamber of a pyrolysis incinerator. The chamber consists of a 50 mm refractory concrete lining and a 3 mm SS400 steel casing. A 3D CAD model was developed and simulated using ANSYS Mechanical 2021R1, incorporating internal pressure loading or 0.5 MPa and fixed boundary conditions. Mesh sensitivity analysis was conducted to ensure numerical accuracy. The results show that the maximum von Mises stress is 7.357 times 10 minus 4 MPa, which is significantly below the yield strength of SS400, yielding a safety factor exceeding 300. The maximum deformation recorded is 3.85 mm, equivalent to 0.19 percent of the chamber diameter. Mesh convergence was validated through the strain energy error index, confirming the stability of the solution. In conclusion, the structural integrity of the chamber is validated under pyrolysis operating conditions. The low stress and deformation levels indicate the robustness of the design, with potential for optimization in material usage for eco efficient applications. This supports its implementation in green environmental technologies aimed at promoting sustainable and resilient waste to energy systems. Further studies are recommended, including coupled thermal mechanical analysis and experimental validation.

Keywords: Pyrolysis, Finite Element Method, Structural Analysis, Incinerator, Green Technologies, Thermal Stress

Topic: Energy and Environmental Physics

[ABS-167]

Resrad Parameter Sensitivity Simulation to Ascertain Local Parameters for Safety Assesment on Bangka Island

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Abstract

Tin slag and waste generated by tin processing often contain Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM), which pose significant radiation risks to workers, the public, and the environment. To mitigate these risks, the development of a dedicated landfill facility is crucial for managing the radiological impact. This study analyzes the implications of storing TENORM waste, both prior to and following the construction of a landfill. The challenge of TENORM management persists, primarily due to the presence of long-lived radionuclides such as uranium-238 (U-238), thorium-232 (Th-232), and potassium-40 (K-40), which are often inadequately handled by industry. To address this, a landfill design was proposed and evaluated using RESRAD-Offsite 4.0 software, focusing on radiation safety and long-term exposure risks. To optimize safety and resource allocation, the study also investigated the sensitivity of RESRAD input parameters in estimating radiation dose and cancer risk. A total of 194 parameters were simulated, with approximately half exerting a significant influence on dose estimations. For example, the U-238 animal product intake transfer factor showed negligible sensitivity, affecting dose estimates by just 0.00001 mSv/year over 1,000 years. Conversely, precipitation demonstrated moderate sensitivity due to its effect on radionuclide leaching. Most notably, the fraction of time spent indoors on contaminated ground exhibited extremely high sensitivity, with dose estimates increasing by more than 11,000%. These findings underscore the importance of precise parameter selection in risk modeling and support the development of safer, more effective TENORM waste disposal strategies.

Keywords: Radiation Dose, Safety Assessment, Resrad Offsite, Parameter Sensitivity, TENORM

Topic: Energy and Environmental Physics

[ABS-170]
Physical Properties of Sedimen in Ciliwung River as Proxy Indicator of Anthropogenic Activities

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Abstract

The Ciliwung River in the middle zone of segment III is one of the river areas in West Java that is experiencing a decline in environmental quality. Intensive human activities have implications for pollutant input in the form of anthropogenic materials that could affect the condition of the Ciliwung River. This research was conducted to identify the condition of the Ciliwung River regarding the influence of anthropogenic materials on river sediments, particularly through the abundance of magnetic minerals via the identification of physical properties in the sediment. Measurement of physical properties was carried out using susceptibility, EC, TDS, and hysteresis parameters, along with chemical parameters such as pH in river sediments. The results revealed that the susceptibility value ranged from 893.31x10-8 to 3.712.11x10-8 m3/kg, with susceptibility frequency dependent less than 4 per cent, indicating multidomain grains and hysteresis parameter results containing magnetite, which suggested a contribution from anthropogenic materials. Meanwhile, the results of EC, TDS, and pH measurements in both sediment and hydrology remain within the standards established based on their function.

Keywords: river sediment, magnetic susceptibility, anthropogenic

Topic: Energy and Environmental Physics

[ABS-191]
Machine Learning for Real-Time Environmental Monitoring and Air Quality Prediction

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Abstract

Te are developing a method to analyze real-time environmental data using machine learning. The data is collected from sensors that measure carbon dioxide (CO&#8322-) concentration, temperature, humidity, wind speed and direction, and fine particle levels (PM2.5). The sensor data is transmitted using the public MQTT broker at mqtt://mqtt.eclipseprojects.io. Our goal is to detect patterns in the data, understand the relationships between environmental variables, and predict changes in air quality and climate conditions. We use several machine learning techniques, including regression, classification, and deep learning. Before training the models, we clean the data to handle noise and missing values, and select key features to improve model accuracy. Model validation is also performed to ensure reliable predictions. The analysis accompanied with visualization is expected to provide insights that can support environmental policy and help address climate change.

Keywords: Machine learning- environmental data- CO&#8322-- PM2.5- temperature- humidity- wind- MQTT- air quality prediction

Topic: Energy and Environmental Physics