THE 8TH INTERNATIONAL CONFERENCE ON APPLIED & ENGINEERING PHYSICS (CAEP-8)

HỘI NGHỊ TOÀN QUỐC LẦN THỨ 8 VỀ VẬT LÝ KỸ THUẬT VÀ ỨNG DỤNG

ABSTRACTS & PROGRAM

Binh Duong, Vietnam. 12-15 October 2023

https://iop.vast.vn/icaep/2023/index_e.html

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Vietnam Academy of Science and Technology
Vietnam National University Ho Chi Minh city
Institute of Physics, VAST
Vietnamese-German University
Institute of Tropical Technology, VAST
International Center of Physics, VAST
Vietnam Atomic Energy Institute, MOST
National Center for Technological Progress, MOST
Vietnam Society of Physics
Vietnam Engineering Physics Association
Advanced Photoníc Research Institute, GIST, Korea
Institut des Sciences Moléculaires d'Orsay, CNRS, France
National Taiwan University of Science and Technology, Taiwan
Suranaree University of Technology, Kingdom of Thailand
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Nguyen Thi Hoai (VGU)

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Asia Pacific Center for Theoretical Physics (APCTP)

Vietnamese-German University

Advanced Photonics Research Institute (APRI)

Vietnam National University Ho Chi Minh City

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BRIEF PROGRAM

Session A: Engineering Physics

Session B: Applied Physics

Date / *Time*	**THURSDAY** *12 October 2023*	**FRIDAY** *13 October 2023*	**SATURDAY** *14 October 2023*	**SUNDAY** *15 October 2023*
8:30 - 12:00		**- OFFICIAL OPENING** **- PLENARY SESSION I**	**- SESSION A** **- SESSION B**	**Social Program**
LUNCH				
13:30 - 17:30	**REGISTRATION**	**- VGU Tour** **- SESSION A** **- SESSION B** **- POSTER SESSION**	**- SESSION A** **- SESSION B** **- PLENARY SESSION II** **- OFFICIAL CLOSING**	
18:30 - 20:30		**Welcome Party**	**Conference Party**	

PROGRAM

October 13, 2023 (Friday)

PROGRAM

October 13, 2023 (Friday)

07:30 - 08:15 **Registration**

08:15 - 08:30 **Music performance**

08:30 - 09:15 **Official Opening**

Prof. Nguyen Dai Hung *(Vietnam Physical Society, Vietnam)*
Prof. Ha Thuc Vien *(Vietnamese-German University, Vietnam)*
Prof. Thomas Pino *(Institut des Sciences Moléculaires d'Orsay, France)*
Prof. Do-Kyeong Ko *(Advanced Photonics Research Institute, GIST, Korea)*
Prof. Dinh Van Trung (*Institute of Physics, VAST, Vietnam*)

Ceremony of VPS Dedication Arward 2023 to Prof. Cao Minh Thi
(President, Physical Society in Ho Chi Minh City)

CONFERENCE PHOTOGRAPH

PLENARY SESSION I

Chairperson:

Prof. Tran Quoc Tien *(IMS, Vietnam)*
Prof. Elmer S. Estacio *(UPD, Philippines)*

PL-01 **09:15 - 09:40** **TRANSNATIONAL UNIVERSITY: A SUCCESSFUL STORY OF EXCELLENT TEACHING AND RESEARCH TRANSFER FROM WEST TO EAST**

Ha Thuc Vien

Vietnamese-German University

PL-02 **09:40 - 10:05** **INSTITUTE OF PHYSICS AND THE INTERNATIONAL CENTRE OF PHYSICS: PROMOTING SCIENTIFIC RESEARCH AND INTERNATIONAL COLLABORATION**

Dinh Van Trung

Institute of Physics, VAST

PL-03 **RESEARCH ACTIVITIES IN APRI AND X-RAY**
10:05 - 10:30 **FLUORESCENCE IN MULTI-LAYER MATERIALS WITH UTRASHORT LASER-INDUCED X-RAY AND ELECTRONS**

Do-Kyeong Ko

Advanced Photonics Research Institute, GIST, Korea

10:30 – 10:45 **COFFEE BREAK**

PL-04 **ELECTROMAGNETIC METAMATERIALS: FROM**
10:45 - 11:10 **FOUNDATIONS TO FUTURE FRONTIERS**

Bui Son Tung, Bui Xuan Khuyen, Pham Thanh Son and Vu Dinh Lam*

Graduate University of Science and Technology, VAST

PL-05 **IMAGING THE SHADOWS OF BLACK HOLES**
11:10 - 11:35

Satoki Matsushita

Institute of Astronomy and Astrophysics, Academia Sinica, Taiwan

PL-06 **MATERIALS FOR SUSTAINABLE ENERGY APPLICATIONS**
11:35 - 12:00

Rungsima Yeetsorn*

King Mongkut's University of Technology North Bangkok (KMUTNB), Thailand

12:00 - 13:30 **LUNCH**

13:30 - 14:30 **VGU TOUR**

14:30 - 14:45 **COFFEE BREAK**

SESSION A:

Engineering Physics

October 13, 2023 (Friday)

Chairperson:

Prof. Do-Kyeong Ko (APRI, GIST)
Prof. Vu Dinh Lam (GUST, VAST)

A-01 **14:45 - 15:10** **POTENTIAL USE OF MOLECULAR SIEVE CARBONS FOR HYDROGEN STORAGE AND DEUTERIUM PURIFICATION**

(Invited talk)

TX Nguyen, SK Bhatia, H Jobic and J-S Bae

Vietnamese-German University, Vietnam

A-02 **15:10 - 15:35** **LOW PHASE NOISE MICROWAVE SYNTHESIS FROM ULTRA-STABLE LASERS USING OPTICAL FREQUENCY COMBS**

(Invited talk)

Dang Bao An Tran, Giuseppe Marra, Patrick Gill

National Physical Laboratory, United Kingdom

A-03 **15:35 - 16:00** **FEASIBILITY STUDY ON INTEGRATED MULTI-PIXEL HETERODYNE RECEIVER CHIP AND MODULE WORKING AT 220 GHz**

(Invited talk)

Ming-Jye Wang*, Teddy Huang, Yan-Jun Wang, Tse-Jun Chen, Chao-Te Li, Chao-Ching Wang, Fang-Yu Hsu, and Jia-Ruei Nian

Institute of Astronomy and Astrophysics, Academia Sinica, Taiwan

A-04 **16:00 - 16:25** **ELECTROSYNTHESIZED NANOSTRUCTURED MOLECULARLY IMPRINTED POLYMER FOR DETECTING DICLOFENAC MOLECULE**

(Invited talk)

Dinh-Hai-Ngan Nguyen, Quang-Hai Le, Tuan-Linh Nguyen, Hong-Nam Pham; Van-Quynh Nguyen*

University of Science and Technology of Hanoi - VAST

A-05 **LARGE SPIN HALL EFFECT IN BISB TOPOLOGICAL**
16:25 - 16:40 **INSULATOR/CrO x /CoFeB/MgO WITH PERPENDICULAR MAGNETIC ANISOTROPY FOR ULTRALOW POWER SOT-MRAM**

H. H. Huy, Z. Ruixian, T. Shirokura, S. Takahashi, Y. Hirayama and P. N. Hai

Tokyo Institute of Technology, Japan

A-06 **ENHANCING DIELECTRIC BARRIER DISCHARGE**
16:40 - 16:55 **PERFORMANCE BY LIQUID INSULATOR**

Duc Ba Nguyen, Quang Hung Trinh, Lan Thi Phan and Hoang Tung Do

Duy Tan University

A-07 **PROTOTYPE OF ONLINE REAL-TIME SYSTEM FOR**
16:55 - 17:10 **RADIATION DOSE MONITORING**

Vo Hong Hai*, Nguyen Phan Hao , Nguyen Chi Thanh, Nguyen Thi Hoai Nam, Nguyen Hong Ly, Nguyen Thi Quynh, Nguyen Hoang Vi Quan, Nguyen Anh Tu

University of Science - VNUHCM, Vietnam

A-08 **LONG RANGE PLASMONIC DEVICES FOR FLUORESCENCE**
17:10 - 17:35 **PHOTONICS**

(Invited talk - online)

Julien Laverdant*, Cam Nhung Vu, Le Xuan Hung, Pham Thu Nga

Université de Lyon, France

14:45 - 17:30 **POSTER SESSION**

Chairperson:

Dr. Do Hoang Tung *(IOP, VAST)*

Dr. La Vinh Trung *(VGU)*

18:30 - 20:00 **WELCOME PARTY**

SESSION B:

Applied Physics

October 13, 2023 (Friday)

Chairperson:

Prof. Tran Thien Thanh *(VNUHCM)*
Dr. Tran Thanh Hai (*IMECH, VAST)*

B-01 **14:45 - 15:10**

ADVANCES IN SCIENCE AND TECHNOLOGY IN REHABILITATION

(Invited talk)

The Thuong Nguyen*

Institute of Biomedical Physics, Ho Chi Minh City, Vietnam

B-02 **15:10 - 15:35**

FROM PHYSICAL STIMULATION TO VISUAL PERCEPTION: STUDY ON THE INFLUENCE OF PERSPECTIVE BACKGROUND TO THE OBJECT'S SIZE ESTIMATION

(Invited talk)

Pham Hong Duong*, Tran Ngoc Thanh Trang, Duong Thi Giang, Le Anh Tu, Nguyen Tri Lan

Institute of Material Sciences, VAST

B-03 **15:35 - 15:50**

DETERMINATION OF CHARACTERISTICS OF OSL DOSIMETERS AT CENTER FOR NUCLEAR TECHNOLOGIES

Thi Thao Quyen Trinh*, Huu Loi Le, Manh Tri Le, Truong Son Truong, Quang Son Ong, Van Doanh Ho

Center for Nuclear Technologies, Vietnam

B-04 **15:50 - 16:15**

RICE HUSK SILICA AS A SOLUTION TO GLOBAL FOOD SECURITY AND CTS PROGRAM TO SUCCEED TOGETHER

(Invited talk)

Nguyen Viet Hung

BSB Nanotechnology Joint Stock Company, Vietnam

B-05 **SOME RESULTS OF RESEARCH ON DISINFECTION AND**
16:15 - 16:30 **PRESERVATION OF REUSABLE KIDNEY FILTER WHITH OZON GAS**

Trinh Dinh Trung*, Trinh Ngoc Dieu, Tran Van Phu, Luu Tien Khien, Nguyen Xuan Thiem, Cao Duc Chinh

Center for High Technology Development, VAST

B-06 **MAGNETIC/GOLD NANOCRESCENTS LIKE NANO-**
16:30 - 16:45 **HEATER AND NANO-PROBE**

Xuan Hoa Vu*, Thi Thu Ha Pham, Emmanuel Fort, Michael Levy, Tran Thu Trang and Nguyen Van Dang

Thai Nguyen University, Vietnam

B-07 **A COMBINATION OF NON-INVASIVE DIAGNOSTIC AND**
16:45 - 17:00 **MEDICAL TRAINING DEVICES IN SPINAL REHABILITATION: PILOT STUDY**

The Thuong Nguyen*,Thong Le Van, Nhat An Nguyen

Institute of Biomedical Physics, Ho Chi Minh City, Vietnam

B-08 **EVALUATION OF CALIBRATION RESULTS FOR GAMMA**
17:00 - 17:15 **AND X- RAY DOSE RATE MEASUREMENT DEVICES**

L.H. Loi*, H.V. Doanh, O.Q. Son, N.H. Long, H.D. Tam, D.V. Hoang

Center for Nuclear Technologies, Vietnam

B-09 **ABATEMENT OF METHYLENE BLUE IN WATER BY A**
17:15 - 17:30 **PLASMA LIQUID INTERFACE**

Duc Trung Vo, Nga Thi Dinh, Tung Hoang Do, Son Truong Nguyen and Duc Ba Nguyen

Hochiminh City University of Natural Resources and Environment

14:45 - 17:30 **POSTER SESSION**

Chairperson:
Dr. Do Hoang Tung *(IOP, VAST)*
Dr. La Vinh Trung *(VGU)*

18:30 - 20:00 **WELCOME PARTY**

PROGRAM

October 14, 2023 (Saturday)

SESSION A:

Engineering Physics

October 14, 2023 (Saturday)

Chairperson:

Dr. Ka Lok Chan (*RAL Space*)
Dr. Nguyen Xuan Anh (*IGP, VAST*)

A-09 **08:30 - 08:55**

OPTIMIZING TERAHERTZ PHOTOCONDUCTIVE ANTENNA EMITTER OPERATION BY THE INTEGRATION OF PLASMONIC STRUCTURES BOTH IN THE OPTICAL AND TERAHERTZ FREQUENCY REGIONS

(Invited talk)

Elmer Estacio

University of the Philippines Diliman, Philippines

A-10 **08:55 - 09:20**

HIGH-RATE REACTIVE SPUTTERING OF OXIDE FILMS FOR MICRO-STRUCTURED OPTICAL APPLICATIONS

(Invited talk)

Jiri Olejnicek*, Martin Cad, Jiri Smid, Michal Kohout and Zdenek Hubicka

Institute of Physics, Czech Academy of Sciences, Czech Republic

A-11 **09:20 - 09:45**

HYBRID STRUTURE OF 2D COPPER OXIDE/ REDUCED GRAPHENE OXIDE FOR PHOTODETECTOR APPLICATIONS

(Invited talk)

Duc Anh Ngo, Nhat Minh Nguyen, Thanh Van Tran Thi, Cong Khanh Tran, Le Thai Duy, Vinh Quang Dang*

University of Science, VNUHCM, Vietnam

A-12 **09:45 - 10:10**

SELF-HEALING, REPROCESSABLE AND RECYCLABLE RUBBER BASED ON METAL THIOLATE IONIC NETWORK

(Invited talk)

Madya, Raa Khimi*

Universiti Sains Malaysia

A-13 **10:10 - 10:25** **ASSESSMENT OF RICE WATER REQUIREMENT UNDER CLIMATE CHANGE SCENARIOS IN AN GIANG PROVINCE USING THE CROPWAT 8.0 MODEL**

Nguyen Duc Anh*, Vo Luong Hong Phuoc

University of Science, VNUHCM, Vietnam

10:25 - 10:35 **COFFEE BREAK**

A-14 **10:35 - 11:00** **APPLICATION OF HIGH VOLTAGE ELECTRICAL FIELD, ELECTROMAGNETIC FIELD AND ULTRASOUND IN SEPARATION AND EXTRACTION PROCESS**

(Invited talk)

Tawiwan Kangsadan*, Ajalaya Boripun, Sayan Ruankon, Rossarin Ampairojanawong

King Mongkut's University of Technology North Bangkok (KMUTNB), Thailand

A-15 **11:00 - 11:25** **EXPLORING THE VERSATILITY OF THERMAL AND COLD PLASMA IN MATERIALS SCIENCE APPLICATIONS**

(Invited talk)

Nguyen Thanh Tung

Institute of Materials Science, VAST

A-16 **11:25 - 11:40** **THICKNESS-DEPENDENT n-MoS 2 /p-GaN VERTICAL HETEROSTRUCTURE FOR HIGH RESPONSIVITY SELF-POWERED UV PHOTODETECTORS**

Nur'Adnin Akmar Zulkifli*, Atiena Husna Abdullah Ripain, Suhana Mohd Said and Rozalina Zakaria

University of Malaya, Malaysia

A-17 **11:40 - 11:55** **RESEARCH ON THE OPTIMAL LENGTH CALCULATION OF Yb^{3+} ACTIVE FIBER IN THE FABRICATION OF HIGH-POWER FIBER LASER SOURCE**

Cao Khac Thien, Do Viet Hoang, Ngo Hai Long, Le Van Binh, Banh Quoc Tuan*

NACENTECH, Vietnam

A-18 **11:55 - 12:10** **PLASMONIC-ENHANCED MoS_2 ON SILICON SUBSTRATE WITH MONOMETALLIC NANOPARTICLES FOR HIGHLY EFFICIENT PHOTO SENSOR**

Atiena Husna Abdullah Ripain*, Nur'Adnin Akmar Zulkifli, Wan Haliza Abd Majid and Rozalina Zakaria

University of Malaya, Malaysia

12:10 - 13:30 **LUNCH**

Chairperson:

Dr. Jiří Olejníček ***(Czech Academy of Sciences)***
Dr. Dang Vinh Quang ***(VNUHCM)***

A-19 **13:30 - 13:55** **THE SYNTHETIC METHODS FOR REALIZING HIGHLY STABLE PEROVSKITE QUANTUM DOTS**

(Invited talk)

Chang-Lyoul Lee*

Advanced Photonics Research Institute, GIST, Republic of Korea

A-20 **13:55 - 14:10** **EFFECT OF ORGANIC ELECTRON DONATING DOPANT ON TRAP DENSITY IN 7-BIS(DIPHENYLPHOSPHORYL)-9,9'-SPIROBIFLUORENE AS AN ELECTRON TRANSPORTING LAYER**

F. H. Abd Nasir*, W. S. Wong, K. L. Woon, N. Chanlek, H. Nakajima and P. Songsiriritthigul

University of Malaya, Malaysia

A-21 **14:10 - 14:35** **CONCENTRATOR PHOTOVOLTAICS SYSTEM BASED ON NON-IMAGING OPTICS DEVICES AND ITS AUTOMOTIVE APPLICATION**

(Invited talk)

Ngoc Hai Vu*, Viet Duc Le

Phenikaa University, Vietnam

A-22 **COMBINING MULTIPLE EMR RANKING RESULT IN**
14:35 - 15:00 **CONTENT-BASED IMAGE RETRIEVAL**

(Invited talk)

Dao Van Tuyet*, Tran Van Huy, Ngo Hoang Huy, Pham Thi Kim Dzung

Thuy Loi University Branch in Binh Duong Province, Vietnam

A-23 **HYPERSPECTRAL REMOTE SENSING OF ATMOSPHERIC**
15:00 - 15:25 **COMPOSITION**

(Invited talk)

Ka Lok Chan

Rutherford Appleton Laboratory (RAL) Space, United Kingdom

A-24 **DIRECT CONVERSION OF OPTICAL TO ELECTRICAL**
15:25 - 15:50 **SIGNALS IN A CE:YAP SCINTILLATOR WITH A TIO_2 PHOTOCONDUCTIVE SENSOR**

(Invited talk - online)

Marilou Cadatal-Raduban*, Tomoki Kato, Taiyo Hayashi, Gakuto Ozawa, Shingo Ono, Kohei Yamanoi, Michal Kohoutd Zdeněk Hubička, Jiří Olejníček

Massey University, New Zealand

15:50 - 16:05 COFFEE BREAK

SESSION B:

Applied Physics

October 14, 2023 (Saturday)

Chairperson:

Prof. Nguyen Tien Khiem (*IMECH, VAST*)
Dr. Jahangir Kamaldin *(Universiti Sains Malaysia)*

B-10 **08:30 – 08:55** **AN INVESTIGATION OF THE IMPACT OF COMPLEX TERRAIN ON THE STRUCTURE OF PLANETARY BOUNDARY LAYER BY VEHICLE-BASED LIDARS**

(Invited talk)

Wei-Nai Chen, M. Roja Raman

Research Center For Environmental Changes, Academia Sinica, Taiwan

B-11 **08:55 – 09:20** **THE NATIONAL GEOPHYSICAL STATION NETWORK FOR CLIMATE CHANGE ADAPTATION AND NATURAL DISASTER PREVENTION**

(Invited talk)

Nguyen Xuan Anh

Institute of GeoPhysics, VAST

B-12 **09:20 – 09:35** **ANALYTICAL APPLICATIONS OF NUCLEAR TECHNIQUES FOR SOCIO-ECONOMIC DEVELOPMENT**

Tran Thien Thanh*, Huynh Dinh Chuong, Vo Hoang Nguyen, Phan Long Ho, Chau Van Tao

University of Science, VNUHCM

B-13 **09:35 – 09:50** **CHARACTERISTICS ON LARGE-SCALE WAVE STRUCTURE IN SOUTHEAST ASIA**

Yu Yi Liow*, Suhaila M Buhari, Mardina Abdullah, Tajul Ariffin Musa, Tulasiram Sundarsanam

Universiti Teknologi Malaysia

B-14 **09:50 – 10:05** **THE INVESTIGATION OF SLEEP INERTIA IS CONDUCTED THROUGH THE EXAMINATION OF THE POWER SPECTRUM DENSITY OF ELECTROENCEPHALOGRAPHY SIGNALS**

Khang Diep Thua*, Khai Le Quoc, Linh Huynh Quang

Ho Chi Minh City University of Technology (HCMUT), VNUHCM

B-15 **10:05 – 10:20** **A STUDY ON RADIATION LEVELS AND THE IMPACT ON CONCRETE MAC AS REPLACING OF CEMENT FOR THERMOELECTRIC FLY ASH**

Lam Duy Nhat*, Ho Van Doanh, Le Quang Vuong, Truong Thanh Sang, Do Thu Thuy, Tran Thien Thanh, Hoang Duc Tam

University of Science, VNU HCM

10:20 - 10:35 **COFFEE BREAK**

B-16 **10:35 - 11:00** **LASER DIAGNOSTICS OF FLAMES: LABORATORY INVESTIGATION OF ASTROPHYSICALLY RELEVANT NANOPARTICLES**

(Invited talk)

Thomas Pino

Université Paris Saclay, France

B-17 **11:00 - 11:25** **DEVELOPMENT OF SOLAR/LED LIGHTING SYSTEM FOR AGRICULTURE APPLICATION**

(Invited talk)

Tran Quoc Tien*, Vu Thi Nghiem, Nguyen Manh Hieu, Tong Quang Cong, Pham Van Truong, Tang Duc Loi, Bui Binh Nguyen, Pham Bich Ngoc, Vu Ngoc Hai, Vu Duc Tu, Vu Hoang, Nguyen Thanh Phuong, Kieu Ngoc Minh, Seoyong Shin

Institute of Materials Science, VAST

B-18 **11:25 - 11:40** **PRELIMINARY RESULTS IN TRANSFER OF 40K AND 226 Ra FROM SOILTO SHORT-TERM VEGETABLE**

Nguyen Thi Le Hang, Huynh Thi Yen Hong, Nguyen Van Thang, Le Cong Hao*

Nuclear Technique Laboratory, University of Science, VNUHCM

B-19 **11:40 - 11:55** **EXACT SOLUTION FOR THE QUANTUM RABI MODEL WITH THE A^2 TERM**

Nguyen Quang San*, Dao Van Tuyet

Belarusian State University

B-20 **11:55 - 12:10** **APPLYING REMOTE SENSING INTEGRATED WITH MACHINE LEARNING AND GIS-DSAS TO ASSESS RIVERBANK EROSION IN THE HAM LUONG RIVER, VIETNAMESE MEKONG DELTA**

Le Van Quyen*, Ha Nam Thang, Nguyen Luyen Phuong Doan, Sameh A. Kantoush, Luc Anh Tuan, Doan Van Binh

Vietnamese-German University

12:10 - 13:30 LUNCH

Chairperson:

Prof. Thomas Pino (*Université Paris Saclay*)
Dr. Nguyen Thanh Tung (*IMS, VAST*)

B-21 **13:30 - 13:55** **NANOTECHNOLOGY AND NANOSAFETY: THAILAND AS CASE OF STUDY**

(Invited talk)

Ramjitti Indaraprasirt

National Science and Technology Development Agency, Thailand

B-22 **13:55 - 14:20** **SUSTAINABLE DEVELOPMENT OF NANOMATERIALS FOR THE GLOBAL TRADE FROM THE PERSPECTIVE OF GHS AND GLP**

(Invited talk)

Jahangir Kamaldin

Universiti Sains Malaysia

B-23 **14:20 - 14:35** **APPLYING MACHINE LEARNING COUPLED WITH MONTE CARLO FOR PREDICTING THE CONCENTRATION OF SODIUM COMPOUNDS IN GAMMA TRANSMISSION MEASUREMENTS**

Nguyen Thanh Dat*, Tran Vu Thien An, Doan Thi Xuan Quynh, Hoang Thi Kieu Trang, Hoang Duc Tam

Ho Chi Minh City University of Education, VNUHCM

B-24 **THE INITIAL RESULTS OF THE RESEARCH ON THE USE OF**
14:35 – 14:50 **WASTE MATERIALS TO PRODUCE ENVIRONMENTALLY FRIENDLY CONCRETE FOR RADIATION SHIELDING**

Vu N. Quang, Tran N. M. Trung

Ho Chi Minh City University of Education, VNUHCM

B-25 **STRUCTURAL HEALTH MONITORING - AN INVERSE**
14:50 – 15:15 **PROBLEM OF SCIENCE AND ENGINEERING**

(Invited talk)

Nguyen Tien Khiem, Tran Thanh Hai

Institute of Machanics, VAST

B-26 **OPTICAL DESIGN AND APPLICATIONS**
15:15 – 15:30 Vo Xuan Son

Crystal Optics Inc., Japan

B-27 **SYNTHESIS OF IRON-BASED MATERIALS USING A**
15:30 – 15:55 **PLASMA-IN-LIQUID PROCESS**

(Invited talk)

Arlette Vega-González*, Xavier Duten, Luis G. Romero-Esquivel

French National Research Center (CNRS), France

15:55 - 16:05 **COFFEE BREAK**

PLENARY SESSION II

October 14, 2023 (Saturday)

Chairperson:

Prof. Dinh Van Trung (*IOP, VAST*)
Dr. Chang-Lyoul Lee *(APRI, GIST)*

PL-07 **COSMIC LENSES**

16:05 – 16:30 Jeremy Lim

University of Hong Kong

PL-08 **RESEARCH AND MANUFACTURE SOFT PIEZOELECTRIC**
16:30 – 16:55 **CERAMIC SYSTEMS FOR APPLICATION IN HYDROACOUSTIC TRANSDUCERS**

Do Viet On*, Dung Thi Hoai Trang, Truong Van Chuong, Le Tran Uyen Tu, Le Phuoc Dinh and Vo Thanh Tung**

University of Science-Hue University, Vietnam

16:55 – 17:15 OFFICIAL CLOSING

18:30 - 20:00 CONFERENCE PARTY

POSTER SESSION

14:45 - 17:30, October 13, 2023

Chairperson:

Dr. Do Hoang Tung ***(IOP, VAST)***

Dr. La Vinh Trung ***(VGU)***

POSTER SESSION

P-01 THE SMALL EFFECTIVE MODE AREA IN FLOWER-SHAPED HOLLOW CORE PHOTONIC CRYSTAL FIBRES

Nguyen Thi Thuy, Pham Viet Tuan, Le Tran Uyen Tu, Nguyen Thi Oanh, Hoang Trong Duc, Chu Van Lanh

Hue University of Education

P-02 IMPROVING EFFICIENCY OF TRACKING GAMMA SOURCE BASED ON DEEP LEARNING METHOD

Truong Hoang Linh, Huynh Dinh Chuong, Hoang Duc Tam, Nguyen Huynh Duy Khang

Ho Chi Minh City University of Education

P-03 A REVIEW STUDY ON AIN LAMB WAVE RESONATOR TECHNOLOGY

Vo Quang Sang, Yiting Duan

Le Quy Don University

P-04 DETERMINE CU(II) ION IN AQUEOUS BY A SOLUTION CATHODE GLOW DISCHARGE - OPTICAL EMISSION SPECTROSCOPY COMBINED WITH ARTIFICIAL NEURAL NETWORK

Hoang Bao Khanh, Nguyen Anh Tien, Nguyen Huynh Duy Khang

Ho Chi Minh City University of Education

P-05 DETERMINING THE DEPTH OF SOME SEDIMENTATION BASINS IN THE MEKONG DELTA USING OPTIMIZATION ALGORITHM

Tin Duong Quoc Chanh, Giang Nguyen Ngan*, Dau Duong Hieu, Toan Luong

Can Tho University

P-06 IDENTIFYING THE KEY SITES FOR THERMAL STABILITY OF GLUCOSE-6-PHOSPHATE DEHYDROGENASE BY MOLECULAR DYNAMICS SIMULATIONS WITH A COARSE-GRAINED MODEL

Nhung T. T. Nguyen, Trinh X. Hoang

Institute of Physics, VAST

P-07 FABRICATION OF HIGHLY UNIFORM PLASMA TREATED SERS SUBSTRATE ON PDMS

Nguyen Thi Hang Nga, Nguyen Duc Toan, Nguyen Van Kha , Vu Duong

Thuyloi University

P-08 STUDY OF THE EFFECT OF OPTICAL PARAMETERS OF THE LASER NOZZLE ON METAL CUTTING PROCESS USING FIBER LASER

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Joint Institute for Nuclear Research, Russia

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Mai Huu Xuan* , Nguyen Manh Hung , Huynh Quang Linh

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ABSTRACTS

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TRANSNATIONAL UNIVERSITY: A SUCCESSFUL STORY OF EXCELLENT TEACHING AND RESEARCH TRANSFER FROM WEST TO EAST

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PL-02

INSTITUTE OF PHYSICS AND THE INTERNATIONAL CENTRE OF PHYSICS: PROMOTING SCIENTIFIC RESEARCH AND INTERNATIONAL COLLABORATION

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Abstract. The International Centre of Physics (ICP), a category II centre under the auspices of Unesco and an associated division within the Institute of Physics, was established with the aims to advance training and to enhance fundamental and applied research in physics through scientific exchange and international collaboration. In this presentation we will provide an overview of ICP and its recent activities toward achieving these goals. We also emphasize the synergy between ICP and other research and higher education institutions in Vietnam and in the Asean region. Future plan and opportunities for collaboration will be discussed.

PL-03

RESEARCH ACTIVITIES IN APRI AND X-RAY FLUORESCENCE IN MULTI-LAYER MATERIALS WITH UTRASHORT LASER-INDUCED X-RAY AND ELECTRONS

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Abstract. The Advanced Photonic Research Institute (APRI), a research institute of the Gwangju Institute of Science and Technology (GIST), was established in 2001 for education and R&D in the field of optical science and technology. APRI have 4.2 PW ultrafast laser research facility and have conducted various researches, such as nonlinear spectroscopy, nano-optics, optical fiber, optical materials/devices, bio-photonics, and quantum optics. First half of the talk, the recent research activities and achievements of APRI will be introduced.

Second half of the talk, the application of the ultrashort lasers to the x-ray fluorescence(XRF) measurent will be presented. Ultrashort laser can generate point-like x-ray and electrons simultaneously, which might allow to analyze both the surface and the interior of multi-layered materials. In this study, a laser-induced X-ray fluorescence measurement experiment was performed on metal alloys, multi-layer material, and Korean 10 Won coins using laser-induced x-rays and electrons. The Ti:sapphire ultrashort laser (800nm, 36fs, 1 kHz, 10 W) was focused using an off-axis parabolic mirror with a peak power of ~10^{17} W/cm2 and the focused beam was irradiated onto the aluminum metal tape target to generate the laser-induced X-ray and electron source. The X-ray fluorescence signals of the surface and interior of the samples were distinguishable by the penetration depth difference between X-rays and electron sources. Detailed quantitative measurement results and the potential to apply this technique as a nondestructive artworks and cultural heritage analysis will be duscussed in the presentation.

PL-04

ELECTROMAGNETIC METAMATERIALS: FROM FOUNDATIONS TO FUTURE FRONTIERS

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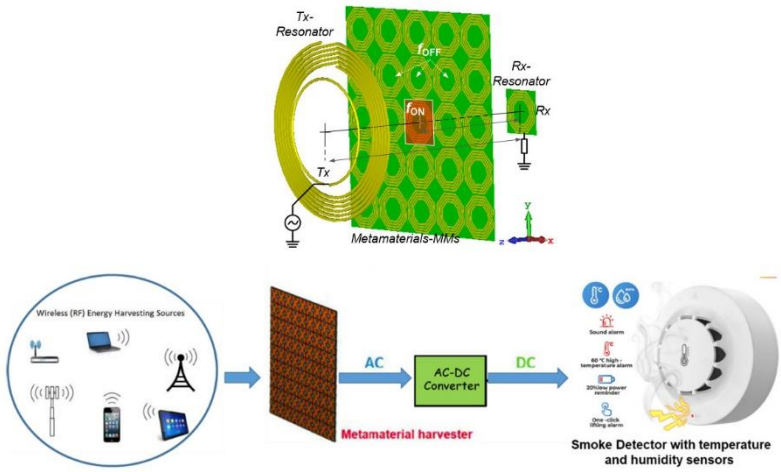
Abstract. This talk provides a comprehensive academic exploration of electromagnetic metamaterials (MMs). It encompasses an introduction to MMs, highlighting their profound impact on electromagnetic wave manipulation. Our group's foundational research areas, including negative-refractive-index MMs, metamaterial perfect absorbers, and electromagnetically-induced-transparency MMs, are discussed, elucidating their significance in advancing MM theory. Then, we present notable achievements in applied research, showcasing the development of efficient wireless power transfer systems and highly selective molecule sensing platforms. These practical applications underscore the transformative potential of MMs in addressing real-world challenges. Lastly, we outline future research directions, emphasizing ongoing work in gas sensors leveraging MMs for heightened sensitivity and selectivity. Additionally, we discuss the vision of MMs in energy charging solutions for devices and vehicles, highlighting their potential for wireless and efficient energy transfer systems. This scholarly discourse aims to inspire collaboration and further advancement within the metamaterial research community.



Potential applcations of metamaterials.

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PL-05

IMAGING THE SHADOWS OF BLACK HOLES

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Abstract. In 2019, the Event Horizon Telescope (EHT) Collaboration released the first image of the black hole shadow of M87* in human history (EHT Collaboration et al [1]). In 2021, polarized light image of the black hole shadow (EHT Collaboration et al. [2]), and in 2022, the second image of the black hole shadow of Sgr A*, the supermassive black hole at the center of our Galaxy, have been released (EHT Collaboration et al. [3]). Now the new research field of studying black holes, general relativity, and various activities at the vicinity of black holes with imaging black hole shadows has been started.

In this talk, I will present how these images were taken, and what physics has been derived from the data and the images so far. Furthermore, I will talk about what our new telescope, the Greenland Telescope (GLT; Inoue et al. [4], Chen et al. [5]), is going to contribute in this new research field (e.g., Lu et al. [6]).

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PL-06

MATERIALS FOR SUSTAINABLE ENERGY APPLICATIONS

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Abstract. The pursuit of sustainable energy solutions has evolved into an immediate global necessity, catalyzing extensive research and innovation within the field of materials science and engineering. This seminar elucidates the importance of materials in driving transformative changes within the domain of sustainable energy applications. The talk is structured into three primary segments: the development of polymer composites and electrically conductive carbon materials for energy generation and storage systems; the investigation of materials degradation in relation to their operational behavior; and the recycling processes employed to ensure the responsible end-use of batteries. The first segment focuses on the fundamental significance of polymer composites and biomass in conveying transformative advancements in sustainable energy applications, including fuel cells, batteries, and supercapacitors. Polymeric composites provide a multifaceted foundation for augmenting the efficiency and longevity of devices designed for energy storage and conversion. Simultaneously, electrically conductive carbon particles derived from biomass assume a significant role in contributing to the circular economy. Participants will acquire perspectives pertaining to the information involved in formulating and designing the polymer composites, with a focus on optimizing their attributes to align with the requirements of a wide array of applications. Additionally, this presentation will feature research investigations related to the integration of electrically and thermally conductive composites and polymers, demonstrating their capacity to enhance energy efficiency and prolong the operational lifespan of fuel cells, flow batteries, and supercapacitors.

The second part delves into the investigation of materials degradation which is a critical concern in sustainable energy applications, and this seminar will address this issue head-on. This section will disseminate research outcomes explaining how materials degrade under various operating conditions and application requirements. Understanding the mechanisms of degradation is essential for prolonging the lifespan of energy devices and upholding their consistent performance over time. The third component of the seminar centers around highlighting the significance of battery recycling within the framework of sustainability. A specific instance of progress in battery recycling technology will be presented as a case study, offering insights into how these processes can advance the responsible management of materials.

All research information from Materials for Energy Applications research group of TGGS, KMUTNB, would contribute to ideas for a more sustainable and energy-efficient future.

PL-07

COSMIC LENSES

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Abstract. The invention of telescopes over 400 years ago revolutionized our knowledge and understanding of the universe, displacing the Earth and eventually our Galaxy from the center of the universe. Just over 40 years ago, the discovery of natural cosmic telescopes started another revolution in astronomy – this time in our understanding of Dark Matter and the early universe, the latter exemplified by the first scientific image released from the James Webb Space Telescope in July 2022. In this brief review, I first describe the basic principles of gravitational lensing that allows massive objects such as stars, galaxies, and galaxy clusters to function as cosmic telescopes: by magnifying objects in the distant background, gravitational lensing enables the detection of galaxies otherwise too faint to be seen and study of galaxy features otherwise too small to make out. I then describe some of astrophysical applications of gravitational lensing, focusing on those undertaken by my research group: from elucidating the nature of Dark Matter, pointing the correct path to New Physics; to testing claims of galaxies discovered in the very early universe, too early yet for galaxies to have formed according to current cosmological models.

PL-08

RESEARCH AND MANUFACTURE SOFT PIEZOELECTRIC CERAMIC SYSTEMS FOR APPLICATION IN HYDROACOUSTIC TRANSDUCERS

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Abstract: Research and development in the fields of hydroacoustic technology as well as sea and island defense technologies are currently top priority for countries all over the world. Hydroacoustic devices have complex structures, many types and high cost, but their main soul is the transducers that receive and transmit underwater sound waves. Hydroacoustic transducers typically use commercial PZT-based piezoelectric ceramics with excellent electro-mechanical properties. As a result, we developed new PZT-based material systems with characteristics comparable to those of commercial ceramics and used them to create highly sensitive piezoelectric components for hydroacoustic transducers. The investigation on the dielectric, ferroelectric, and piezoelectric properties of soft PZT piezoelectric ceramic materials at the morphological phase boundary is presented in this article. The resonance and acoustic characteristics of the hydroacoustic transducers are systematically investigated through the Comsol Multiphysics simulation program.

Keywords: *Piezoelectric ceramics, soft PZT, hydroacoustic transducer.*

SESSION A

A-01

POTENTIAL USE OF MOLECULAR SIEVE CARBONS FOR HYDROGEN STORAGE AND DEUTERIUM PURIFICATION

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Abstract. Hydrogen isotopes play vital roles in our life. Light isotope, hydrogen (H), is not only an ideal green energy carrier but also widely used in the ammonia and steel productions and petroleum refinery. The heavy isotopes, deuterium (D) and Tritium (T), under heavy waters are utilized as moderators for the nuclear fission facility, the key reactants of the nuclear fusion reaction, pharmaceutical industry and scientific research. Despite hydrogen being the most abundant light isotope, the effective hydrogen storage up to the target of US Department of Energy (DOE) (7% wt) is a daunting task that limits development and commercialization of zero-emission energy source. In particular, there are two available commercial hydrogen storage techniques that comprise high pressure compression between 350-700 bars and liquified hydrogen at the cryogenic condition (20 K). Both the methods are not cost-effective with the critical disadvantages. Meanwhile, sources of the heavy isotopes (D and T) are very scarce with 0.015% of naturally occurring hydrogen for the deuterium and 10^{-18} % for Tritium. Hence, the cost-effective hydrogen storage and heavy isotopic purification become crucial tasks to achieve the future renewable energy sources for humankind's activities avoiding significant environmental impacts. For the last two decades, the tremendous number of researches has shown the potential use of the nanoporous materials including zeolites, metal organic frameworks (MOFs), and porous carbons to procure high hydrogen uptakes that meet the DOE target under the cryogenic temperature 77K and 20 bar. Among these, the microporous carbons become very attractive for their non-toxicity, mechanical/chemical stabilities, cheap and facile preparation, especially from biomass. In this conference, we will present our recent findings with synergetic experiments and molecular dynamics simulations that reveal the significant enhancement in the carbon-H_2 interaction strength (30%) compared to carbon- heavy gases (e.g. methane, carbon dioxide, nitrogen, argon). Such the enhancement of the carbon-H_2 strength essentially induces the densified hydrogen, especially in ultramicropores (<1nm)[1]. We further found the quantum effect in the molecular sieve carbon (MSC)-Takeda 3Å that retards the H_2 diffusion at subcritical temperatures (<77K) that permits D_2 enrichment from its mixture with hydrogen[2].

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A-02

LOW PHASE NOISE MICROWAVE SYNTHESIS FROM ULTRA-STABLE LASERS USING OPTICAL FREQUENCY COMBS

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Abstract. An optical frequency comb provides a direct and phase-coherence link between the optical and microwave domain. A laser locked to a high-finesse ultra-low expansion glass optical cavity can achieve a fractional frequency stability of 2×10^{-16} for averaging times between 1 and 10 s [1]. The combination of an ultra-stable optical oscillator and an optical frequency comb acts as an optical-to-microwave frequency division chain, whereby the stability of the optical reference is transferred to microwave domain. Such photonic microwave signal exhibits a substantially lower phase noise than that of the best crystal microwave oscillators [2-5]. In this talk, I will give a review of recent efforts of several National Metrology Institutes (including NPL) to synthesize ultra-low microwave signals using optical-to-microwave frequency division. Two main techniques have been demonstrated for the photonic microwave generation: (i) tight locking of the repetition rate (few hundreds of MHz) of a comb to an optical reference signal whose phase noise is reduced by few orders of magnitude, where the microwave signal is detected at a high harmonic of the repetition rate [2-4]; (ii) employing a transfer oscillator technique with a free-running comb for which the comb noise is electrically suppressed from a beat-note signal with an ultra-stable optical reference [5]. The generated photonic microwave signals (between 8 and 12 GHz, depending on experimental configurations) exhibit state-of-the-art phase noise level of below -100 dBc/Hz at 1 Hz offset frequency. Such microwave sources can benefit many applications such as radar systems, telecommunications, long baseline interferometry, precision spectroscopy, and the realization of atomic-fountain-clock-based time scale.

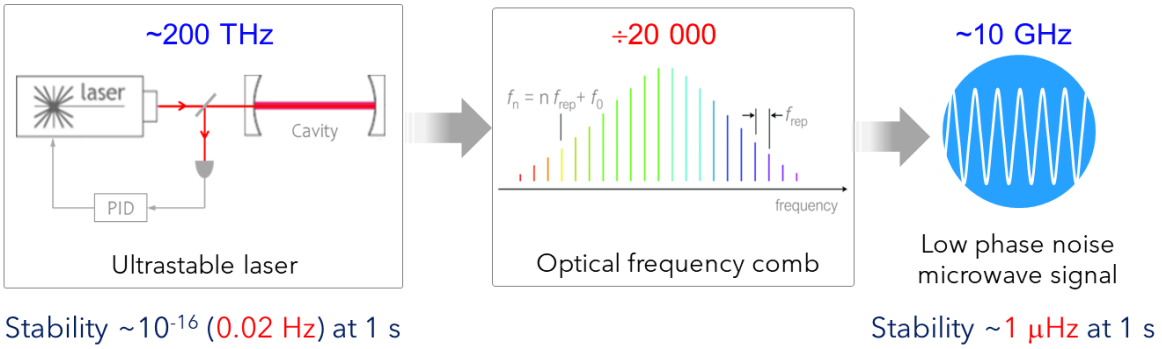

Figure 1. Operational principle for ultra-low phase noise microwave generation from an ultra-stable optical reference (a laser locked to a high-finesse cavity) using an optical frequency comb.

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A-03

FEASIBILITY STUDY ON INTEGRATED MULTI-PIXEL HETERODYNE RECEIVER CHIP AND MODULE WORKING AT 220 GHZ

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Abstract. The quick development of the sensitive receiver based on superconductor detector technology makes the astronomical researches on sub-mm wavelength enormously growing in the past three decades. Many telescopes with different instruments working on sub-mm wavelengths were built for targeting different astronomical topics. The cost of a telescope is extremely high, typically >10M USD and could be more than 500M USD for a next generation large aperture (50-m class) sub-mm telescope. Enhancement of the observation speed is a very important issue for the operation of the telescope. Multi-pixel receiver is one of the solutions. Because of a complicated system in heterodyne detection, nowadays, only a few multi-pixel sub-mm wavelength heterodyne receivers were deployed on the telescopes. However, the receiver system based on current architecture is difficult to achieve a large number of pixels (>100). An integrated multi-pixel sub-mm wavelength receiver chip definitely is a critical technology for next generation multi-pixel sub-mm wavelength heterodyne receiver, which is not realized yet.

We are studying the feasibility of constructing a compact 7-pixel receiver module working at 230 GHz based on integrated sub-millimeter wave circuits on single integrated receiver chip, especially on developing the necessary key technologies. To simplify the structure at the proof-of-concept stage, each pixel is of single polarization and double-side-band (DSB) detection. The receiver chip consists of planar RF (LO) probes, planar LO power distributor, planar LO/RF couplers, RF impedance matching circuits, SIS mixers, CPW (co-planar waveguide) IF output ports, and DC wires for SIS mixer bias and control lines. Seven conical horns are arranged in hexagonal configuration in the front size to couple the signal from sky. A single LO source is injected from the backside. The receiver chip is embedded in the housing with waveguide input ports, IF output connectors, SIS mixer DC bias and control lines. The conceptual design and also current progress will be presented.

A-04

ELECTROSYNTHESIZED NANOSTRUCTURED MOLECULARLY IMPRINTED POLYMER FOR DETECTING DICLOFENAC MOLECULE

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Abstract. This work describes the preparation and application of micropatterned molecular imprinting in conductive polymer film for the detection of diclofenac molecules. A fast and cost-effective technique for generating nanostructured polymer on glassy carbon electrode (GCE) by combining nanosphere lithography (NSL) and electrochemical polymerization is reported. Firstly, GCE is modified by a close-packed monolayer of polystyrene (PS) spheres sized 500nm in diameter, which subsequently serves as a template for the electrochemical deposition of poly(3,4-ethylene dioxythiophene) (PEDOT) accompanied by diclofenac (DCF). The functional monomers of 3,4-ethylene dioxythiophene (EDOT) were electropolymerized in the presence of sodium diclofenac (DCF-Na) as a target molecule to prepare a molecularly imprinted polymer (MIP) electrode. After dissolving PS and DCF-templated molecules simultaneously in tetrahydrofuran (THF) solvent, the micropatterned structure of PEDOT is generated on the GCE surface. This as-prepared MIP surface is applied to test the recognition of DCF molecules in phosphate-buffered saline (PBS) solution. Good linearity of peak current recorded by differential pulse voltammograms (DVP) after exposure to different DCF concentrations was obtained with a limit of detection (LOD) of 77.5 nM. The sensitivity of the as-prepared MIP electrode is 5 times larger than that of the control electrode made by non-molecular imprinted polymer (NIP). It opens a pathway to significantly improve the sensitivity and the quality of conventional electrochemical sensors for the detection of Diclofenac.

Keywords: *Molecular imprinted polymer; nanosphere lithography; diclofenac; electrochemical polymerization; nanostructure.*

A-05

LARGE SPIN HALL EFFECT IN BISB TOPOLOGICAL INSULATOR/CRO_X/COFEB/MGO WITH PERPENDICULAR MAGNETIC ANISOTROPY FOR ULTRALOW POWER SOT-MRAM

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Abstract. With giant charge-to-spin conversion efficiency, BiSb topological insulator has emerged as an attractive candidate for the spin current source in spin-orbit torque (SOT) Magnetoresistive Random Access Memory (MRAM). However, so far, only BiSb deposited on top of Co/Pt multilayers shows the large spin Hall angle. Here, we report a large spin Hall angle of 2.8 in junctions made of bottom BiSb and CoFeB/MgO with perpendicular magnetic anisotropy using chromium oxide interfacial layer, which is suitable in magnetic tunnel junctions (MTJ) application. We achieved spin-orbit torque magnetization switching by a small current density of 3.8 MA/cm^2 at a pulse width of 50 μs, which is an order of magnitudes smaller than that in reference sample using Ta heavy metal. Our work demonstrates the capability of integrating BiSb to CoFeB/MgO-based ultralow power SOT-MRAM.

Key word: *BiSb, spin Hall effect, spin-orbit torque, topological insulator.*

A-06

ENHANCING DIELECTRIC BARRIER DISCHARGE PERFORMANCE BY LIQUID INSULATOR

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Abstract. Dielectric barrier discharge (DBD) is a common, effective, and useful plasma reactor configuration for generating nonthermal plasma at atmospheric pressure. This comes from the DBD configuration, which features a simple configuration, stable plasma generation, and low operating cost. Indeed, a traditional DBD comprised at least one dielectric layer between two metal electrodes. Since a high dielectric layer isolates two metal electrodes, the micro-discharges are extinguished at the surface dielectric. Consequently, avoid excess increasing current discharge and transferring microdischarges to arcing. They are advanced points for DBD configurations in plasma generation and its applications. However, common DBD was created by a sheet, tape, and tube of metals wrapped over a solid dielectric material. Therefore, a thin air layer exists between the electrode and solid dielectric material. Consequently, when high voltage was supplied to electrodes, plasma generation occurred not only in the discharge zone but also surrounding the electrode, resulting in energy loss and emission of O_3 and NO_x. We propose an alternative method, immersing in part or full DBD reactor in liquid insulator for these issues and enhancing plasma performance. Herein, we summarize the method applied for plasma jet generation and gas treatment, such as dry reforming of methane, decomposition of CHF_3 and C_2F_6, and organic vapor compounds. Furthermore, suggested research with this method is also discussed.

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A-07

PROTOTYPE OF ONLINE REAL-TIME SYSTEM FOR RADIATION DOSE MONITORING

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Abstract. This study presents the development of an advanced online real-time system dedicated to the monitoring of radiation dose levels. The system comprises three essential components: (1) a real-time radiation dose detector, (2) a web server infrastructure for data acquisition and storage, and (3) a web-based interface and mobile application for data visualization and real-time alerts. It enables continuous monitoring and provides instant measurements of parameters such as Counts per Second (CPS), dose rate (µSv/h), and cumulative counts. Furthermore, the system offers real-time alarms for radiation levels exceeding predefined thresholds. The collected data can be easily retrieved for in-depth analysis and evaluation directly at the measurement site. This innovative system promises to enhance radiation safety practices and serves as a valuable tool for researchers and professionals engaged in radiation monitoring and research.

A-08

LONG RANGE PLASMONIC DEVICES FOR FLUORESCENCE PHOTONICS

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Abstract. The recent progress in nanofabrication allow us to design new materials for applications in sensing and telecommunication. Plasmonic systems from noble metals offer lots of potential applications due to a strong local field confinement and enhancement. The Surface Plasmon Polariton (SPP) is a two dimensional wave propagating at a metal-dielectric interface. This surface wave is highly coherent [1] and can be easily manipulated by simple structuration of the metallic surface. Despite these very promising properties, metallic surfaces possess optical losses which limit their applications. Therefore, many strategies are pursued to overcome these losses.

In this talk, we will focus on one way to overcome losses through plasmonic modes hybridization. When two metallic surfaces are close together, the SPP of each surface interact to create bonding and antibonding mode if their energies match. These two modes are named LongRange (LR) and ShortRange (SR) Surface Plasmon. The LR plasmon possesses a propagation distance up to 50µm in the visible range which is 10 times longer than the SPP making it promising for plasmonic chips. Two applications of LR plasmon will be considered with active emitters such as quantum dots and J-agregates. On one hand, we will show that placing quantum dots (weak coupling regime) will induce Purcell effects and waveguiding of the emission by the plasmonic modes [2]. On the other hand, strong coupling and new quantum state between a molecule energy and the LR plasmon may be achieved by inserting J-agregates in the structure [3]. The new mix state is called a polariton. The physical properties (coupling energy, modes width and extension) of the generated polariton have been investigated and will be discussed.

The different configurations will be compared and potential applications will be highlighted using Graphene Quantum Dots [4].

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A-09

OPTIMIZING TERAHERTZ PHOTOCONDUCTIVE ANTENNA EMITTER OPERATION BY THE INTEGRATION OF PLASMONIC STRUCTURES BOTH IN THE OPTICAL AND TERAHERTZ FREQUENCY REGIONS

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Abstract: In this talk, I will be presenting our most recent efforts in the optimization of the terahertz (THz) emission characteristics of GaAs-based photoconductive antenna (PCA) devices. Two optical/plasmonic approaches will be presented: one designed for the optical region, deposited on the photoconducting gap of the PCA; and the other approach designed for interaction with the device's emitted THz field. In the optical region, the improvement of photoabsorption and ultrafast photocarrier generation with the incorporation of a gold nanoparticle array will be discussed. On the other hand, the fabrication of 1-dimensional and 2-dimensional micrometer-size metal line arrays will be shown to significantly enhance the launching of THz pulses unto the Si hyper-hemispherical lens and into fee space via the principle of extraordinary optical transmission. These new results will be presented in the context of exploring possible future collaborative research thrusts and new common topics of interest between the University of the Philippines and IOP-VAST, as well as the ICP.

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A-10

HIGH-RATE REACTIVE SPUTTERING OF OXIDE FILMS FOR MICRO-STRUCTURED OPTICAL APPLICATIONS

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Abstract. In this work, we present a universal high-speed plasma deposition technology for the sputtering of various oxide films with a practical demonstration focused on preparation of optical films made of titanium dioxide. TiO_2 is a very interesting material especially with regard to its optoelectronic properties and chemical stability. Due to its extremely high refractive index in the visible range (n = 2.6), it is suitable for use in a wide range of optical applications. However, the plasma-chemical preparation of high-quality TiO_2 optical films is complicated and slow, especially due to the unwanted oxidation of titanium targets during the sputtering process. Our deposition technology combines reactive sputtering by DC hollow cathode discharge with thermal evaporation of Ti particles from the hot surface of the hollow cathode. The uncooled titanium nozzle(s) serves as hot hollow cathode(s) and simultaneously as an inert gas (Ar) inlet(s). The reactive gas (O_2) is introduced into the vacuum chamber through a separate inlet. During deposition, the temperature of the hollow cathode reaches up to 1600°C, depending on the discharge parameters. This make it possible to combine the ion sputtering of metallic cathode with thermal evaporation of its hot surface, which significantly increased the deposition rate of the final oxide material. The highest achieved deposition rate for TiO_2 was 567 nm/min (34 μm/h), which (with respect to the geometry of this process) corresponds to total volume of the deposited TiO_2 material 1.2 mm^3/min per 1 kW of absorbed power. Despite extremely high thermal flux to the substrate, TiO_2 films were successfully deposited even on thermally-sensitive PET foil. Afterwards, this technology was successfully used to prepare microstructured optical layers with a high refractive index on polymer substrates in order to develop new security elements for the protection of banknotes and documents. The developed technology is very versatile and recently we have used it not only for the preparation of TiO_2 films [1,2], but also for the preparation of WO_3 [3], CoO_4 [4] and other materials.

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A-11

HYBRID STRUTURE OF 2D COPPER OXIDE/ REDUCED GRAPHENE OXIDE FOR PHOTODETECTOR APPLICATIONS

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Abstract. Lately, photodetectors play a critical role in human life ranging from environmental monitoring to international communication systems, and thus, the development of these devices using low-cost processes to obtain high device performance is of great interest. In this report, a simple solution-processed hybrid 2D/2D structure of CuO and rGO for broadband photodetector applications is introduced. Particularly, while 2D CuO acts as the active material which absorbs light to generate electron-hole pairs, 2D rGO plays the role of a transport layer driving charge carriers between two electrodes. Interestingly, the as-fabricated photodetector exhibits remarkable sensitivity to a wide wavelength range from 395 nm to 945 nm (Vis-NIR regions). Moreover, its responsivity and photoconductive gain were calculated (under 395-nm wavelength excitation) up to 8 mA W^{-1} and 28 folds, respectively, which are comparable values with others reported recently. This 2D/2D rGO/CuO hybrid structure is promising for the development of low-cost but high-performance optoelectronic devices, especially photodetectors, in the future.

Keywords: *CuO, rGO, hybrid, photodetectors, 2 dimentional.*

A-12

SELF-HEALING, REPROCESSABLE AND RECYCLABLE RUBBER BASED ON METAL THIOLATE IONIC NETWORK

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Abstract. An intrinsic self-healing natural rubber featuring reversible metal-thiolate ion networks was fabricated and the corresponding healing mechanism and mechanical properties were presented. The developed materials were able to repair themselves at room temperature upon damage without any external stimuli. Reversible metal-thiolate ion networks were proven to form within the rubber material. These networks dominated the cross-linking system and were identified by Differential Scanning Calorimetry (DSC) and Fourier-transform Infrared Spectroscopy (FTIR). Meanwhile, the quantitative amount of metal-thiolate ion networks and covalent crosslinks was determined by swelling testing. Scanning Electron Microscopy (SEM) results revealed that intermolecular diffusion had occurred at the fracture area of the self-healing samples. The results revealed that the mechanical properties could be 100% regenerated after the broken samples were brought into contact with each other. It was also found that self-healing increased by 60% of the material lifespan. This new material is expected to open up promising avenues for the manufacturing of sustainable rubber products.

A-13

ASSESSMENT OF RICE WATER REQUIREMENT UNDER CLIMATE CHANGE SCENARIOS IN AN GIANG PROVINCE USING THE CROPWAT 8.0 MODEL

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Abstract. Water management for crops is of great importance in determining crop yield. This study aims to predict evapotranspiration and water requirements of rice in An Giang province using the CROPWAT 8.0 model based on meteorological and hydrological data series from 2018 to 2022. The study was carried out for rice plants (95 – 100 days) in three rice crops including Winter-Spring, Summer-Autumn and Autumn-Winter. The model took into account different scenarios such as low rainfall (2018 - 2019), high rainfall (2020) and especially in the context of climate change with medium (RCP 4.5) and high (RCP 8.5) emissions. The results showed that evapotranspiration is highest in the Summer-Autumn season and water requirements are largest in the Winter-Spring season. Meanwhile, the Autumn-Winter season with the lowest evapotranspiration and water demand is the most favorable for the highest rice yield among the three crops. According to climate change scenarios over two periods from 2046 - 2065 and 2080 - 2099, evapotranspiration and water requirements will be increasing over time. Climate change threatens to negatively impact rice yields and the agricultural economy in An Giang province.

A-14

APPLICATION OF HIGH VOLTAGE ELECTRICAL FIELD, ELECTROMAGNETIC FIELD, AND ULTRASOUND IN SEPARATION PROCESS

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Abstract. Separation of immiscible liquid-liquid dispersions is an important operation in many industries such as metallurgy, pharmaceuticals, food, and petroleum. This process is usually carried out in gravitational and centrifugal settlers where sedimentation and coalescence of droplets takes place. However, the tiny particles or sub-micron liquid droplets suspended in the mixtures are difficult to remove by conventional separation methods such as sedimentation or filtration. Alternative physical methods have been explored and investigated. High voltage electrical fields, electromagnetic fields, and ultrasound waves have been recognized as powerful tools that find applications in various separation and extraction processes in different industries. Results show that the separation can be achieved with high efficiency, fast or accelerated process, no chemical addition, reduce or eliminate process of post treatment even purification process, and less energy consumption when compared with the centrifugal separators. Nonetheless, the application in biobased emulsion such as biodiesel-glycerol mixture has been rarely investigated. Therefore, our TGGS-CPE Novel Technology Research Lab focuses on the application of electrical fields [1-2], electromagnetic fields [3-4], and ultrasound waves to improve the chemical process (reaction, extraction, and separation) to increase the efficiency and sustainable separation and extraction of liquid-liquid systems. Due to the multidisciplinary nature of the research, we work closely with our partners in the Microwave and Radio Frequency Research Lab and the High Electrical Voltage Research Lab in the Electrical and Computer Engineering Program at TGGS.

As the emulsion mixture consists of polar and non-polar chemicals, the polar chemicals would react differently to the non-uniform electric field, single mode microwave, or ultrasonic wavelength. Under high electric field, free space charge can be generated. Droplets in high voltage electric fields can be attracted to each other and eventually merge either by electrostatic forces between uncharged polarized particles, known as dipole coalescence, or by electrophoretic motion of charged droplets. The newly formed larger droplets then precipitate faster. While microwave as an energy source can promote rapid heating, reduce heat loss, and cause the reaction to occur under the uniform heating. The electric field and the magnetic field components of microwave interact differently with materials by different mechanisms. Since molecules are dipolar, they rotate and/or migrate to the conducting ions, resulting in increased heat transfer rates and thus reduced reaction time. In addition, the application of ultrasound has been widely used as an alternative in various separation processes such as extraction, demulsification, and surface cleaning. Many studies have shown that the ultrasound-assisted process has better yield, high efficiency, and selectivity in a

short time and with lower energy consumption without the use of toxic chemicals. Ultrasound can be used at different frequencies or intensities, which can have different effects. Low-frequency waves (< 100 kHz) enhance the mechanical and physical degradation, while high-frequency waves (> 100 kHz) improve the sonochemical effects.

Our current research on the electrically driven separation process has demonstrated that the separation process with applied low and high electrical voltage performed better than gravitational settling (without applied electrical field) in separating glycerol and other impurities from biodiesel. As observed in the experiments, the glycerol droplets moved towards the electrode tips where the electric field was generated, while the charge on the surface of the glycerol droplet changed. The more droplets were in the electrical field, these droplets would align along the streamlines and the coalescence of droplets would occur. This phenomenon took place in a shorter time than gravitational settling. Therefore, electro-separation technology has potential to be applied to other multi-component and emulsion mixtures.

For the commercialization, the electrically driven, microwave-assisted, and ultrasound-assisted separation technologies must be further explored, and the optimized condition must be determined for the scale-up. Our research laboratory has been intensively investigated the correlation between electrical, chemical, and material parameters that affect the separation efficiency as well as the coalescence-sedimentation model for the liquid-liquid separation. These results will be presented in future articles.

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A-15

EXPLORING THE VERSATILITY OF THERMAL AND COLD PLASMA IN MATERIALS SCIENCE APPLICATIONS

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Abstract. In the dynamic realm of materials science, the utilization of thermal and cold plasma has emerged as a transformative and versatile approach. This presentation delves into the exploration of these two distinct plasma techniques and their applications at the Institute of Materials Science, Vietnam Academy of Science and Technology. Thermal plasma, renowned for its high-temperature capabilities, is harnessed for large-scale nanomaterial synthesis and advanced material modifications. Conversely, cold plasma, characterized by its unique non-thermal properties, finds purpose in catalytic engineering, precise nanomaterial control, biomaterials development, and environmentally sustainable applications. By elucidating the potential of thermal and cold plasma as promising avenues for innovation and advancement in materials science, we share our belief that plasma technologies will play a pivotal role in the creation of novel materials endowed with enhanced properties and functionalities.

A-16

THICKNESS-DEPENDENT n-MoS_2/p-GaN VERTICAL ETEROSTRUCTURE FOR HIGH RESPONSIVITY SELF-POWERED UV PHOTODETECTORS

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Abstract. The exceptional electrical and optical characteristics of molybdenum disulfide (MoS_2) have garnered significant interest. This study aims to investigate the influence of the depletion layer thickness in the n-MoS_2/p-GaN heterojunction on the performance of vertically stacked n-MoS_2/p-GaN heterostructure solar cells. The depletion layer model is employed to analyze the photoelectric properties, specifically by varying the thickness of MoS_2. Additionally, we propose the fabrication of a photodetector based on the heterostructure of p-type Gallium nitride and n-type MoS_2 built by a MoS_2 position-selectivity method. Our findings suggest a more efficient and straightforward approach to optimize the photoelectric efficiency in MoS_2/GaN p–n PD and building high-performance self-powered PDs.

A-17

RESEARCH ON THE OPTIMAL LENGTH CALCULATION OF Yb^{3+} ACTIVE FIBER IN THE FABRICATION OF HIGH-POWER FIBER LASER SOURCE

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Abstract. Active fibers play a crucial role as lasing medium in fiber laser structures, offering significant advantages in energy efficiency, beam quality, economic efficiency, and flexibility in integration with automation machinery systems. As a result, fiber lasers are increasingly used for various industrial applications, particularly in metal processing. Research and technology mastery in the production of high-power fiber optic laser sources in Vietnam are the goals of our research group. This paper presents a study and calculations on the impact of the length of Yb^{3+} doped active fiber on laser output power and nonlinear characteristics that may be detrimental when operating at high power levels. The study provides optimal length calculations for Yb^{3+} doped active fiber required in the fiber optic laser source structure. Additionally, the research explores various fiber laser structure models (one-end pumping, two-ends pumping) and their effects on laser output power, taking into account the characteristics of the optical fibers.

Keywords*: high-power fiber laser, active fiber, laser diode, Yb^{3+} doped fiber, laser engine*

A-18

PLASMONIC-ENHANCED MoS_2 ON SILICON SUBSTRATE WITH MONOMETALLIC NANOPARTICLES FOR HIGHLY EFFICIENT PHOTO SENSOR

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Abstract. We report the quality of heterostructures using 2D-TMDC materials namely MoS 2 decorating with monometallic gold nanoparticles (Au NPs). Implementing the coupling effects of hybrids plasmonic nanoparticles (NPs), the interactions between 2D and incident photons are significantly enhanced in photo sensor applications at visible region. Implementing the coupling effects of hybrids plasmonic nanoparticles (NPs), the interactions between 2D and incident photons are significantly enhanced in photo sensing. The metallic NPs that exhibit localized surface plasmon resonance (LSPR) improves strong light absorption, scattering and increase the light path interaction by the incident photons with the existence of micro-optical cavity like structure. We established a large area multilayer MoS_2 incorporated with gold plasmonic nanoparticles (Au NPs) on p-Si substrate namely Au NPs MoS_2 by straight-forward and cost-effective spray coating. We will observe the performance by analyzing the figure of merit (FOM) of the device under visible light. The proposed photo sensor with combining monometallic and 2D will provide new insights and strategy to construct reliable-next generation optoelectronic devices.

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A-19

THE SYNTHETIC METHODS FOR REALIZING HIGHLY STABLE PEROVSKITE QUANTUM DOTS

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Abstract. In spite of despite excellent opto-electronic properties of perovskite quantum dots, they have a significant drawback of low structural stabilities under environment. In this talk, four methods, (1) ligand modification, (2) core-shell structure, (3) cross-linking and (4) alkali metal doping, for enhancing structural stabilities of PQDs will be introduced. These methods significantly improve structural stabilities of PQDs by suppressing defect generation and healing defects.

A-20

EFFECT OF ORGANIC ELECTRON DONATING DOPANT ON TRAP DENSITY IN 7-BIS(DIPHENYLPHOSPHORYL)-9,9'-SPIROBIFLUORENE AS AN ELECTRON TRANSPORTING LAYER

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Abstract. Electron-transporting materials in organic semiconductor generally has been known to have a lower mobility compared to hole-transporting materials due to trap-limited electron transport. This study attempted to use purely organic electron donating dopants in an electron-transporting material 7-bis(diphenylphosphoryl)-9,9'-spirobifluorene (SPPO13) in an effort to increase its current density. The dopants chosen for this study are the organic electron donors tetrathiafulvalene (TTF), 4-(2,3-Dihydro-1,3-dimethyl-1*H*-benzimidazol-2-yl)-*N*,*N*-dimethylbenzenamine (N-DMBI), tetrakis(dimethylamno)ethylene (TDAE), all of which have demonstrated the ability to donate electrons. The addition of 2% TTF resulted in a higher current density for SPPO13, while the other dopants instead led to a decrease in current density. X-ray photoelectron spectroscopy suggested that there is a shift in binding energy for phosphorus atoms when TTF is added, making the P=O bond more electropositive. This is further supported by quantum chemical calculations. The increased current density is attributed to the lowering of the dipole moment of the P=O bond of SPPO13, which has been shown to affect charge transport.

A-21

CONCENTRATOR PHOTOVOLTAICS SYSTEM BASED ON NON-IMAGING OPTICS DEVICES AND ITS AUTOMOTIVE APPLICATION

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Abstract. Solar concentrators leveraging non-imaging optics constitute a paradigm-shifting technological advancement within the domain of solar energy capture. In stark contrast to conventional imaging optics, which aim to precisely focus sunlight onto a singular point or a minute surface area, non-imaging optics are designed to efficiently harness and direct solar radiation onto photovoltaic (PV) cells while refraining from forming a well-defined image. This approach serves to optimize the utilization of incident solar irradiance and thereby facilitates economically viable and adaptable solar energy solutions. These systems prove particularly advantageous in scenarios characterized by spatial constraints or mobility imperatives, such as in the context of automotive or portable solar energy applications. This research introduces static flexible concentrator photovoltaic (Static CPV) systems tailored for electric vehicles (EVs). The CPV system is composed of solid Compound Parabolic Concentrators (CPCs), 3-junction solar cells, and crystalline silicon (Si) cells. Direct sunlight, conforming to the requisite incident angle within the acceptance angle of the solid CPC, is efficiently focused onto the 3-junction solar cells. Concurrently, diffuse sunlight is gathered by the crystalline Si cells. In instances where both direct and diffuse sunlight surpass the acceptance angle of the CPC, they escape the solid CPC and are subsequently harnessed by the Si solar cells. This architectural configuration facilitates the production of Static CPV systems boasting a geometrical concentration ratio of 4× for 3-junction cells.

The module's design was developed utilizing optical simulation software, LightTools™. The simulation outcomes demonstrate that the module exhibits the potential to attain an annual efficiency of 25%. Moreover, it possesses the inherent flexibility required to accommodate car roof applications. This research underscores the viability of Static CPV systems as a sustainable energy solution for the burgeoning electric vehicle industry, with a focus on enhancing energy efficiency and design adaptability.

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A-22

COMBINING MULTIPLE EMR RANKING RESULT IN CONTENT-BASED IMAGE RETRIEVAL

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Abstract. The efficient multi-feature ranking algorithm (EMR) has been widely applied in content-based image retrieval. In this algorithm, each image is represented by low-level features that describe color, texture, and shape. The advantages of low-level features include their ability to quickly detect differences in color, texture, and shape, and their invariance to rotation and translation without the need for learning. However, low-level features have limitations in describing the semantics of images.

To improve the performance of the EMR algorithm in content-based image retrieval, in this study, we propose a method that combines low-level features and embedding vectors from the Deep Metric Learning (DML) model to enhance the discriminability of query images with respect to images in the dataset. Experiments were conducted to demonstrate the effectiveness of the proposed ranking method in improving the quality of EMR.

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A-23

HYPERSPECTRAL REMOTE SENSING OF ATMOSPHERIC COMPOSITION

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Abstract. This talk will talk about the Differential Optical Absorption Spectroscopy (DOAS) technique and its significant contributions to the field of atmospheric composition monitoring. The presentation will commence with a comprehensive elucidation of the DOAS working principle, and its working mechanisms. The talk will also cover the various applications of DOAS, encompassing Long-Path DOAS (LP-DOAS), Multi-Axis DOAS (MAX-DOAS), and satellite-based DOAS measurements. These applications will be expounded upon, highlighting their distinctive capabilities and scope in atmospheric composition monitoring. Furthermore, the talk will elucidate the pivotal role of these measurements in advancing studies within atmospheric physics and chemistry. And how these precise measurements contribute to our comprehension of crucial atmospheric dynamics, including air quality assessment, source identification of pollutants, and the intricate interactions among atmospheric constituents.

A-24

DIRECT CONVERSION OF OPTICAL TO ELECTRICAL SIGNALS IN A CE:YAP SCINTILLATOR WITH A TIO_2 PHOTOCONDUCTIVE SENSOR

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Abstract. Vacuum ultraviolet (VUV) radiation that spans the wavelength range from 200 nm to 100 nm is indispensable in numerous technological applications and scientific research. In recent years, tremendous research has gone into the development of VUV light sources to meet these technological and scientific demands. Development of detectors for this short wavelength region is as crucial, to match the rapid progress. Scintillators such as trivalent cerium ion-doped yttrium aluminum perovskite (Ce:YAP) are luminescent materials that absorb incident high-energy radiation, converting it into more accessible optical wavelengths through the emission of photons (photoluminenscence or PL) having energies in the UV or visible region. As such, scintillators are the main sensing units in VUV detectors. However, a separate photodetector is needed to detect the PL emitted by the scintillator by converting it to electrical signals. In this work, we present the development of a hybrid Ce:YAP scintillator by coating the scintillator's surface with a titanium dioxide (TiO_2) thin film. The TiO_2 film serves as a photoconductive sensor that directly converts the PL emission from Ce:YAP to electrical signals, thereby eliminating the need for an external photodetector. TiO_2 was reactively sputtered in Ar/O_2 atmosphere on the surface of Ce:YAP using DC hollow cathode discharge. A titanium rod with outer and inner diameters 12 and 5 mm respectively was used as the target. The TiO_2 film was deposited under working pressure of 1 Pa, and discharge current of 1.5 A. The distance from the hollow cathode to the Ce:YAP substrate was set to 10 cm to ensure homogeneity. The deposition rate was 7 nm/min, corresponding to about 30 minutes of deposition time for a 200-nm thick TiO_2 layer. The effect of heating the Ce:YAP substrate during sputtering and annealing of the Ce:YAP-TiO_2 hybrid scintillator post-TiO_2 deposition was investigated. The PL emission spectrum from Ce:YAP broadened while the peak wavelength shifted to shorter wavelengths after annealing. The shift resulted to a greater overlap between the absorption spectrum of TiO_2 and the PL emission of Ce:YAP. Annealing also improved the crystallinity of the TiO_2 photoconductive thin film. Development of this hybrid scintillator will pave the way to miniaturization of scintillators for the detection of high-energy radiation.

SESSION B

B-01

ADVANCES IN SCIENCE AND TECHNOLOGY IN REHABILITATION

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Abstract. Rehabilitation plays a pivotal role in the healthcare sector, encompassing a multidisciplinary approach aimed at assisting individuals in recovering and regaining their physical, mental, and functional abilities following injuries, illnesses, or disabilities. The primary objective of rehabilitation is to enhance an individual's quality of life, promote their independence, and support their full reintegration into society. Globally, an increasing array of innovative techniques is emerging, assuring precision and being employed to restore functionality in individuals who are unwell or disabled. This report offers an overview of the advancements in rehabilitation training equipment systems spanning various medical fields, including cardiology, orthopedics, and neurology. In conjunction with these systems, computers enable real-time monitoring, adjustments, and the collection of data regarding patients' rehabilitation parameters. This serves as a critical scientific foundation, ensuring precise dosages and the safety and effectiveness of rehabilitation exercise therapies. The results of initial applications in hospital settings illustrate the trends and potential for the development of new technologies in our country.

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B-02

FROM PHYSICAL STIMULATION TO VISUAL PERCEPTION: STUDY ON THE INFLUENCE OF PERSPECTIVE BACKGROUND TO THE OBJECT'S SIZE ESTIMATION

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Abstract. In the realm of vision, we perceive our environment through interpreting signals stimulated from the eyes to the brain. Instant recognition and reaction via intuition (System 1) sometimes don't align with reality but assist us in quickly responding to dangers. However, humans also possess a logical reasoning system based on logic (System 2) that helps us process information based on existing experience and knowledge [1]. Visual illusions serve as a traditional example of the discrepancy between the actual world and our perception of it. The corridor illusion [3] is a variant of the Ponzo phenomenon where two identical boxes create different impressions when placed on a background with converging lines at the corridor's end. The Ebbinghaus illusion, another visual phenomenon, describes how a circle can appear larger or smaller depending on the size of the surrounding circles [4]. However, previous studies mainly approached these phenomena qualitatively. Contrasting those studies, our research quantified the disparity between physical stimuli and subjective perception. We focused on studying the influence of perspective background on object size estimation. For 64 participants, we recorded their size estimations of objects and compared them to the objects' actual sizes. These findings are not only scientifically significant but also practically meaningful. Artists and designers can utilize these discoveries to create more appealing visuals. Those working in virtual or augmented reality can also leverage this information to craft more authentic experiences for users. Simultaneously, understanding the extent to which our brains can be "deceived" can aid us in making smarter decisions in daily life.

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B-03

DETERMINATION OF CHARACTERISTICS OF OSL DOSIMETERS AT CENTER FOR NUCLEAR TECHNOLOGIES

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Abstract: Evaluation of the characteristics of Optically Stimulated Luminescence Dosimeters (OSLDs) play an important role in determination of the equivalent absorbed dose for humans and objects exposed to external radiation sources during a specific period. In addition to its distinct advantages compared to other dosimeters, the key parameters of OSLDs must conform to the standards of a personal dosimeter set by the International Electrotechnical Commission and recommendations of the International Atomic Energy Agency. Despite widespread global use of OSLDs in various industrial and medical applications, research on OSLD compliance with radiation safety standards in Vietnam is limited. The purpose of this study is to experimentally evaluate the characteristics of OSLD. Parameters were investigated including limit of detection, linearity, uniformity, repeatability, and energy response of OSLDs. To conduct these assessments, OSLDs from the Landauer manufacturer were irradiated with different radiation qualities: gamma radiation using a ^{137}Cs source – 662keV and X-ray radiation using an X-ray calibration system with a narrow spectrum beam quality N-80 following standard ISO 4037:2019. The dosimeters were processed at the Secondary Standard Dosimetry Laboratory (SSDL) of the Center for Nuclear Technologies. The MicroStar reading system was employed to measure the personal equivalent doses: Hp(10), Hp(7), and Hp(0.03) for the OSLDs. The results of this study will significantly enhance the accuracy and reliability of OSLDs reading results in the fields of radiation safety and nuclear medicine in Vietnam.

Keywords: *OSL, Optically Stimulated Luminescence Dosimeters, personal equivalent dose, Secondary Standard Dosimetry Laboratory.*

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B-04

RICE HUSK SILICA AS A SOLUTION TO GLOBAL FOOD SECURITY AND CTS PROGRAM TO SUCCEED TOGETHER

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Abstract. BSB Nano Technology Joint Stock Company pioneered the development of "Turning rice husk into gold" technology on an industrial scale, producing a large range of bio-based Silica grades to meet mass to premium applications and support many different industries. Rice husk, an abundant agricultural waste, is used as raw material for the production process of specialty silica, applying circular economic model with value added technology, contributing to sustainable development and reducing CO_2 emission.

In addition, this bio-based Silica is also used in Nano technology to create an unique Nano composite product with the ECO OK brand, applied for agricultural cultivation, friendly to humans and the environment, brings high economic efficiency, has been proven on different crops, especially rice and wheat in many countries around the world and represents an effective and affordable solution to global food security.

Along with the international collaboration program CTS (Comprehensive Technology Solution), BSB Nanotech has collaborated with domestic and international partners to successfully develop many products for various industrial applications, creating high value and economic efficiency.

During this event, BSB Nanotech is honored to report to the Conference the contents mentioned above.

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B-05

SOME RESULTS OF RESEARCH ON DISINFECTION AND PRESERVATION OF REUSABLE KIDNEY FILTER WHITH OZON GAS

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Abstract. In artificial kidney technology, reuse of dialysis is the process of removing residual waste in the dialyzer, soaking in disinfectant chemicals and storing for 48 hours to use dialysis again for the same patient. Reuse dialysis filters to reduce the cost of each dialysis session. However, reusing the dialysis filter must ensure effectiveness and safety for the patient, especially the filter must be sterile and free of chemical residue. Currently, most hemodialysis units in our country reuse dialysis filters for hemodialysis patients. The disinfection method that has long been applied is to use chemicals to soak the filter; However, this method also has limitations such as: it is easy to leave chemical residues inside the filter. When put into dialysis, it will lead to a potential risk of chemical shock and even death. Expensive because of the constant consumption of chemicals used daily for treatment. The article presents some research results applying the method of disinfection and preservation of reusable hemodialysis dialysis filters with ozone gas, achieving the following results: no ozone residue in the dialyzer, bacteria can be eliminated, bacteria and endotoxins reached the target with Decision 2482/2018-BYT, dated April 18, 2018 of the Ministry of Health on "Instructions for artificial kidney technical procedures".

Keywords: *Disinfection, ozone, chemicals, kidney dialysis machine.*

B-06

MAGNETIC/GOLD NANOCRESCENTS LIKE NANO-HEATER AND NANO-PROBE

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Abstract. In complex and multiscale systems, such as heterogeneous fluids or living cells, the local properties differ significantly from the macroscopic ones. Hence, designing nanodevices that can simultaneously act and probe locally these materials at the nanometer scale is of critical importance. We use a gold semi-coated magnetic or fluorescent nanoparticles, called gold nanocrescents, both to access the local properties of such complex systems and to perturb them at the nanoscale. These particles are produced by nanosphere lithography, evaporating a 30 nm thick layer of gold on magnetic 160 nm. This technique allow to change easily the size and the structure of nanocressent.

These gold nanoparticles possess a strong plasmon resonance which gives them a strong scattering cross section. They can thus be easily tracked using dark field microscopy. Moreover, their asymmetrical shape induces a splitting of the plasmon resonance. This optical anisotropy allows one to follow their rotational dynamics. From the autocorrelation of the scattered intensity signal one can access the nanoscrescent rotational diffusion time. Hence, from both, the translational and rotational Brownian diffusions of the nanocrescents it is possible to probe the local nanorheology of a material.

In addition, these nanoparticles can also serve as active nanosensors. Due to their magnetic properties, they can be submitted to an external force via an applied magnetic gradient. Besides, using an incident laser at the wavelength of the plasmon resonance, the nanocrescents can be heated. The environment can thus be perturbed locally in a tunable and remote way, the same nano-object being simultaneously a nano-source and a nano-probe.

B-07

A COMBINATION OF NON-INVASIVE DIAGNOSTIC AND MEDICAL TRAINING DEVICES IN SPINAL REHABILITATION: PILOT STUDY

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Abstract. Spinal diseases are among the most prevalent conditions that significantly impact an individual's quality of life and daily activities. One primary contributing factor is the weakness and imbalance of the muscle bundles on either side of the spine, coupled with restricted mobility in the lumbar spinal joints. The rehabilitation of spinal mobility typically involves a range of approaches, including exercises designed to enhance the strength of muscle groups on both sides while increasing the flexibility of vertebral joints. In this report, we present a combination of non-invasive diagnostic tools and specialized exercise equipment for patients with spinal disorders. Results show that the improvement in muscle strength plays a vital role in ameliorating and rehabilitating lumbar vertebral motor function and pathological conditions. The Spinal Mouse, a new non-invasive diagnostic device for spinal function, emerges as a secure and invaluable instrument for routinely monitoring and assessing spinal function in patients engaging in specialized equipment-assisted exercises.

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B-08

EVALUATION OF CALIBRATION RESULTS FOR GAMMA AND X-RAY DOSE RATE MEASUREMENT DEVICES

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Abstract. The use of portable radiation survey meters (PSM) has become increasingly widespread for accquiring and monitoring of radiation levels in areas where ionizing radiation is utilized. Ensuring the accuracy of these radiation dose rate measurements is crucial. The Secondary Standards Dosimetry Laboratory at the Nuclear Center in Ho Chi Minh City provides calibration services for gamma and X-ray dose rate measurement devices using calibrated sources of gamma radiation (Cs-137) and X-rays (N-40, N-60, N80, N-100, N-120). In this report, we present a statistical analysis of approximately 250 measurement devices from more than 20 different models. We evaluated the calibration factors, measurement uncertainties, and energy responses of these radiation measurement devices. Therefore, we maked assessments regarding the quality and suitability of these devices for accurate radiation measurement. Some of the devices in this study include the Survey Meter PM1405, Nuclear Radiation Monitor Inspector AlertTM, Inspector Alert IMI,...

Keywords: *portable radiation survey meters, Secondary Standard Dosimetry Laboratory, calibration factor, energy response.*

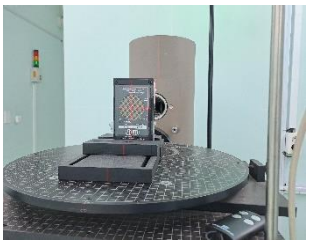

Fig. 1. *Arrangement of equipment for gamma calibration.*

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B-09

ABATEMENT OF METHYLENE BLUE IN WATER BY A PLASMA LIQUID INTERFACE

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Abstract. Removal of methylene blue (MB) in wastewater by non-thermal atmospheric pressure plasma (NTP) is gaining interest as an alternative method. Indeed, the MB can be destructed by NTP under room temperature conditions and without adding a chemical agent. The exceptional efficiency of NTP is attributed to the generation of numerous, including hydroxyl radicals (OH), hydrogen peroxide (H_2O_2), reactive oxygen species (O·), superoxide anion radical (O2-), and ozone (O_3). In this study, NTP-assisted MB abatement was performed through a cold plasma jet by a gliding arc interacted with MB solution (5 to 20 mg/L). The experimental results demonstrated that the complete removal of MB was obtained at adequate temporal interaction of the plasma jet with the solution. The degree of MB removal strongly depended on the initial MB concentration, time interaction, and experimental parameters, namely agitation and the introduction of oxygen. The solution was treated with a suitable process time and analyzed with FTIR and GC-MS to determine intermediate compounds during plasma interaction with the MB solution; consequently, a mechanism for MB removal by the NTP will be proposed.

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B-10

AN INVESTIGATION OF THE IMPACT OF COMPLEX TERRAIN ON THE STRUCTURE OF PLANETARY BOUNDARY LAYER BY VEHICLE-BASED LIDARS

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Abstract. The PBL structure in Taiwan is controlled by local circulations which are highly associated with the complex topography. The precipitous topography complicates the flow patterns of local circulations such as the sea-land breeze and mountain-valley breeze, both are highly affected by the surface obstacles and land use in the PBL. To deeply investigate the influence of complex terrain on the PBL and the regional circulation in Central Taiwan, vehicle-based lidars (an aerosol lidar and a Doppler wind lidar, DWL) were applied to measure the spatial (vertical and horizontal) distribution of aerosols and winds.

The aerosol lidar is a small compact lidar system mounted in a van that is designed to obtain vertical aerosol/cloud profile from near-surface up to 7 km. The Doppler wind lidar (from the Ocean University of China, China) mounted on a pickup truck measures the Doppler shift between the reference and backscattered radiations to provide horizontal and vertical wind profiles at distances from 50 m up to 10 km. The wind lidar was operated in a modified 5-beam swing (DBS) mode. The motion of the trunk and the attitude of the lidar were corrected from the lidar velocity measurements. The analysis regards the uncertainties and the motion-induced errors can be found in Zhai et al. (2018).

The Taichung Basin and Yulin-Chiayi Plain are selected as the areas to employ the vehicle-based aerosol and wind lidars to measure the east-to-west cross-section of aerosol and wind of the PBL. The PBL cross-section observed over the Taichung basin and Yulin-Chiayi Plain indicated the significant changes in the PBL structure including terrain-induced vertical mixing of aerosol, wind shear, and return flow of the local circulation.

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B-11

THE NATIONAL GEOPHYSICAL STATION NETWORK FOR CLIMATE CHANGE ADAPTATION AND NATURAL DISASTER PREVENTION

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Abstract: The Institute of Geophysics, VAST currently maintains a national network of geophysical stations, including over 40 stations for monitoring earthquakes, geomagnetism, atmospheric physics, ionosphere, etc. The results obtained from monitoring the Earth's geophysical fields have directly contributed to disaster mitigation and socio-economic development of the country. For example, they have been used for earthquake reporting, tsunami warning, data used in seismic resistance codes, and lightning protection standards. In the era of the Industrial Revolution 4.0, Internet of Things (IoT) technology plays an important role in enhancing the application of geophysical monitoring technology. In this report, I will provide an overview of the works conducted by the Institute of Geophysics in monitoring various geophysical fields and discuss their future direction in the context of the Industrial Revolution 4.0.

B-12

ANALYTICAL APPLICATIONS OF NUCLEAR TECHNIQUES FOR SOCIO-ECONOMIC DEVELOPMENT

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Abstract. Nowadays, isotopic, and nuclear techniques play an important role in many facets of our daily life and are an integral part of our socio-economic development. In this work, we present environmental monitoring and non-destructive testing techniques at the Department of Nuclear Physics in University of Science. Firstly, radioactivities (Ra-224, Ra-226, Ra-228) in groundwater samples were measured by HPGe detector with co-precipitation method. Then, the annual committed effective dose of the age groups was lower than the international regulations. The concentration of the total dissolved solids, sulfate, chloride, sodium, barium, and manganese met the national regulations. Secondly, the system for the non-destructive evaluation of the thickness of material plates based on the Compton back-scattering technique using a Si(Li) detector and 241Am radioactive sources was developed. The calibration curve is constructed based on the areas under the Compton scattering peak obtained from the measurements of reference samples. This calibration curve is used to determine the saturation thickness, the maximum measurable thickness with the desired accuracy, and the unknown thickness of a sample.

B-13

CHARACTERISTICS ON LARGE-SCALE WAVE STRUCTURE IN SOUTHEAST ASIA

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Abstract. The seeding mechanism of Equatorial Plasma Bubble(EPB) is uncertain due to the lack of observation in EPB seeding observation. It is believed that EPB developed from the upwelling large-scale wave structure(LSWS) at the bottom of F layer during the post-sunset period. The increase in Rayleigh-Taylor instability's development rate due to upward atmospheric gravity wave may result in LSWS [1, 2, 3]. LSWS was observed by using the Gnu Radio Beacon Receiver (GRBR) with signals from the C/NOFS satellite. The characteristics of LSWS were studied using the data between year 2012 and 2014 in Southeast Asia. The study revealed that most of the zonal wavelength of LSWS were between 300 km to 700 km and more than 1000 km. LSWS might be the seed to initiate the development of EPB from the upwelling when LSWS grows to sufficient strength [3, 4, 5]. These findings will be discussed in terms of seeding.

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B-14

THE INVESTIGATION OF SLEEP INERTIA IS CONDUCTED THROUGH THE EXAMINATION OF THE POWER SPECTRUM DENSITY OF ELECTROENCEPHALOGRAPHY SIGNALS

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Abstract. Sleep research is a topic that has always attracted the attention of scientists. Sleep improvement research focuses on areas such as sleep latency, sleep depth, and wake-up time. In particular, research on wake-up time in the morning, which directly affects the alertness of the subjects, is a topic that research groups are focusing on developing. The phenomenon of subjects being less alert after waking up in scientific research is called sleep inertia (SI). SI is a state of grogginess upon waking up, leading to decreased cognitive performance for a period of time. Some SI observational studies have hypothesized that a general decrease in beta wave activity and an increase in delta wave activity after waking up may represent the electroencephalography (EEG) signals underlying SI. This study used polysomnography (PSG) data from 22 male and female subjects, lasting about 9 hours recorded in the hospital over two nights. We performed power spectrum density (PSD) EEG of beta (13-35 Hz) for each subject. The results showed that at the moment of waking up, the beta power spectrum suddenly decreased compared to the previous epoch. The beta power spectrum when decreased reached values ranging from 0.0611-0.1586 and median of 0.1196 at channel Fpz-Cz and ranging from 0.0271-0.2105 and median of 0.1383 at channel Pz-Oz. The value obtained from channel Fpz-Cz seems better than channel Pz-Oz. This result is consistent with some studies on decreased beta activity and may represent the EEG basis of SI. With this result, the study proposes an additional hypothesis for the EEG basis of SI may be the decrease in beta power spectrum to threshold values of 0.0611-0.1586 and median of 0.1196 at channel Fpz-Cz.

Keywords: *sleep inertia, EEG signals, Fpz-Cz channel, PSD, beta.*

B-15

A STUDY ON RADIATION LEVELS AND THE IMPACT ON CONCRETE MAC AS REPLACING OF CEMENT FOR THERMOELECTRIC FLY ASH

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Abstract. In this study, we employed high purity germanium (HPGe) radiation detector to evaluate the radioactivity levels of materials utilized in the formulation of fly ash concrete. This included PCB40 cement, two variants of thermoelectric fly ash (FA) collected during both dry and rainy seasons, river sand, artificial sand, 10mm×20mm construction stone, and sikacrete additives. Eight sets of concrete samples, each consisting of three identical samples measuring 150mm×150mm×150mm, were prepared using these materials. The study included eight sets of samples. One set had no fly ash (FA) and was labeled as the C2 sample group. The remaining seven sample groups (FAC220-225-230-235-240-245-250) contained different proportions of FA, ranging from 20% to 50%, as a substitute for conventional cement (CM). The compressive strength of these samples was assessed after 28 days following the national standard TCVN3118:2022. Additionally, microstructural alterations were examined using field emission scanning electron microscopy (FESEM). Our findings revealed that the materials we surveyed exhibited varying levels of radioactivity, with dry season fly ash registering the highest average activity levels of ^{226}Ra, ^{232}Th, and ^{40}K, measuring 81.8 ± 2.9; 99.6 ± 3.4; and 951 ± 40 Bq.kg^{-1}, respectively. Importantly, these levels fell within the range of values reported in international studies published by the International Atomic Energy Agency (IAEA). The study also calculated the average effective dose values for outdoor (D_{out}) and indoor (D_{in}) settings, annual effective dose, and total excess lifetime cancer risk (ELCR) for all raw materials and finished concrete samples. Additionally, equivalent radium activity and gamma and alpha readings for building materials were computed, all of which remained below the IAEA's recommended safety limits. Moreover, the study demonstrated that fly ash, when used in concrete mixtures, has the potential to replace conventional cement while enhancing mechanical properties and ensuring radiation safety within the permissible range of building materials. The highest compressive strength of 24.3MPa was achieved for the FAC235 sample, surpassing that of the C2 sample. FESEM analysis revealed that the C2 sample exhibited greater porosity, corresponding to lower compressive strength compared to the FAC35 sample. The outcomes of this research not only suggest a viable solution for managing fly ash waste but also advocate for a reduced reliance on conventional cement in concrete production, thereby mitigating adverse environmental impacts.

Keywords: *Fly ash concrete, radioactivity, mechanical properties, compressive strength, microstructure, environmental impact, waste management.*

B-16

LASER DIAGNOSTICS OF FLAMES: LABORATORY INVESTIGATION OF ASTROPHYSICALLY RELEVANT NANOPARTICLES

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Abstract. The interstellar medium (ISM) and the flames are characterised by completely different physical and chemical conditions. However, they both contain a strongly similar variety of carbon-based matter including polycyclic aromatic hydrocarbons (PAHs) and their derivatives, cage structures including fullerenes, and carbonaceous nanoparticles (Hansen 2022, Martin 2022). Flames are thus been shown to be pertinent reactive media in the laboratory that allow to progress on the understanding of the journey of carbon matter in space.

In the laboratory, laser diagnostics are one of the best tools to probe flames to identify the by-products, to trace the kinetics or to explore the structure. Among them, laser induced fluorescence and laser induced incandescence have been extensively used. In particular, they are very important to explore the soot inception, at the transition from the molecular precursor to the first nanoparticles, a hot topic in combustion science. I will try to show that progress on the characterisation of the soot nuclei could be of strong importance not only to guide mitigation on soot formation but also to interpret many spectral features detected in space. The development of online diagnostics as well as the combination of several spectroscopies will be presented.

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B-17

DEVELOPMENT OF SOLAR/LED LIGHTING SYSTEM FOR AGRICULTURE APPLICATION

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Abstract. We have developed a solar/LED hybrid lighting system that utilizes free-form optics devices, plastic optical fiber bundles, and LED devices. By optimizing the combination of solar and LED radiations, our system can effectively utilize natural energy while minimizing electricity consumption, thereby improving indoor environments and providing a full visible spectrum for plant growth. We conducted simulations, designed and implemented a prototype system, and optimized it through practical testing. Our system achieves an optical efficiency of ~16% and can save energy by 54.3% (on sunny days) and 38.9% (on cloudy days). Indoor farming experiments with several plants were successfully conducted both in vitro and ex vitro, demonstrating the system's potential application for indoor agriculture.

B-18

PRELIMINARY RESULTS IN TRANSFER OF ^{40}K AND ^{226}Ra FROM SOIL TO SHORT-TERM VEGETABLE

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Abstract. Activity concentrations of the selected radionuclides ^{226}Ra and ^{40}K were measured in surface soil samples and short-term vegetable collected in Hoc Mon district, which is a suburban area of Ho Chi Minh City by means of gamma spectroscopy with an HPGe detector. The specific activity of ^{226}Ra in soil and broccoli samples was 31.85 ± 3.47 Bq/kg and 11.02 ± 4.54 Bq/kg, respectively, this value for ^{40}K 93.20 ± 7.77 Bq/ kg and 2957.09 ± 99.70 Bq/kg. Soil-plant factors from soil to broccoli were 0.36 ± 0.15 respectively for isotope ^{226}Ra and 37.98 ± 3.91 for ^{40}K.

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B-19

EXACT SOLUTION FOR THE QUANTUM RABI MODEL WITH THE A^2 TERM

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Abstract. Quantum Rabi model (QRM) is widely used for the analysis of the radiation-matter interaction at the fundamental level in cavity quantum electrodynamics. Typically, the QRM Hamiltonian includes only $\hat{p}\hat{A}$ term, however, the complete nonrelativistic Hamiltonian of quantum electrodynamics includes A^2 term as well. Here we find an exact solution and demonstrate with the help of the exact canonical transformations that the QRM Hamiltonian with the A^2 term (QRMA) is reduced to the standard QRM model Hamiltonian with the renormalized frequency and the coupling constant and the eigenstates are expressed through the squeezed states of the field.

As a result, the A^2 term qualitatively changes the behavior of the QRM with purely electromagnetic interaction in the strong coupling regime: the value of the ground state energy of an atom inside the cavity is higher than in vacuum and the number of the crossing of energy levels with different quantum numbers decreases.

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B-20

APPLYING REMOTE SENSING INTEGRATED WITH MACHINE LEARNING AND GIS-DSAS TO ASSESS RIVERBANK EROSION IN THE HAM LUONG RIVER, VIETNAMESE MEKONG DELTA

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Abstract. Riverbank erosion is a long-term natural disaster that occurs in practically all deltas around the world. The objective of this study is to examine riverbank evolution in the Ham Luong River in the Vietnamese Mekong Delta from 1998 to 2020. Remote sensing combined with machine learning methods were used to extract riverbanks from Landsat satellite images. The riverbank change rate was then calculated using the Digital Shoreline Analysis System (DSAS 5.1) as an extension of the ArcGIS software. We found that riverbank erosion dominated the accretion from 1998 to 2020. Particularly, 57.6% (73 km) of the entire length of the two banks was eroded resulting in 175 ha of losing land, while only 44.2% (56 km) of the riverbanks' length was deposited (which equal to 76.7% of the total erosion length), with an area of 138 ha was accreted. Low (-1.0 to -0.5 m/year) and medium (-3.0 to -1.0 m/year) erosion rates accounted for 10.35% and 9.5% of the computed transects. Besides, erosion mainly happened along the right bank, with a mean net bank line erosion of -11.34 m/year. Riverbank erosion has increased in both rate and extent over three periods 1998-2005, 2005-2017, and 2017-2020. In 1998-2005, riverbanks were accreted by 46.92 m^2/year. Riverbanks, however, were increasingly eroded in 2005-2017 and 2017-2020, with a net evolution area of -9.34 m^2/year and -98.06 m^2/year, respectively. Notably, the riverbank was slightly eroded when being protected by the vegetation belt in 1998-2005; but it became rapidly eroded when the vegetation belt disappeared (e.g., in 2017-2020). The study suggests implementing effective measures to maintain the Ham Luong riverbanks, including protecting and regenerating vegetation belts. The application of remote sensing and machine learning in conjunction with GIS-DSAS is highly transferrable for riverbank change studies in the Mekong Delta and other river systems in Vietnam and around the world.

Keywords: *Vietnamese Mekong Delta, erosion, accretion, remote sensing, machine learning, riverbank, DSAS.*

B-21

NANOTECHNOLOGY AND NANOSAFETY*:* THAILAND AS CASE OF STUDY

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Abstract. This presentation will give an overview of Nanotechnology as an enabling technology and Nanosafety Initiatives in Thailand based on the guidelines stated in the current Nanosafety and Ethics Strategic Plans of 2021-2023. It will also give an overview of the Nanosafety Network for Industry which is considered the back bone of nanotechnology development Awareness in Thailand.

Key words*: nanotechnology, public Awareness, alliances.*

B-22

SUSTAINABLE DEVELOPMENT OF NANOMATERIALS FOR THE GLOBAL TRADE FROM THE PERSPECTIVE OF GHS AND GLP

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Abstract. Life cycle of a nanomaterial starts from the initial synthesis that begins at the research stage, then continues to the stage of product development for industry and/or consumer commercial use, eventually ends at the stage of waste disposal [1]. This reflects the expression of the phrase Cradle to Grave or Womb to Tomb of a product life cycle [2]. Subsequently, this cycle repeats as part of the modern-day recycling efforts to optimize resource usage and reduce negative impact to human and environment [3]. The presentation aims to illustrate the sustainable development aspects to be addressed by nanomaterials in accordance with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) [4]. The nanomaterial is expected to address the classification of its severity level of the physical, health and environmental hazards upon exposure to human and environment. The severity level of the nanomaterial is based on the in-silico analysis and/or experimental testings using in vitro and in vivo models using the standard test guidelines published by the Organization for Economic Co-operation and Development (OECD) [5]. In order to assure high trustworthy of the experiments safety data for the mutual acceptance between countries for the international trade, it is expected for these testings to be carried out under the good laboratory practice (GLP) quality system specified by the OECD [5]. Consequently, the GLP quality safety data is presented at the designation sections of the safety data sheet [4].

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B-23

APPLYING MACHINE LEARNING COUPLED WITH MONTE CARLO FOR PREDICTING THE CONCENTRATION OF SODIUM COMPOUNDS IN GAMMA TRANSMISSION MEASUREMENTS

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Abstract. The study presents a new approach for determining the concentration of sodium compounds in solutions. In this approach, the machine learning models were trained by data obtainted from Monte Carlo simulation. This data showed a good agreement with the experimental spectra for both compounds. The models were also optimized through adjustments to the activation functions, the number of hidden players as well as the nodes within each of these hidden players. Then, the trained model was used to predict the concentrations of 10 olution samples containing NaOH and NaCl. Out of these, there are 8/10 samples with relative deviations between reference and predicted values of less than 5%. The remaining two samples exhibited deviations of 5.53% % and 6.24%, respectively. This result indicates the machine learning model combined with Monte Carlo simulation can be applied to predict the concentration of compounds in gamma transmission measurements.

Keywords: *concentration, machine learning, Monte Carlo, transmission.*

B-24

THE INITIAL RESULTS OF THE RESEARCH ON THE USE OF WASTE MATERIALS TO PRODUCE ENVIRONMENTALLY FRIENDLY CONCRETE FOR RADIATION SHIELDING

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Abstract. This research indicates the feasibility of recycling waster materials such as coal powder (graphite) with stone powder ($CaCO_3$) from quarries, honeycomb ash from household waste, and mechanical processing waste (scrap steel) which are environmentally burdens by testing with different rates to replace sand for concrete production. Proposing effective formulas to create environmentally friendly concrete with improved resistance to outdoor environments, load-bearing capacity, and durability while still ensuring concrete's basic mechanical properties (compression, bending, slump, etc.). In addition, according to the regulations, a radiation safety standard for people must be calculated by calculating the external radiation index within the permitted limit. By replacing scrap steel (0, 12.63, 25.26, 37.89, 50.52, 63.15, 75.78); graphite (0, 7.59, 15.18, 22.76, 30.35); stone powder and honeycomb ash (0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100) for sand, all concretes achieved a compressive strength greater than 25Mpa, which is suitable for civil engineering projects. The weight of concrete replaced with stone powder ($CaCO_3$), coal powder (graphite), and honeycomb ash is lighter than the control concrete by 2-15% and the scrap steel is heavier by 7-20%. This shows that lightweight waste materials can be used in civil engineering projects and heavy scrap steel can be used safely to shield radiation at radiation facilities. These initial results provide a basis for further investigation of the radioactive activity of the isotopes ^{235}U, ^{238}U, ^{232}Th, and ^{40}K; the Radon gas emission coefficient, and the linear attenuation coefficient corresponding to the energy level of 661.7 keV of ^{137}Cs.

Keywords: *Waste materials, environment, concrete, radiation.*

B-25

STRUCTURAL HEALTH MONITORING – AN INVERSE PROBLEM IN SCIENCE AND ENGINEERING

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Abstract. The talk is devoted to presenting an approach to the problem of structural health monitoring (SHM) that consists mainly of detecting potential damage in an existing structure from its behavior-collected data [1-2]. The approach is based on the system identification technique that proposes to determine a parameteric model of an existing structure from measured data of its dynamic behavior. Content of the damage detection process is described in Schema 1.

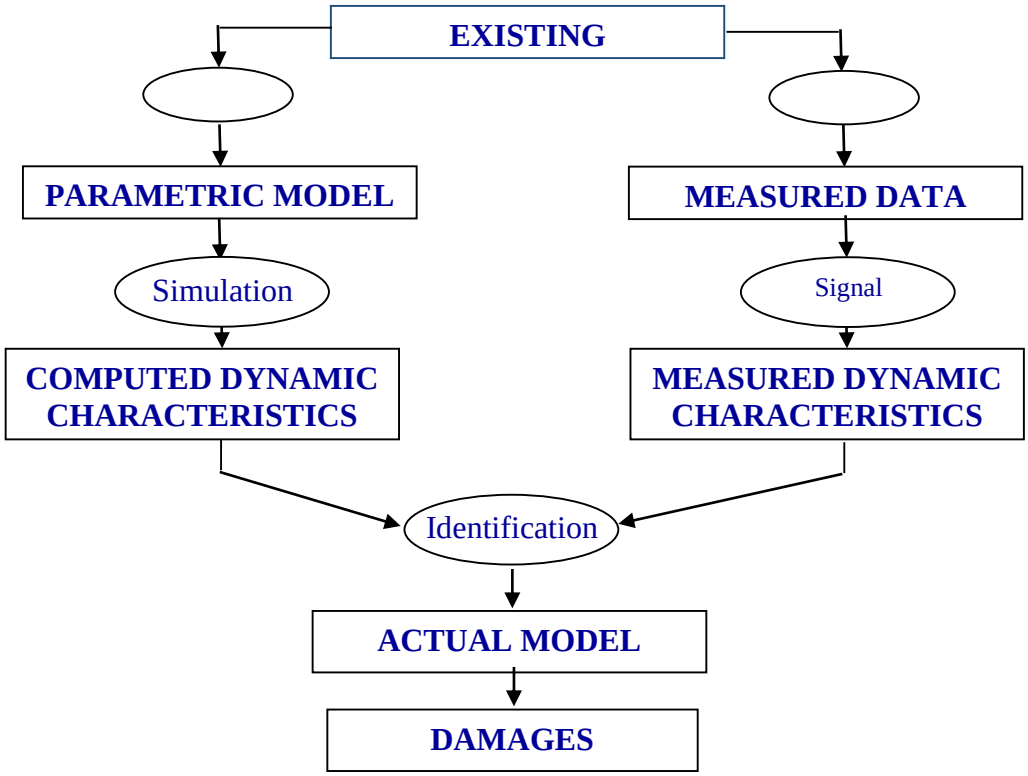


Fig. 1. *Flowchart of damage detection process*

So, the damage detection process consists of three main tasks: Theoretical Modelling, Experimental Testing and Structure Identification of a structure under consideration.

Methods of Modelling: Analytical, Finite Element and Dynamic Stiffness Techniques.

Equipment for Experimental Testing are Dynamic Signal Analyzers, Exciters, Sensors.

Methods used for Signal processing and Structure Identification are FFT, Wavelet Transform and Tikhonov's Regularization Technique.

The damage detection problem is illustrated by an example of crack detection in bridge girder using moving load [3-4] and distributed piezoelectric sensor [5-6] what is shown in Fig 2 and shortly given below.

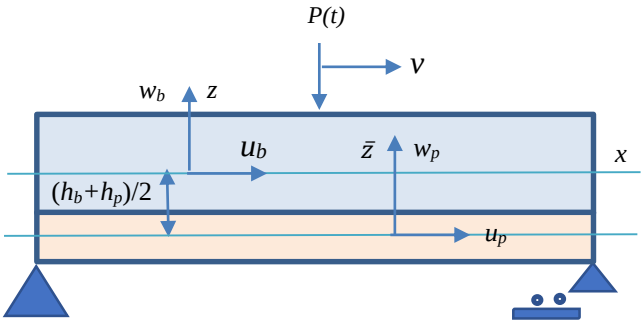
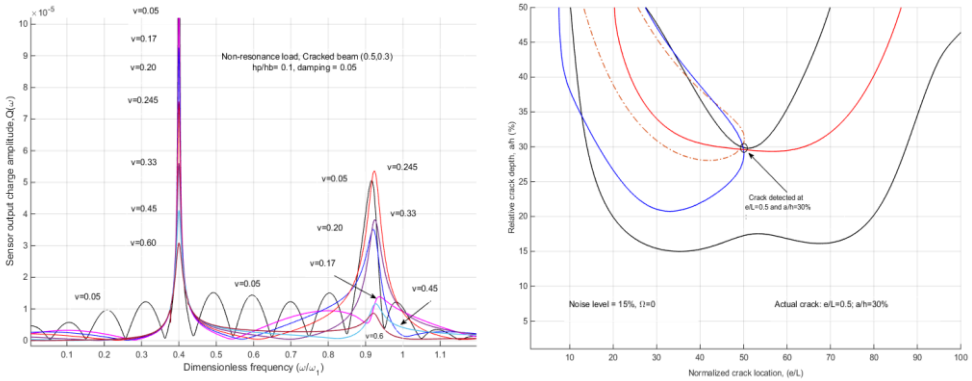


Fig. 2. *Model of beam structure bonded with a piezoelectric layer under moving load*

In this example there is used analytical model described by the equations

$$\begin{gathered}(I_{11}^{*}\ddot{u}_0 - B_{11}^{*}u_0'') + \left(I_{12}^{*}\ddot{\theta} - B_{12}^{*}\theta''\right) = 0;\\ (I_{12}^{*}\ddot{u}_0 - B_{12}^{*}u_0'') + \left(I_{22}^{*}\ddot{\theta} - B_{22}^{*}\theta''\right) - A_{33}^{*}(w_0' - \theta) = 0;\\ I_{11}^{*}\ddot{w}_0 - A_{33}^{*}(w_0'' - \theta') = P(t)\delta(x - vt),\\ Q(\omega) = (bh_{13}/\beta_{33}^{p})\int_0^L [U'(x,\omega) + h\Theta'(x,\omega)]dx.\end{gathered} \tag{1}$$

Instead of an exciter there is taken a vehicle moving on the beam with constant speed that produces a moving harmonic force. The piezoelectric layer is employed as a distributed sensor that allows us to measure sensor output charge in the frequency domain $Q(\omega)$. Using the measured charge (Fig. 3a), we can detect a crack at position L/2 with depth 30% beam thickness (Fig. 3b).



(a) (b)

Fig. 3. *Measured sensor output charge (a) and diagram for crack detection (b)*

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B-26

OPTICAL DESIGN AND APPLICATIONS

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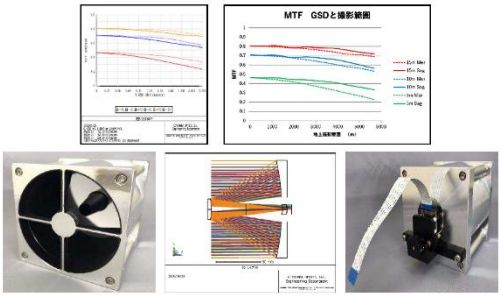
Abstract. Crystal optics company specializes in designing and manufacturing optical products related to the high-tech field in Japan.

Relevant to the following optical application areas:

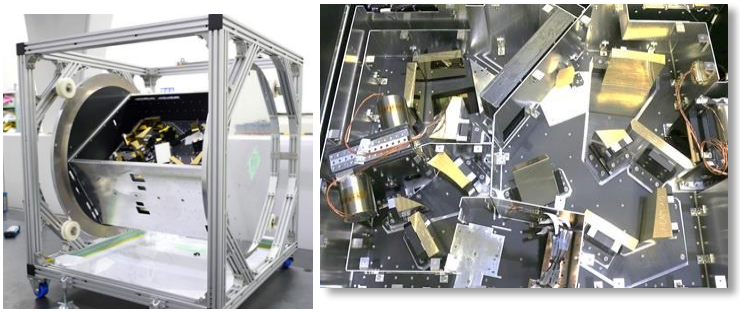
① Space and Astronomy:

-Space Telescope: High Resolution Optical Camera (HCAM)



(Used in the small satellite Hodoyoshi-4 of the University of Tokyo)

-Astronomical Observation System: Mid-infrared Optical Camera (MIMIZUKU)



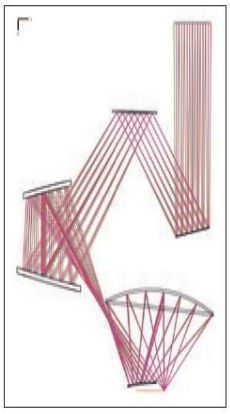
(Tokyo Atacama Observatory Project)

② Optical and Medical :

-Head-up Display : Freeform Mirror

(Used for Head-Up Display which projects data such as speed and navigation directions onto the windshield)

- Eccentric All-reflective Objective Unit:

(Designed for focusing and irradiation of femtosecond-laser pulses)

- Optical Research and Development: High-precision X-ray Mirrors

(Used in these advanced synchrotron radiation facilities and X-ray free electron laser facilities)

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B-27

SYNTHESIS OF IRON-BASED MATERIALS USING A PLASMA-IN-LIQUID PROCESS

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Abstract. In the last few decades, the use of iron-oxide materials has attracted great interest in many application areas, such as environmental, biomedical and electrochemical energy storage [1]. Owing to their high natural abundance, easy availability and low cost, significant interest has been dedicated to its synthesis.

Recently, the plasma-in-liquid process (PLI) has been used to synthesize different metal oxide nanoparticles, including iron-based particles [2-4]. In a bottom-up approach, the plasma generated species are able to react with the metal ions present in the solution, leading to the oxide formation. This technique is considered as environmental friendly since no additional chemicals are needed; most of the metal precursors are soluble in water which avoids using toxic solvents; and it has low heating requirements when carried out at ambient temperature.

In this work, the PLI process is used in order to produce iron oxide particles from aqueous solutions containing a dissolved iron salt. Pulsed plasma discharges are generated using platinum wires as the electrodes, which are immersed in the solution, and positioned in a pin-to-pin configuration. The effect of the metal precursor concentration, frequency and applied voltage of the discharge pulse on the material production is studied.

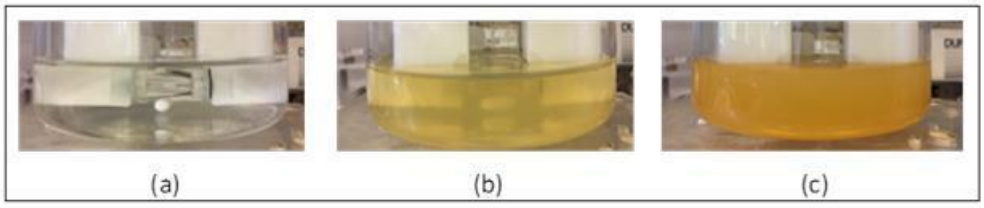

Figure1. Influence of the applied voltage on the production of iron-based materials prepared with the PLI process. Initial concentration: 30mM in Fe2+. (a) Initial solution. Solution obtained after applying a pulsed plasma discharge for 30 minutes, at (b) 10kV and (c) 12kV.

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POSTER SESSION

P-01

THE SMALL EFFECTIVE MODE AREA IN FLOWER-SHAPED HOLLOW CORE PHOTONIC CRYSTAL FIBRES

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Abstract. In this paper, we present for the first time a new photonic crystal fiber with a flower-shaped hollow core of six smaller petals arranged in circular fashion, infiltrated with chloroform. In addition, the air hole's size of the first layer is set to be smaller than that of the others in the cladding. This efficient design greatly improves the effective refractive index and effective mode area of the photonic crystal fibers. The small effective mode areas have been achieved with values of about 2 μm2 at a wavelength of 1.55 μm. This also enhances the nonlinearity of the fibers and is beneficial for applications through supercontinuum generation.

Keywords: *Flower-shaped, Photonic crystal fibers, small effective mode areas, supercontinuum generation.*

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P-02

IMPROVING EFFICIENCY OF TRACKING GAMMA SOURCE BASED ON DEEP LEARNING METHOD

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Abstract. In the field of nuclear and radiation safety, ensuring safety when using gamma sources is one of the highest-priority requests requiring stringent assurance procedures. Even though highradiation gamma sources are protected in a lead sheilding to ensure human safety, the loss of gamma source is inevitable in the event of an accident [1]. Consequently, the development of rapid and precise gamma source tracing methods have atttract the interest of researchers. In order to reduce the potential danger to human health, manual detection should be replaced by robots. Robots equipped with detectors will move along predetermined survey lines to map the radioactivity by location, from which the gamma source can be determined. This approach reaches challenges in terms of detecting time and the characterizations of specific map that the robot must detect. Diverse methods, including the gradient-search method and the zip-zap detection method [2], have been considered for determining the source location with high accuracy and in a brief amount of time. Although these methods can enhance the ability to detect gamma sources, they are still not optimized in terms of time (found sources in the range of 60 to 70 steps in a 10 m × 10 m region), and the accuracy of gamma source detection is low. In order to overcome these issues, we report the results of deep learning in finding lost gamma sources without human intervention. We proposed different deep learning models: Artificial Neural Network (ANN), Convolutional Neural Network (CNN), and Recurrent Neural Network (RNN), and demontrated the ability of deep learning in reducing the number of steps in tracking the gamma source location after a 5 or 15 - step path, thereby decreasing the time required to detect gamma sources [3 – 5]. In addition, we confirmed the capability of deep learning to recognize gamma sources with variety of radioactive activities. Our findings not only demonstrate the applicability of deep learning to gamma source tracking, but also the applicability of this technique to other disciplines of nuclear engineering.

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P-03

A REVIEW STUDY ON AIN LAMB WAVE RESONATOR TECHNOLOGY

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Abstract. Frequency references with a low phase noise and a low temperature-induced frequency drift are important components for navigation systems, wireless communication systems, and signal processing applications. MEMS resonators can be sorted into piezoelectric and capacitive transduced ones. Generally, the piezoelectric MEMS resonators tend to show a large coupling coefficient and the capacitive resonators have a super high Q but a small coupling coefficient. We will introduce the piezoelectric resonators in detail here (SAW, BAW, LWR) and then a brief introduction to the capacitive resonators. Lamb wave resonators (LWRs), a promising solution forfuture single-chip multi-frequency reconfigurable wirelesscommunications, have shown great potential to yield highperformance narrowband filters and designing highperformance LWR is pursued by intensive research efforts. With miniaturized sizes and perfect compatibility with CMOS, aluminum nitride (AlN) Lamb wave resonators (LWRs) are promising solutions for future single-chip multi-band wireless communications. Aluminum nitride (AlN) Lamb wave resonators (LWRs) arepromising solutions for future single-chip multi-frequencyreconfigurable wireless communications. With miniaturizedsizes, low impedance, and perfect compatibility with CMOS, they have shown great potential to constitute low loss andchannel-select band pass filters, therefore, designing a high-performanceLWR is pursued by intensive research efforts**.**

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P-04

DETERMINE CU(II) ION IN AQUEOUS BY A SOLUTION CATHODE GLOW DISCHARGE - OPTICAL EMISSION SPECTROSCOPY COMBINED WITH ARTIFICIAL NEURAL NETWORK

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Abstract. To experimentally synthesize spinel Ho-doped copper ferrites nanomaterials with the formula $CuFe_{2-x}Ho_xO_4$ (x = 0; 0.10; 0.15) [1], the molar ratio of Cu(II):Fe(III):Ho(III) in aqueous with high accuracy is required, and the determination of the metal content in the solution is essential. Using the ICP-OES method to determine the metallic ions is one of the methods but the disadvantage of high power, high frequency, and using Argon gas. Solution cathode glow discharge - optical emission spectroscopy (SCGD-OES) is a new method that improves the disadvantage of the ICP-OES method [2-3]. However, the signal of SCGD-OES is unstable at high-ion concentration, and need to develop a new technique to improve the accuracy in determination of ion concentration. In this research, we report our study of verifying Cu(II) concentration in aqueous by SCGD-OES method combined with artificial neural network (ANN). After collecting the experiment data, we analyzed the results of OES data and determined Cu(II) ion from 1.25% to 3.5%. High peaks characteristic for Cu(II) ion in the OES graph are 325.5 nm, 328 nm, 511 nm, 516 nm, and 522 nm, respectively. However, the intensity peaks of Cu(II) are unstable at position 325.5 nm and 328 nm wavelengths [4-5]. Here, we demonstrate the ability to use ANN to find exact output parameters by training the input data. ANN modified model for determining Cu(II) ion concentration is run 300 training times with nodes in two layers is 9 and 5, respectively. After using ANN modified model, the results test in validation data of mean square error (MSE) is 0.0013 and ratio error (RE) is 0.0331. The relative error and absolute error after running on validation data are 2.918%, and 0.073, respectively. Apllication ANN to determine Cu(II) ion concentration in solution is accurately predicted even when the spectrum is unstable, identify prominent vertices relative to elements, and identify the weights of prominent vertices. In the future, from [6] are using SCGD-OES to determine multi-metallic ions, the ANN model method will upgrade and combine with SCGD-OES in case the problem of detecting many metals at low concentrations.

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P-05

DETERMINING THE DEPTH OF SOME SEDIMENTATION BASINS IN THE MEKONG DELTA USING OPTIMIZATION ALGORITHM

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Abstract. The Mekong Delta is the key agricultural economic region of Vietnam. This land was formed from alluvial sediments and gradually accumulated over the epochs of changing sea levels. Studying the geological structure in the region to assess the potential for mineral exploitation as well as forecasting geological disasters that may occur in the future is necessary. In the field of oil and gas exploration, gravity exploration method allows detecting sedimentary basins, structures and tectonic fracture systems in sedimentary basins; distinguishing subsidence and uplift zones in sedimentary basins. The common geophysical method to calculate the depth of sedimentary basins is to solve the inverse gravity exploration problem. In this paper, the Marquardt optimization algorithm is used to solve the inverse gravity problem using Granser's FFT (Fast Furier Transform) technique and Cordell and Henderson's space domain technique to determine the depth of sedimentary basins in the Mekong Delta.

Keywords: *the depth of the sedimentary basin, solving the inverse gravity problem, FFT technique, spatial domain technique, Marquardt algorithm.*

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P-06

IDENTIFYING THE KEY SITES FOR THERMAL STABILITY OF GLUCOSE-6-PHOSPHATE DEHYDROGENASE BY MOLECULAR DYNAMICS SIMULATIONS WITH A COARSE-GRAINED MODEL

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Abstract. Glucose-6-phosphate dehydrogenase (G6PD) is an enzyme that catalyzes the oxidation of G6P by NADP+ in the metabolic pentose phosphate pathway. The NADPH generation through this catalyzed reaction is crucial in protecting red blood cells against oxidative damage. The deficiency of G6PD may lead to a red blood cell breakdown causing hemolytic anemia. G6PD deficiency is genetically inherited and is known as the most common enzymopathy, affecting ~5% of the world population [1]. The catalytic activity of G6PD has been shown to correlate with its thermal stability [2]. In this study, we investigate the thermal stability of G6PD by using molecular dynamics simulations with a structure-based coarse-grained model, in which each amino acid is considered as a single bead. We identify the key sites defined as the positions in the amino acid sequence that have the largest contributions to the specific heat of the enzyme, thus are the most sensitive to the enzyme's thermal stability. It is shown that a significant fraction of these key sites are linked to the most severe class I point mutations associated with G6PD deficiency.

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P-07

FABRICATION OF HIGHLY UNIFORM PLASMA TREATED SERS SUBSTRATE ON PDMS

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Abstract. Nowadays, surface Raman enhancement (SERS) effect based on metal nanostructures is of particular interest to research with the aim of detecting toxic organic substances (RB, R6G,…)[1,2,3] heavy metals in seafood, agricultural products[4] or aspartame[5] in foods… Base materials such as Si, glass, metal [2,6] which are high stability as well as easily being fabricated, often used in experimental research. However, the actual surface samples often have curvatures and various in shape. It is necessary to develop flexible and highly flexible SERS soles. In this research, we deliver the silver nanoparticles on a Polydimethylsiloxane (PDMS) substrate by the rotary coating method. A define (masked) area of PDMS substrates were treated by an Argon plasma jet. Within the plasma treated area, the SERS substrates have high uniformity. Under suitable fabrication conditions, the PDMS-based flexible SERS substrate allows the detection of Methylene blue (MB) standards to a concentration of 10^{-10} M, equivalent to that of the same type of SERS substrate.

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P-08

STUDY OF THE EFFECT OF OPTICAL PARAMETERS OF THE LASER NOZZLE ON METAL CUTTING PROCESS USING FIBER LASER

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Abstract. In laser cutting process, optical parameter of the nozzle, which determine the position of focal point relative to the workpiece surface, is one of the most important parameter directly affecting the cut quality. Accurately ascertaining the focal point may produce narrow kerf width, smooth cut surfect, reduced dross formation that clings to the lower edge of the workpiece. In this study, we present our research results and calculation on the optical parameters of the laser nozzle to determine the focal point and its effect on the cut quality.

In addition, some illustrative results about laser cut surface with optimal focal points are demonstrated.

Keyword: *fiber laser, laserbeam, laser cutting*

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P-09

STUDY AND SELECT DIODE LASER PUMPING FOR 1KW POWER FIBER LASER IN INDUSTRIAL LASER SYSTEM

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Abstract. Our paper present research results and findings about optical pumping technology for high power fiber laser by using diode laser pumping system. By improving pumping technique and optimizing configuration of laser pump can heighten output power of fiber laser, serving industrial application.

From the above findings, our team has selected and proposed building diode laser pumping system from the following components: diode laser modules, power source, optical connector components... We show how to choose parameter of the diode laser module such as pumping wavelength, pumping power. And lastly, the diode laser pumping system for fiber laser with 1KW power output is presented.

Keyword: *laser pumping, optical pumping, fiber laser.*

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P-10

STUDY THE THERMAL EFECT ON QUALITY OF DIODE LASER PUMPING FOR FIBER LASER

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Abstract. We demonstrate our research on the thermal impact on quality of diode laser beam, the cause of heat generation in diode laser, and formulate a thermal stabilization method at our lab. On that basis, we evaluate the parameters of optical pumping for high power fiber laser by using diode laser pumping system.

From the above findings, our team select optical pumping parameters for a type of fiber laser with optimal pump efficiency. And lastly, the diode laser pumping system for fiber laser with 1KW power output is presented.

Keyword: *laser pumping, optical pumping, fiber laser.*

P-11

DAILY STRESS LEVEL PREDICTION BASED ON SMARTPHONE-BASED GPS DATA: A PRELIMINARY STUDY

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Abstract. Mental stress has emerged as a pressing concern in contemporary society, exerting a substantial negative influence on individuals' overall quality of life and professional productivity. Therefore, daily mental health management plays an essential role in facilitating timely guidance and appropriate interventions. Smartphone, which is can-not-leave device nowadays, could be effective instruments to remotely access stress-related behavior. In this work, the GPS and stress status data from the StudentLife database [1], a large-scale smartphone dataset acquired from 48 students in 10 weeks, were utilized to perform the analysis. The GPS data had been processed to estimate the mobility status (staying or moving) of the carrying person. Afterward, statistical features of mobility behavior and time were extracted from the processed GPS data. In mobility behavior features, in addition to the moving or staying frequency features, 8 statistical factors (maximum, minimum, mean, standard deviation, first quantile, third quantile, median and total) of staying time were achieved. These features were fed to 2 ensemble learning models, XGBoost and Random Forest, to perform the daily 2-level (happy, stress) and 3-level (happy, stress, stress out) stress status prediction. The results present considerable performance in 2-level prediction. In the inter-person validation, the accuracy and the weighted F1-score are 79% and 76% in the Random Forest model and 77% and 75% in the XGBoost model respectively. Moreover, in random-split validation, the accuracy and weighted F1-score approach 78% and 75% correspondingly. On the other hand, the 3-level prediction reach the accuracy of 63% and the weighted F1-score of 60% in random-split validation, and 56% and 49% in inter-person validation respectively. In summary, a robust association has been established between human mobility behavior patterns and mental stress events. However, additional feature mining strategies should be deployed to improve the performance of the prediction model and address the unrestricted environment experiment.

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P-12

OPTIMIZATION OF THE ARRANGEMENT OF THE GOODS IN E-BEAM IRRADIATION TO INCREASE THE PRODUCTION

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Abstract. Irradiation technology is to use a high-energy beam of electron radiation (EB) on food to sterilize the food and keep the quality as well as the organoleptic (no change in sensation). The uniformity of irradiated dose, quantity, and time is a big problem of the current irradiation factory. Optimizing irradiation output is a problem posed by irradiation plants to save energy, time, increase profits, and quickly respond to customers' processing. On the other hand, the optimal method should be easy to use and adequate to the production needs of the factory. Therefore, the irradiated dose of some materials was investigated and implemented programming to optimize the arrangement and increase the irradiation of tangible goods.

Keywords: *E-beam, Irradiated optimized, arrangement.*

P-13

RESEARCH AND DEVELOPMENT OF SOLARIMETER EQUIPMENT USING HIGH PERFORMANCE SOLAR CELLS, APPLYING FOR MONITORING THE PERFORMANCE OF SOLAR POWER SYSTEM

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Abstract. Solar power is a renewable energy source that has attracted a lot of attention from researchers and energy managers because of its outstanding advantages. In Vietnam, there are a lot of farms that install solar panels with ultra-high power. However, there is no suitable real-time monitoring and evaluation system for solar power systems. Therefore, the authors have researched manufacturing a solarimeter based on the operating principle of Reference Cells (Figure 1) using a high-efficiency photovoltaic cell (conversion efficiency > 21%) to monitor and evaluate the conversion performance as well as the health of the solar power system [1]. The instrument has shown the ability to measure solar radiation with the same accuracy as the standard instrument. The survey results under actual conditions also show that the solar irradiance measurement range of the device is significantly sensitive to the wavelength range of solar radiation that the silicon solar cells can absorb. Thus, the fabricated device shows potential for application in monitoring and evaluation systems of conversion efficiency and status of silicon solar power systems.

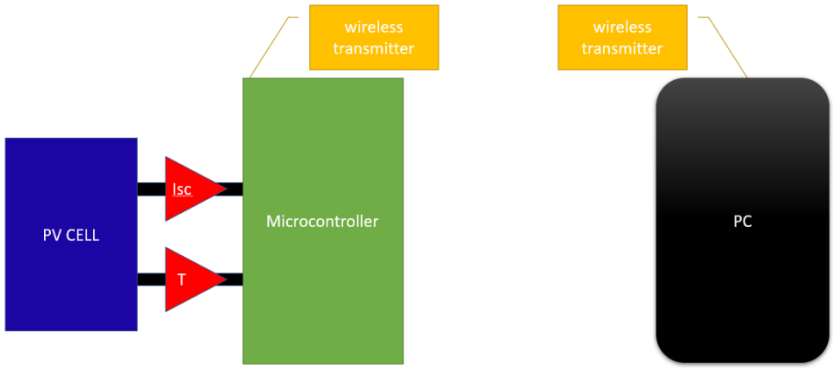

Figure 1. *The schematic diagram of solarimeter*

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P-14

LIFSHITZ TRANSITION IN $Cd_2Os_2O_7$ PYROCHLORE

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Abstract. Nowadays, multiphase materials are more attractive because of their unique advantages. One of these, pyrochlore $Cd_2Os_2O_7$ seems to be a suitable material for research in phase transition. In our work, we focus on the phase transition of $Cd_2Os_2O_7$ materials, mostly through the temperature-dependent Raman scattering method. In our study of the major contribution to the couplings with phonons, we figured out the changes at two of these temperatures: T_{MIT} (205 K) and T_N (227 K), respectively [1, 2]. This anomalous behavior supports our forecast that the phase transitions in $Cd_2Os_2O_7$ are of the Lifshitz type. In the Lifshitz transition, the MIT transition does not occur simultaneously with the magnetic transition [1, 3], which partly substitutes for the conventional Slatter model [4, 5] that MIT and magnetic transitions take place at the same time.

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P-15

OPTICAL PROPERTIES AND ENERGY TRANSFER PROCESSES OF Tb^{3+} DOPED ZnS NANOCRYSTALS

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Abstract. Tb^{3+} doped ZnS nanocrystals (NCs) with different concentrations of Tb^{3+} ions were synthesized using a chemical method. The XRD pattern and XPS spectrum analysis showed that Tb^{3+} doped ions replaced the Zn^{2+} ions in the crystal lattice. The optical properties of the Tb^{3+} doped ZnS NCs were studied using absorption, photoluminescence excitation and photoluminescence spectra. The Ω_λ (λ = 2, 4, 6) were calculated from the absorption spectra using the Judd-Ofelt theory. The quantum efficiency and properties of the ligand field of samples were determined. The energy transfer processes from the ZnS host to the Tb^{3+} ion and between Tb^{3+} ions also were discussed in detail.

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P-16

DEVELOPING AND ENHANCING PHOTOCATALYSIS OF SEMICONDUCTOR/g-C_3N_4 HETEROJUNCTION FOR ENVIRONMENTAL APPLICATION

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Abstract. The use of fossil fuels generates harmful emissions to the environment such as carbon dioxide (CO_2), nitrous oxide, nitric oxide and nitrogen dioxide (together termed NO_x), and fluorinated gases (such as hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, etc.) are considered the primary pollution for the environment currently [2]. A Global warming potential was used to compare the global warming effects of different gases, which has been calculated to reflect how long gases remain in the atmosphere, on average, and how strongly it absorbs energy [3]. Besides, the discharge of persistent organic pollutants (POPs)also contributes to water pollution, increasing global environmental pollution. Recently, CO_2 removal and conversion into valuable products have drawn much attention due to its ability to mitigate the amount of CO_2 greenhouse gas and form alternative energy sources [4]. Many different methods exist to remove contaminants in the environment, such as electrochemical and thermochemical conversion, biological fixation, and photocatalytic reduction [5-8]. Photocatalysis is the best choice because it does not require high temperature, pressure, and high voltage [9-11]. Moreover, this method is considered a promising and potential solution for sustainable development with zero carbon emission, no produced secondary pollution, and energy efficiency in the future [12-14]. In this presentation, we introduce a development of semiconductor (such as WO_3, ZnO, TiO_2, etc.)/g-C_3N_4 heterojunction towards the photocatalytic applications in environmental pollution treatment and creating the renewable energies

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P-17

INDUCED SECONDARY NEUTRONS AND GAMMA EMISSION FROM A MEDICAL PROTON ACCELERATOR AT ENERGIES OF 76 MeV, 80 MeV, AND 132 MeV IN A WATER PHANTOM

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Abstract: This study investigates radiation-induced secondary neutrons and gamma emissions resulting from the irradiation of a water phantom by a medical proton accelerator. Measurements were conducted using a 2-inch x 2-inch stilbene scintillator detector at Changgung Hospital, Taiwan. To distinguish neutrons from the gamma background, we applied a pulse shape discrimination technique based on the Q ratio. Our analysis covers three proton beam energies: 76 MeV, 80 MeV, and 132 MeV. This study will present detailed results obtained from these measurements.

P-18

ON THE USE OF LOGARITHMIC AMPLIFIER FOR LASER WARNING SENSOR

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Abstract. In the modern battlefield, laser warning systems (LWS) became essential supportive equipment that helps increase the survivability of military vehicles. LWS must detect, classify, identify, give warning of laser threats from laser weapons, and activate the electro-optical counter measurement systems such as jamming, smoke screening, active protection units, etc... [1, 2]. The "eyes" of this system are near IR photodetectors. Designing the amplifier for the photodetectors of the LWS is not trivial. Of cause, the amplifier must have a high gain to detect the laser emission from a far distance. However, laser weapons utilize lasers with different power grades, also the weapons themselves can be deployed at diverse ranges to the protected targets. Therefore, LWS photodetectors must cover a wide range of laser powers. In this work, we study the use of logarithmic amplifiers for the LWS. This type of amplifier has not only high gain but also a wide dynamic range which is very suitable for the requirements mentioned above.

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P-19

RESEARCH AND USING THE CHALCOGENIDE MATERIALS IN LENS DESIGN FOR THE MANUFACTURE OF THERMAL IMAGING DEVICES

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Abstract. Nowaday, the objective lens design of domestic thermal imaging devices is using crystalline materials such as: Germanium, Silicon, Zinc Selenide... A number of international articles have announced the application of Chalcogenide materials for advace results. In this article, some results of optimal calculation of parameters to design the objective lens of a thermal imaging device based on Chalcogenide material are presented.

P-20

STUDY OF UNIFORMITY CHARACTERISTICS OF USING LIGHT EMITTING DIODES IN VISIBLE LIGHT COMMUNICATION APPLICATIONS

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Abstract. The uniformity characteristic of emitted radiation in VLC applications is a factor that is possible to affect the efficiency of a detector as well as the overall efficiency of the VLC system. In this paper, we theoretically investigate the optical uniformity characteristic of using LED in VLC applications in terms of the parameter of emission angle of LED, and the spatial distribution of LED. The result indicates that the optical uniformity can be controlled at a high level by controlling the emission angle of the LED or distributing the LEDs in the space of the room.

P-21

STUDY OF THERMAL CHARACTERISTICS OF WHITE LIGHT EMITTING DIODES USING FINITE ELEMENT METHOD

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Abstract. Understanding the thermal behavior is an important task in thermal mangement for white light emitting diodes. In this research, a thermal model was built and a finite element method was employed using MATLAB software to identify the temperature distribution. The influence of the injection current and thermal conductivity difference on the temperature distribution of the encapsulant, blue LED die, and substrate region was clearly observed. The results indicate that white light packaging technology should locate phosphor far from the LED die, that the thermal conductivity of the silicone–phosphor region should be improved, that heat should be dissipated for pc-WLEDs when using a high operating power, and that the injection current should be kept as moderate as possible.

P-22

STUDY OF SECONDARY PARTICLE EMISSION TO HADRONIC PHYSICS MODELS IN GATE/Geant4 PROTON THERAPY SIMULATIONS AT 100 MeV

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Abstract. Proton therapy is a promising new type of cancer treatment, but its possible benefit is still being studied. Proton therapy simulations are heavily influenced by the chosen physics models that rely on Monte Carlo techniques such as the GATE code based on the Geant4 toolkit. In this study, we investigate three physics models, BERT, BIC, and INCL++, which are used by the GATE/Geant4 program to simulate the interaction process of 100 MeV protons with the nuclei in the water phantom. We analyze the angular and energy distributions of the secondary neutrons and gamma particles produced by the water phantom. Our investigation revealed notable differences in the angular and energy distributions of emitted particles among the three models. This study emphasizes the necessity of carefully selecting a hadronic physics model for GATE/Geant4 simulations in proton therapy.

P-23

DETECTION OF GLUCOSE AT TRACE CONCENTRATION BY SURFACE ENHANCED RAMAN SPECTROSCOPY (SERS)

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Abstract. We have studied to use Surface Enhanced Raman Spectroscopy (SERS) for trace detection of Glucose. Nanoplasmonic structures for SERS are produced by pulsed laser ablation (PLA) method. Using the nanoplasmonic structures, we have investigated the SERS spectrum of Glucose in different concentrations by a mini uRamaan 785 - Technospex in order to develop a procedure for trace detection of glucose. The results are shown in this report.

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P-24

INVESTIGATION ON OPTICAL PROPERTIES OF Eu^{3+} IONS-DOPED BOROSTELLURITE GLASS

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Abstract. Borotellurite glasses doped with different concentrations of Eu^{3+} ions have been fabricated by melt-quenching technique. The structure phase of materials was analyzed through X-ray diffraction patterns. Optical properties of Eu^{3+} ions in the fabricated glasses have been studied through the luminescence excitation, emission spectra, and the decay curves of the Eu^{3+}:$^5D_0$ level. The radiative parameters of the Eu^{3+} ions have been calculated using the Judd-Ofelt theory.

P-25

EFFECT OF FOLIAR APPLICATION OF PLASMA ACTIVE WATER SUPPLEMENTED WITH MICRONUTRIENTS ON THE GROWTH AND DEVELOPMENT OF BASELLA ALBA

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Abstract. The potential for application of plasma technology in general and plasma-activated water in particular in agriculture is very large, with different forms such as, sterilization, preservation of agricultural products, seed treatment and germination stimulation [2]. Plasma-activated water is created when a cold plasma jet interacts directly with water. This interaction generates free oxygen and nitrogen radicals (RONS) in solution [1]. RONS can persist in water for a long time and act as signaling molecules in plant metabolism or as nutrients for plants. The application of plasma-activated water in agricultural cultivation will contribute to limiting the use of chemical fertilizers that adversely affects the environment. Therefore, plasma-activated water can be used as a foliar fertilizer for plants [3].

The purpose of this study was to evaluate the effects of foliar fertilization with plasma-activated water supplemented with micronutrients on growth parameters of leafy vegetable plants. The experiment was conducted on basella alba with different foliar fertilization formulas. Parameters were monitored during the experiment such as weight of leaves and roots, chlorophyll content and nitrate residue content (at the harvest). The results showed that there were differences in plant growth and development when foliar fertilization with plasma-activated water supplemented with micronutrients compared with the control. Post-harvest products have significantly increased chlorophyll and dry matter content. The amount of chemical and pesticide residues are small, meeting safe vegetable standards. Research results show that the potential of using plasma-activated water supplemented with micronutrients as a foliar fertilizer for plants is very large. From there, it opens up a new direction for the clean agriculture industry when using foliar fertilizer with plasma technology - an environmentally friendly fertilizer with low production costs and high efficiency.

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P-26

TESTING OF A BEAM LOSS DETECTOR FOR ACCELERATED IONS BASED ON NEUTRON REGISTRATION AT THE ACCELERATORS OF THE FLNR JINR

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Abstract. A method for diagnosing losses of accelerated ion beams based on registration of neutrons, which are the main external radiation in heavy ion reactions with structural materials, has been developed. The principle of operation of the non-destructive diagnostic method for losses is described in detail.

Debugging of neutron detectors was performed on the U-400 heavy ion accelerator. As a result of the experiment, the prospects of the method were confirmed. Experimental studies were carried out on a $^{20}Ne^{3+}$ beam with an energy of 11,73 MeV/nucleon. As a result of the research, the operating voltages of the detectors and their sensitivity to losses were determined. The minimum beam currents required for the method based on the registration of neutrons formed during the interaction of the accelerated ion beam with the structural materials of the ion beamline have been determined.

The research results showed that eight Helium-18/80-3.0/L neutron counters, operating in proportional mode, can be used to determine the location of beam losses.

The work also provides a detailed description of the software required for data collection and online visualization from this system.

P-27

EFFECTIVE REFRACTIVE AND EFFECTIVE MODE AREA OF OCTAGONAL CORE PHOTONIC CRYSTAL FIBERS WITH VARIOUS CLADDINGS

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Abstract. A new novel design for guiding waves utilizes a photonic crystal fiber (PCF) with an octagonal-shaped core based on As_2S_3 presented in this work. The lower refractive index cladding is made from PBG-08 to ensure light is transmitted through the fiber by total reflection. By utilizing the Finite Element Method and Perfectly Matched Layer boundary conditions while varying the core diameter of the PCFs, we controlled their optical characteristics. The effective refractive index and effective mode area of PCF were analyzed. At the same time, we also study the above two properties in the case of adding some air hole rings to the cladding. The results show that in the wavelength region of 1µm-3 µm, the effective refractive index of PCF without air-holes is quite high, which is promising for the field of optical communication. Whereas PCF with air-holes is a good candidate for supercontinuous transmission because the effective mode area is very small.

Keywords: *PCF, octagonal, effective refractive index, effective mode area.*

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P-28

PUNCH FORCE ESTIMATION BASED ON THE BAG ACCELERATIONS DURING BOXING TRAINING

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Abstract. The demand for physical fitness and mental health has led to the substantial popularity of martial arts and combat sports. Research on training tracking devices has also been increasingly interested due to the challenges of boxing, such as the risks of injuries and the need for correct training techniques. The aim of this research is to design a device to monitor boxing training to support athletes and coaches. The proposed device is integrated with an accelerometer and a gyroscope and is attached to the punching bag. The linear and angular accelerations due to the punches are measured by the device and are sent to a computer for further analysis. Another circuitry is designed with a loadcell to measure the true punching force. An artificial neural network (ANN) model is developed to learn the true punching force from the punch-induced bag accelerations. As a result, a high correlation of 0.94 of the punching force between the true and the predicted values indicates the feasibility of the proposed device for estimating the punching force based on the punching bag accelerations.
Furthermore, a multi-function user interface is designed to allow athletes and coaches to monitor and assess their training activities both in real-time and in history.

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P-29

APPLICATION OF IoT TECHNOLOGY FOR HIGH-POWER INDUSTRIAL LASER COOLING SYSTEM

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Abstract. In this article, we describe an intelligent cooling system utilizing IoT technology to maintain the temperature of the cooling fluid for a high-power fiber laser. The system is designed to automatically adjust the temperature and provide real-time information about crucial laser parameters for remote monitoring and control. Additionally, the system employs sensors and software to swiftly detect and address temperature stability issues, thereby aiding in stabilizing the laser source, enhancing performance, and prolonging the laser's lifespan.
This article presents a cooling solution for high-power lasers and opens up potential applications for IoT technology in various industrial environments.

Keyword: *intelligent cooling system for high-power laser, IoT*

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P-30

CONFIGURATION ANALYZING AND STUDY ON OPERATING PARAMETERS OF 20W FIBER LASER SYSTEM MODULATED BY ACOUSTO-OPTICAL Q-SWITCH

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Abstract. In this paper, the configuration of a 20W fiber laser system modulated by an Acousto-Optical Q-switch is analyzed and presented. In which, the Ytterbium-doped optical fiber is pumped with a diode laser with a total pumping power of 40 W. The fiber laser resonator configuration consisting of a emitter and a gain stage allows the output laser power to be achieved over 20 W at 1070 nm wavelength region. The acousto-optical Q-switch modulated by an 80 MHz RF pulse is placed in the laser cavity to create output laser pulses with a repetition frequency varying from 20-80 KHz. The laser control signal pulses are synchronized from the main control circuit connected to the computer.

Some results of fiber laser parameters measuring such as laser power, pulse width, laser wavelength, control pulse shape... are presented. The results show the stability and reliability of our laser system. This fiber laser as laser source for laser marking system in order to engrave on the surface of metal materials

Key words: *fiber laser, acousto-optical Q-switch, metal laser engraving.*

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P-31

OPTIMIZING THE PARAMETERS OF A SOLID STATE 355NM ULTRAVIOLET (UV) LASER FOR ENGRAVING APPLICATION ON THE SURFACE OF PLASTIC MATERIALS

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Abstract. Today, the solid state 355 nm ultraviolet (UV) laser for industry are mostly generated by conversion from the 1064 nm wavelength of the Nd:YAG laser to 355nm using several nonlinear optical crystals. The operation of this solid state UV laser system will be influenced by many parameters such as pump diode laser power, Q-switch modulation frequency, and temperature of nonlinear optical crystals...

In this paper, the authors present the research, survey and optimization of the operating parameters of a solid state 355 nm UV laser system. The results show that the laser output power is above 6 W with power stability ≤ 5%, pulse repetition frequency 30 KHz, and the temperature of THG and SHG crystals is 61^0C and SHG respectively 71^0C. In addition, some experimental results using this UV laser system to engrave on the surface of plastic materials are also presented in this report.

Key words: *solid state 355 nm ultraviolet (UV) laser, nonlinear optical crystals, laser engraving*

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P-32

STUDY OF EMISSION SPECTRUM MODELING OF PHOSPHOR CONVERTED WHITE LIGHT EMITTING DIODES

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Abstract. We have successfully simplified a mathematical model for emission spectrum modeling of white light emitting diodes. In this model, Gaussian functions were applied for both blue and yellow emission bands with a suitable value of beta coefficient. Then, the model is applied to investigates the optical properties(e.g. correlated color temperature, color rendering index, chromaticity coordinates, and color vector graphic) of white light corresponding to different amount of yellow/blue light ratio (e.g. yellow/blue light ratio of 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, and 1.2). The results indicate that the simplified form of Gaussian functions for matching the emission spectrum is helpful in reducing the complexity for research related to spectrum design and LED packaging for a certain emission. This useful model then is not only possible to apply to design emission spectrum of phosphor converted white light emitting diodes, but also to study the optical and color performance of emitted white light spectrum.

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SYNTHESIS HYBRID NANO PARTICLES CQDs/Ag BY INTERACT PLASMA SOLUTION METHOD

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Abstract. The report presents the results of the synthesis of hybrid carbon quantum dots (CQDs) and silver (Ag) nanoparticles by the solution-interaction plasma method. The optical, functional and morphological properties of the prepared samples were examined using UV-VIS visible spectroscopy, scanning electron microscopy (SEM) and transmission electron microscopy (TEM), corresponding. The nanoparticle size is fabricated below 20 nm, silver particles are coated onto the array structure of carbon quantum dots. Fluorescence spectra of CQDs-Ag hybrid nanoparticles with emission spectral region from 450 to 650 nm and two spectral peaks at 480 nm and 540 nm. Fluorescence quenching for the CQDs-Ag hybrid nanosample was also observed. The dependence of emission spectrum and fluorescence lifetime of CQDs-Ag hybrid nanoparticles has also been shown.

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Keywords: *hybird nano particlers, CQDs/Ag, CQDs, interaction plasma solution.*

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OPTICAL PROPERTIES OF N-DOPED CARBON QUANTUM DOTS FABRICATED BY INTERACT PLASMA SOLUTION METHOD

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Abstract. Carbon quantum dots (CQDs) and Nitrogen-doped carbon quantum dots (N-CQDs) that fluoresce in the near-ultraviolet and visible wavelengths are an environmentally friendly nanomaterial with many applications. In this paper, we present the optical characteristics of CQDs/N-CQDs fabricated by the solution interaction plasma method. Scanning electron microscopy (SEM), FTIR spectroscopy, fluorescence emission spectrum and fluorescence lifetime techniques were used to evaluate the morphology, structure, and optical properties of CQDs/N-CQDs. The results show that N-CQDs are new carbon nanomaterials composed of amorphous carbon containing rich functional groups such as -NH; -NH_2, C=N compared to CQDs. These results are the basis for future applications of CQDs/N-CQDs materials in optoelectronics.

This research was funded by the project under the Physics Program at the Vietnam Academy of Science and Technology (Project No. KHCBVL.05/21-22).

Keywords: *carbon quantum dots, CQDs, N-CQDs, interact plasma solution.*

P-35

DEVELOPMENT OF A NEWLY PORTABLE DEVICE FOR ANALYSIS OF ENVIRONMENTAL POLLUTANTS USING THE TSC74325 COLOR SENSOR

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Abstract: This research was conducted to develop a new compact device for the portable detection and accurate analysis of environmental pollutants such as heavy metals or organic toxins in aqueous environments utilizing RGB color method. The device employed the TCS34725 color sensor connected to a NodeMCU32 microcontroller. The device was tested with organic dyes including sodium 4-nitrophenolate and rhodamine B. The data obtained were comparable to optical density measurements acquired through UV-Vis spectroscopy (JASCO-V770). Through a careful design and the application of a modified algorithm, the device enables measuring pollutant concentrations across a wide linear range of 0.5 – 60.0 ppm with a limit of detection (LOD) of 0.158 ppm for rhodamine B and 1 – 80.0 ppm with a LOD value of 0.76 ppm for sodium 4-nitrophenolate. In comparison, optical data revealed a linear region ranging from 0.5 – 20.0 ppm and an LOD value of 0.22 ppm. The results revealed a wider linear region and similar LOD values to the data obtained from optical measurement. These findings highlight that the device not only serves as a transportable analytic tool, but also enhances analytical capabilities.

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HIGH-SENSITIVITY PARTICLE SPECTROMETER FOR CLASSIFYING AND COUNTERING ATMOSPHERIC PARTICULATE MATTER CONCENTRATION

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Abstract. Due to the adverse directly effects on human health and the environment. Over the last decades, air quality monitoring specifically particulate matter (PM) has received increased attention over in the world. Most of the research and policy actions have been focused on the development of ambient air pollution monitoring technologies and decreasing PM pollution. For these reasons, there are many methods for determining matter concentration of dust such as optical particle counters, camera-based optical devices. This paper, we present a design, structure and paremeter of optical sensor based on scattering method with a controlled air pump, a PMT H10720 of Hamamatsu as a high sensitive optical detector and a Picoscope 5444D of Optopart company with 16 bits mode as a ADC convertor and the first some results of collection dust indoor and outdoor environment at Institute of Physics 18 Hoang Quoc Viet, Hanoi, Vietnam.

Keywords: *air quality; particulate matter; air pollution; low-cost partice device; optical particle sensor; scattering techniques; image processing methods.*

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P-37

RESEARCH AND DEVELOPMENT OF A FRACTIONAL THERAPY LASER USING RF-CO_2 LASER

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Abstract: This paper presents the results of research and development of a fractional therapy laser using an RF-CO_2 laser excited by radio frequencies (RF). To meet different therapy treatments, the system is designed with some different operating modes including continuously working (CW), single pulse, and a sequence of pulses. Due to the advantages of the RF-CO_2 laser, besides the normal functions as that in the case of using the DC-CO_2 laser (excited by high voltages), the system can also be able to operate in SUPER PULSE mode (pulse duration from 1 to 10 ms) and ULTRA mode (pulse duration from 0.1 to 1 ms).

Keywords: *RF-CO_2 laser, DC-CO_2 laser, fractional therapy laser.*

P-38

CHROMATIC DISPERSION OF $GE_{20}SB_5SE_{75}$-BASED PHOTONIC CRYSTAL FIBER WITH CIRCULAR AND SQUARE LATTICES

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Abstract. This paper proposes two large-solid-core photonic crystal fibers based on $Ge_{20}Sb_5Se_{75}$ with circular and square lattices as a cladding, composed of seven rings of air holes surrounding the core. Using the numerical method, we simulated light propagation in these structures. The fiber dispersion characteristics were investigated in the infrared wavelength range with the change of structural parameters including lattice constant (Λ) and filling factor (f). At both two lattice styles, photonic crystal fiber produced near-zero flat dispersion, including all-normal and anomalous dispersion with one or two zero dispersion wavelengths (ZDWs). We have shown that square lattice PCF has advantages with normal dispersion but circular lattice PCF has advantages with anomalous dispersion. We also choose two optimal structures with flat, near-zero dispersion to consider the nonlinear coefficient and confinement loss at the pumping wavelength. The first structure has a circular lattice, all-normal dispersion with Λ = 1.0 µm and f = 0.35 while the second structure (Λ =2.0 µm and f = 0.3) of the square lattice exhibits anomalous dispersion. This is interesting to choose the best PCF for supercontinuum generation as well as different optical applications.

Keywords: *Photonic crystal fiber (PCF), dispersion, square lattice, circular lattice, chalcogenide.*

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P-39

THE PHYSCO-CHEMICAL CHARACTERISTICS OF CANDLE SOOT PARTICLES

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Abstract. The soot particles are considered an unwanted source of air pollution and are born from the incomplete combustion of biomass, biofuel, and fossil fuels [1]. The soot particles formed from the combustion of candle wax are known to harm health due to their physicochemical properties [2]. In this research, the morphology of candle soot particles was explored by using a scanning electron microscope (SEM). They were show the morphology of carbon nanospheres with particle sizes from 25nm to 40nm. The optical properties of these candle soot particles were also analyzed by using UV-Vis spectroscopy. Besides, the results obtained from energy dispersive (EDS) and Raman scattering spectroscopy represented the chemical properties of soot particles.

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P-40

NANOSTRUCTURE BASED ON DNA ORIGAMI TECHNIQUE: DESIGN, FABRICATION AND NANOPARTICLE CONJUGATION

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Abstract. DNA origami technology is widely used to create a well-defined nanostructure ranging from tens of nanometers to sub-micrometers. DNA nanostructure can be used as a breadboard for attachment detail components such as nanoparticles or dye molecules with nanometer distance accuracy. This work presents the design for three-dimensional DNA nanostructure of X-shape based on DNA origami technique with Python software. Experiments showed that DNA nanostructures was successfully fabricated according to predetermined design. Initial results of binding DNA nanostructures to metal nanoparticles are also presented and discussed.

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DENOISING METHODS IN UROFLOWMETER USING LOADCELLS

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Abstract. Urodynamics is a non-invasive method of diagnosing urinary tract diseases. The development of artificial intelligence (AI) technology enables the ability of uroflowmeters in early detection. Because of compactness and low price, loadcells are often used as the core of an uroflowmeter which monitors the urine volume over time. However, noise generated by environmental fluctuations, self-oscillation of the loadcells, as well as drag force of the jet is the biggest limitation to the accuracy of any device using force sensors. Therefore, in this study, we experimentally evaluate denoising methods which is the most suitable for developing a real-time uroflowmeter. The noise removal performance is investigated using wavelet threshold (WT); empirical mode decomposition (EMD); variational mode decomposition (VMD) as well as the VMD-WT combined analysis method. The results show that the VMD−WT method can effectively remove noise in the dynamic weighing signal and the noise reduction performance is better than WT, and VMD. The average cumulative error of the primary current signal using VMD−WT is less than 1%. The time consumed by using VMD-WT is the longest among current denoising methods. However, all of the denoising methods above work at a speed much faster than the sampling rate of the electric scale.

Keywords: *Uroflowmeter; denoising; wavelet threshold; mode decomposition; loadcell.*

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LOCAL HEAT AND STRAIN EFFECTS IN MEASURING RAMAN SPECTRA OF RuO THIN FILM

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Abstract. Raman spectroscopy is a useful method for investigating vibration structures. It is effectively used to monitor the thin film fabricating process, e.g. the growing rate, the oxidation or crystallization, etc. [1]. The drawback of Raman spectroscopy mainly comes from the low scattering crosssection which requires high-power laser or high excitation photon energy. In both conditions, the local heating phenomena deliver parasitic effects on the obtained Raman spectrum. The Raman peaks are changed in intensity and characteristic position not only because of the phonon distribution but also the strain in the structure of the medium. Especially, the nano and microstructures are strongly sensitive to the excitation heating because their vibration modes are directly related to the dimension confinement. In this study, the Micro-Raman technique is used to qualify the oxidization of a RuO thin film layer in conjugate with multilayers of a thin film spintronic device. The difference in optic-induced thermal expansion behavior of the layers creates difficulties in qualitatively analyzing the oxidization of the metallic layer. By variating the 532nm excitation laser power, we promote a technique to determine the oxidization level of the RuO layer by extrapolating the peak shift value, i.e. the thermal effect, at low laser intensity. The intercept of the linear dependence can be relatively used as the oxidization indicator to control the quality of the fabrication process of the multi-layer thin film devices.

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P-43

TRACE ELEMENT ANALYSIS OF AEROSOL PARTICLES BY USING TOTAL REFLECTION X-RAY FLOURESCENCE WITH THE COLLECTION BY THE MULTISTAGE IMPACTOR

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Abstract: Aerosol particles in the atmosphere have a great impact on the environment and human health. Determining the amounts of metallic elements in atmospheric aerosols is important to reveal their origin and to evaluate their potential effects on humans. Routine analysis of particles usually involves only the mass determination. However, the chemical composition and phases provide fundamental information about the origin of particles, and the research for the scientific solution to reduce the resources of these aerosol particles. In this study, we developed a method based on total reflection X-ray fluorescence (TXRF) analysis for the characterization of atmospheric aerosols. The filter used to collect the aerosol was placed on a multistage impactor with the different cut-off diameter. The design of a multistage impactor is presented, to individually aerosol PM10, PM2.5, and PM1 size fraction. Using multistage impactor and TXRF analysis, the chemical composition of each aerosol size was classified. The results of this study clearly demonstrate that the multistage impactor optimized for TXRF analysis has great potential to improve the quantification of particulate trace metals with high temporal resolution.

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DESIGN AND SIMULATION OF HIGH-EFFICIENCY COOLING SYSTEM FOR HIGH-POWER FIBER LASERS

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Abstract. The increase in heat generation of the semiconductor laser diodes, the laser cavity, splicing joints, and optical components in the fiber laser structure significantly impacts the stability of high-power fiber laser sources [1-3]. This study presents a design of a water-cooling system for high-power fiber lasers whose power in range of 1 kW to several kW. The system is developed with the aim of optimizing heat transfer efficiency between the cooling water and optical components. The cooling capacity is verified through simulation and experimentation, ensuring that parameters such as water temperature, water pressure, and flow rate are maintained at pre-determined temperatures for the optical pump and optical components. Comparing the cooling efficiency of different design models allows for the selection of the optimal cooling model for high-power fiber optic laser sources, suitable for industrial metal processing applications.

Keywords: *fiber laser, heat transfer, cooling plate, laser stability*

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P-45

HYBRID Q-SWITCHED LASER Nd:YVO_4 WITH A Cr:YAG SATURABLE ABSORBER AND AN ACOUSTO-OPTIC MODULATOR

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Abstract. In this work, we study a combined passively and actively Q-switched laser Nd:YVO_4 with a Cr:YAG saturable absorber and an acousto-optic modulator (AOM). Our laser system included a passively Q-switched with a Cr:YAG saturable absorber and an actively Q-switched with an AOM at a repetition rate of 1 KHz, and the incident pump power of 40 W was used. Firstly, the laser is excited using the passively Q-switch and we got a maximum peak power of 0.1 KW with the pulse duration of 200 ns at a repetition rate of 250 KHz. Otherwise, as using the actively Q-switch, the received maximum peak power was 763 KW with the pulse duration of 16 ns. Then, by using a hybrid Q-switched with a Cr:YAG and an AOM, the maximum peak power of 1.18 MW with the minimum pulse duration of 8 ns was obtained. In conclusion, by combining Q-Switch with a Cr:YAG saturable absorber and an acousto-optic modulator, the laser system with high peak power was successfully achieved. Our research gives a direction for the development of compact laser technology in the future.

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DESIGN AND DEVELOPMENT OF A NANOSECOND ACTIVELY Q-SWITCHED DIODE-PUMPED SOLID STATE LASER SYSTEM FOR APPLICATIONS ORIENTED IN ENVIRONMENTAL RESEARCH

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Abstract. All solid-state nano-second pulsed laser systems with high-peak power, high-pulse repetition rate and compact size are being widely and effectively applied in environmental research. In this report, we provide information and results on the design and development of a nano-second actively Q-switched, diode-pumped Nd:YVO_4 solid-state laser system which simultaneously generates 1064 nm and 532 nm emissions at pulse repetition rate up to 5 kHz. The Nd:YVO_4 laser system uses an end-pumped configuration with a continuous-wave diode laser which has a power up to 25 W at 808 nm wavelength. As a result of the pumping geometry, the Nd:YVO_4 laser generates the the TEM_{00} resonator mode. Q-switching of the -Nd:YVO_4 laser is actively performed using an acoustic-optical (AO) crystal placed inside the cavity. The Nd:YVO_4 laser resonator length is 10 cm. To generate second harmonic 532 nm emission, this laser system uses a KDP nonlinear crystal which puts outside the cavity. The output average powers obtained are 0.3 W at 532 nm and 4.5 W at 1064 nm at 5 kHz pulse repetition rate. Laser pulse width is 15-30 ns. The pulse repetition rate range is adjustable up to 5 kHz. With the above parameters, this all solid-state laser system is suitable for environmental research and measurements.

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P-47

BIOIMPEDANCE-BASED CUFFLESS BLOOD PRESSURE ESTIMATION USING HEART RATE VARIABILITY AND PULSE TRANSIT TIME

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Abstract. For decades, although various methods for blood pressure measurement have been developed, there are still challenges in their usability, complexity, and invasiveness. Therefore, a novel design of a continuous blood pressure instrument will provide patients with advantages, especially those who have medical records related to cardiovascular diseases. Along with the photoplethysmography (PPG) instrument, the proposed wrist-worn wearable device measures photoplethysmography (PPG) and impedance plethysmography (IPG) signals simultaneously from two different locations at the wrist and the fingertip. Pulse transit time and heart rate variability were extracted from the raw PPG and IPG data as features. A convolutional neural network (CNN) model was developed to take these features as the inputs. The target blood pressures were measured using a commercial device. The model learns to estimate the blood pressure based on the input features and the target blood pressure. Experiments were carried out with 20 volunteers aged between 20 and 22 years. Evaluation results indicate a strong correlation in blood pressure between the proposed device and the reference instrument. Specifically, a high correlation coefficient of 0.93 and 0.89 were obtained for systolic and diastolic pressures, respectively, demonstrating the feasibility of blood pressure estimation from the proposed bioimpedance-based device.

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P-48

THE USE OF 940NM AND 780NM LOW-POWER SEMICONDUCTOR LASER TO TREAT COVID-19

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Abstract. The use of 940nm and 780nm low-power semiconductor lasers to treat COVID-19 is an emerging area of research. These lasers emit specific wavelengths of light that act on the body's muscle tissue and immune system to create mechanisms to fight viral infections and stimulate the immune system. By targeting the virus and affected areas, such as the respiratory tract. This research aims to reduce viral load and strengthen the body's defense mechanism. Initial studies on COVID-19 patients at Nguyen Manh Hung Traditional Medicine Clinic have shown encouraging results, including improved immune response and reduced symptoms. Laser parameters include excitation frequency and output power, treatment time and biological effects. On that basis, it was found that this method could provide a non-invasive and cost-effective treatment option for Covid-19 patients.

Keywords: *lasers, COVID-19, low-power semiconductor.*

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DEVELOPMENT OF A COMPACT LONG PATH DIFFERENTIAL OPTICAL ABSORPTION SPECTROSCOPY INSTRUMENT FOR CONTINUOUSLY MONITORING GASEOUS POLLUTANTS SO_2, O_3 AND NO_2

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Abstract. In this paper we present the development of a long path (active) differential optical absorption spectroscopy instrument in the wavelength range 200 – 380 nm, allowing the detection of gaseous pollutants of interest SO_2, O_3 and NO_2. The instrument uses a high power UV lamp as a broadband light source and a telescope mirror to send the light beam to a retro-reflector placed at a distance of 1.4 km away and to collect the back reflected light beam. A highly sensitive portable spectrometer is used to measure the spectrum of the returned light beam. Data analysis of the measured spectra allows us to simultaneously determine the column density of molecules SO_2, O_3 and NO_2. Because the optical path length of the setup is known to be 2.8 km both way, we can convert directly the measured column density to the concentration of trace gases in the ppb range. The high sensitivity of our instrument allows detection with ppb sensitivity with a time resolution of less than 2 minutes. We present some initial measurements and comparison with that obtained by monitoring instruments and discuss the variations of SO_2, O_3 and NO_2.

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SYNTHESIS AND SPECTROSCOPIC CHARACTERIZATION OF NANODIAMOND-TAPP COMPLEX

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Abstract. In this paper we will present the synthesis of the nanodiamond-TAPP complex using functionalized nano-diamond particles and the porphyrin molecules. The resulting complex is characterized using optical and near infrared spectroscopy. We will also show that the nanodiamond-TAPP complex possesses high efficiency for the generation of singlet oxygen.Application of the nanodiamond-TAPP complex in photo-dynamic therapy will be discussed.