Keynote Speakers

- **Mr. Ethan TU**
  Founder & CEO, Taiwan AI Labs

- **Mr. Terry TSAO**
  Global Chief Marketing Officer & President of Taiwan, SEMI

Keynote Speaker

The niche and outlook of Taiwan's smart healthcare

AI Labs.tw
台灣人工智慧實驗室

Mr. Ethan TU

Founder & CEO, Taiwan AI Labs

Ethan Tu is the founder of Taiwan AI Labs and PTT Bulletin Board System. He leads the researches that Taiwan AI Labs currently focuses on, “Smart Healthcare,” “Smart City,” and “Human-Computer Interaction”. Prior to founding Taiwan AI Labs in 2017, Tu worked in the National Institutes of Health (NIH) to develop cancer detection systems and human genetic research in the US. In 2006, Tu started to work in Microsoft’s AI team and became a principal development manager in 2012. Tu holds a bachelor’s degree and a master’s degree in computer science at National Taiwan University.

Keynote Speaker

Why Taiwan matters in global semiconductor industry

SEMI 國際半導體產業協會

Mr. Terry TSAO

Global Chief Marketing Officer & President of Taiwan, SEMI

As the Global Chief Marketing Officer and President of Taiwan, Terry Tsao leads global marketing activities at SEMI, including strategic, operational, product, and communications marketing. Tsao also oversees the association's programs, products, and services in Taiwan, and he is also responsible for relationships with SEMI members as well as with representatives of local industry, government, and academia. Additionally, he supports SEMI international programs serves members worldwide. He also managed SEMI South East Asia operation for 6 years as the President of SEMI South East Asia. Prior to joining SEMI, Tsao was Managing Director of International Data Corporation in Taiwan. He has also served as APAC Marketing Director for Trend Micro, and held various management positions in Far Eastone Telecommunications, and Ogilvy. Tsao holds an MBA from Baruch College City University, New York, and an Executive MBA from National Taiwan University.

Session I

Panel A: Medical Science & Application

Moderator

- **Dr. Cheng-Yu CHEN**

Professor, Department of Radiology,School of Medicine Vice-President, Taipei Medical University

Panelists

- **Dr. Julie Y.H. CHAN** (Taiwan-Czechia)

Distinguished Chair Professor, Institute for Translational Research in Biomedicine, Kaohsiung Chang Gung Memorial Hospital

- **Dr. Wing-Yan Michael CHAN** (Taiwan-EU)

Professor and Director, Department of Biomedical Sciences, National Chung Cheng University

- **Dr. Chia-Kwung FAN** (Taiwan-Slovakia)

Professor, Department of Molecular Parasitology and Tropical Diseases & Director, Research Center of International Tropical Medicine, College of Medicine, Taipei Medical University

- **Dr. Hsiao-Wen ZAN** (Taiwan-France)

Professor, Department of Photonics, National Chiao Tung University

- **Dr. Shi-Bing YANG** (Taiwan-Austria)

Assistant Research Fellow, Institute of Biomedical Sciences, Academia Sinica

- **Dr. Po-Liang LAI** (Taiwan-India)

Professor and Chair, Spine Section of Department of Orthopedic Surgery & Director, Bone and Joint Research Center, Chang Gung Memorial Hospital Linkou Branch

Dr. Chi-Yun WANG

Assistant Professor, International Ph.D. Program in Innovative Technology of Biomedical Engineering and Medical Devices, Ming Chi University of Technology

Moderator

臺北醫學大學
TAIPEI MEDICAL UNIVERSITY

Dr. Cheng-Yu CHEN

Professor, Department of Radiology,
School of Medicine Vice-President,
Taipei Medical University

Professor Sandy Chen is a well-known researcher in neuroscience and neuroimaging, particularly on the topics of ischemic stroke, brain tumors, drug abuse, and dementia. He has been granted a totally of 26 MOST projects and has published 158 SCI articles. After being a radiologist at Tri-Service General Hospital, he was transferred to Taipei Medical University hospital to serve as the Chair of the Department of Medical Imaging in 2013, and he built the Translational Imaging Research Center (TIRC) at Taipei Medical University next year. TIRC consists of three branches of the lab, including the Neuroimaging Biomarker Analysis Lab, Translational Lab for Molecular Imaging at Cell and Animal Levels, and Translational Imaging Lab (animal 7T and human 3T MRI). Professor Chen now is the Vice President of Taipei Medical University.

Panelist

長庚 高雄

Dr. Julie Y.H. CHAN

Distinguished Chair Professor,
Institute for Translational Research in Biomedicine,
Kaohsiung Chang Gung Memorial Hospital

[redacted] has a long-standing research interest in brain stem [redacted] regulatory mechanisms. Her pioneer research work on the roles [redacted] reactive oxygen species in the neural control of blood pressure [redacted] contribution to the current understanding of those signals [redacted] genomic hypertension. Her current research interest [redacted] of mitochondria in the development of cardiovascular [redacted] metabolic syndrome and hypertension of developmental [redacted] the current President of the International Union of [redacted] (IUPS), after serving as the first Vice-President from 2013-[redacted] contributed to biomedical science by publishing more than [redacted] journals, including Circulation, Circulation Research, [redacted] of Physiology and American Journal of Physiology. She [redacted] Editor for Journal of Biomedical Sciences and Frontiers in [redacted] Reviewing Editor for Journal of Physiology.

Age-associated Alterations in Redox-sensitive Genes in the Rostral Ventrolateral Medulla in Neural Mechanism of Hypertension Induced by Nitric Oxide Deficiency

Yung-Mei Chao[1], Josef Zicha[2], Hana Rauchova[2], Ivana Vaneckova[2] and Julie YH Chan[1*]

[1]*Institute for Translational Research in Biomedicine, Kaohsiung Chang Gung Memorial Hospital, Kaohsiung 833401, Taiwan*
[2]*Institute of Physiology, Czech Academy of Science, Prague 142 20, Czech Republic*

Abstract

Oxidative stress in the rostral ventrolateral medulla (RVLM), where sympathetic premotor neurons for maintenance of blood pressure reside, plays a pivotal role in the pathogenesis of neurogenic hypertension. Blockade of nitric oxide synthase (NOS) activity by N^{ω}-nitro-L-arginine-methyl ester (L-NAME) induces hypertension via the decrease in NO formation and induction of oxidative stress. Gene transcription in the brain can be modified during the aging process. This study tested the hypothesis that the age-associated alterations in transcripts of redox-sensitive genes in the RVLM may contribute to the neural mechanism of hypertension induced by L-NAME. In 10- or 16-weeks-old normotensive Wistar Kyoto rats, systemic treatment with L-NAME for 2 weeks significantly increased mean arterial pressure. The L-NAME-induced pressor response was greater in the 16-weeks-old animals and was attenuated by intracisternal infusion of tempol, which had no effect on L-NAME-induced hypertension in the 10-weeks-old animals, suggesting an age-dependent brain oxidative stress on the L-NAME-induced hypertension. Tissue specific microarray analysis indicated genes involved in oxidative stress signaling were significantly altered in RVLM of 18-weeks-old normotensive rats, compared with 10-weeks-old controls. Expression of theses oxidative stress signaling genes was further upregulated in RVLM after the L-NAME treatment. Real-time polymerase chain reaction and immunoblotting confirmed the microarray results and showed an exaggerated oxidative stress signaling in the RVLM of the L-NAME-treated animals at the age of 18-weeks old. Together, these results indicated that age-associated activation of the oxidative stress signaling in the RVLM may contribute to neural mechanism of hypertension induced by L-NAME.

Keywords: N^{ω}-nitro-L-arginine-methyl ester、Hypertension、Oxidative stress、Rostral ventrolateral medulla、Antioxidant

Panelist

國立中正大學 National Chung Cheng University

Dr. Wing-Yan Michael CHAN

Professor and Director,
Department of Biomedical Sciences,
National Chung Cheng University

[redacted] obtained his PhD from the Department of Anatomical [redacted] Pathology, The Chinese University of Hong Kong in 2003. After [redacted] postdoctoral training at Professor Tim Huang's laboratory [redacted] University, he joined National Chung Cheng University [redacted] in 2007. His laboratory focuses on the role of aberrant [redacted] pathway in the epigenetic alteration of tumor suppressor genes [redacted] in human cancer. Recently, he also investigates how [redacted] can be used as biomarkers for non-invasive diagnosis of [redacted] and cardiovascular disease.

Prokineticin Receptor-1 Agonist as a Promising Agent to Reverse Anthracycline-Induced Cardiotoxicity in Breast Cancer

Adeline Gasser[1], Yu-Wen Chen[2], Wan-Hong Huang[3], Szu-Chin Li[4], Chun-Hung Lin[5], Yi-Da Li[6], Laurent Désaubry[1], Canan G. Nebigil[1], Michael W.Y. Chan[3,*]

[1]*Laboratory of Cardio-Oncology and Medicinal Chemistry, CNRS, Illkirch 67412, France.*
[2]*Institute of Biomedical Sciences, Academia Sinica, Taipei 11529, Taiwan.*
[3]*Department of Biomedical Sciences, National Chung Cheng University, Chiayi 62102, Taiwan.*
[4]*Department of Hematology-Oncology, National Chung Cheng University, Chiayi 62102, Taiwan.*
[5]*Department of Surgery, National Chung Cheng University, Chiayi 62102, Taiwan.*
[6]*Department of Cardiology, Dalin Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Chiayi County 62247, Taiwan*

Abstract

Anthracycline-induced cardiotoxicity is one of the main issues related to cancer treatment. This irreversible cardiotoxicity-induced heart failure can have a long effect up to 20 years. Therefore, cardio-protective agent is urgently needed for patients treated with anthracycline. We aim to assess the new cardio-protective therapeutics on cancer treatment efficacy in mouse model and identify novel epigenetic biomarker for early detection of cardiotoxicity in breast cancer patients. By using animal-MRI, we found that wildtype B6 mice treated with doxorubicin (DOX) significantly reduced diastolic volume while treatment of IS20, a prokineticin receptor (PKR)-1 agonist, can reverse such changes. Importantly, IS20 itself did not affect the cardiac function of the mice. We have also performed methylation microarray to examine the effect of DOX and IS20 on the methylation changes of iPS-induced cardiomyocytes. Interestingly, global DNA hypomethylation was observed in DOX treated iPS-induced cardiomyocytes. Finally, we have recruited breast cancer patients undergoing anthracycline-based chemotherapy until 24 months of the treatment. Clinical results from serum biomarkers (cardiac Troponin I) and echocardiography showed a significant decreased ventricular function at 3-month of the treatment, although such changes were gradually reversed in the course of treatment. In conclusion, PKR-1 agonist is a promising agent for reversing DOX-mediated cardiotoxicity in breast cancer. The role of epigenetic alteration as biomarker for DOX-mediated cardiotoxicity deserves further investigation.

Keywords: Anthracycline, Cardiotoxicity, Prokineticin, Epigenetics

Panelist

TAIPEI MEDICAL UNIVERSITY

Dr. Chia-Kwung FAN

Professor, Department of Molecular Parasitology and Tropical Diseases &
Director, Research Center of International Tropical Medicine, College of Medicine,
Taipei Medical University

Dr. Chia-Kwung Fan received his Ph.D. from the Graduate Institute of Microbiology, National Taiwan University College of Medicine. Also, he obtained the LL.M from the Graduate Institute of Law and Interdisciplinary Studies, College of Law, National Chengchi University, Taiwan to expand his academic knowledge concerning the [illegible] intellectual properties (I.P.) between neglected tropical diseases (NTDs) and [illegible]. Currently, he is working as a full-time Professor in the Department of Molecular Parasitology and Tropical Diseases, School of Medicine, Taipei Medical University, and he is also a consultant for the Centers for Disease Control, Ministry of Health and Welfare, Taiwan. His major research interest is focused on molecular and [illegible] pathogenesis of cerebral toxocariasis and neurodegenerative diseases. He also actively conducted NTDs control campaigns among (pre-)school children in some Africa countries as well as the Pacific Islands since 2009. He has authored 91 research articles and [illegible] book chapters from 1998 until now.

Emerging and Re-emerging Zoonotic Parasitosis Caused by Fish-Borne Parasites: Health Risk Associated with Consumption of Fishes

Chia-Kwung Fan[1, 2], Daniel Barčák[3], Pasaikou Sonko[1, 2], Martina Orosová[3], Yuarn-Jang Lee[4], Mikuláš Oros[3*]

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[2] *International Ph.D. Program in Medicine, College of Medicine, Taipei Medical University, Taipei 11031, Taiwan*
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Abstract

In Asia, previous studies have investigated the prevalence and genotypes of Trematodes; however, most of the cases reported in the market areas. Most importantly, these investigations are species-specific. Therefore, we found noteworthy to investigate the potential marine and freshwater fishes harboring the important medical parasites transmissible to the definitive host, including humans. In the present study, fish samples caught in three regions of Taiwan (Northern, Central, and Southern) were examined by incomplete parasitological necropsy. The digestive organs, fish musculature, and scales were examined for fish-borne trematodes, cestodes, nematodes, and acanthocephalans. A combination of direct scales observation, muscle compression, and Pepsin-HCl artificial digestion techniques was used for parasites observation. A total of 325 marine (159) and freshwaters (76) fishes collected from Northern (48; 98), Central (54; 53), and Southern (57; 15) regions were investigated for helminth parasites infection. The overall prevalence of infected marine and freshwater fish samples collected was 45.33% and 54.22%, respectively. The highest parasite infection was recorded in marine fishes *Scomber australasicus*, *Katsuwonus pelamis, Chimaera phantasma, Muraenesox cinereus, Elagatis bipinnulata, Acanthocybium solandri, Rhinoptera javanica,* and *Lutjanus argentimaculatus* (100%); followed by *Trichiurus lepturus* (83.60%); *Cheilopogon cyanopterus* (66.67%); *Sillago asiatica* (57.14%); *Lates calcarifer* (50.00%); *Plectropomus leopardus* and *Thunnus obesus* (33.30%); *Acanthopagrus Sp.* (16.67%). Other marine species were not infected. The prevalences of freshwater fishes infected were *Channa sp.,* and *Ctenopharyngodon idella* (100%); *Zacco platypus* (90.00%); *Candidia barbata* (73.21%); *Opsariichthys pachycephalus* (69.70%); *Cyprinus carpio* (50.00%); A. *paradoxus* (40.91); *Onychostoma barbatulum* (33.33%); *Varicorhinus alticorpus* (18.75); and other species were not infected. The helminth parasites belonging to the groups' Nematoda, Cestoda, Trematoda, and Acanthocephala have been sampled and processed for subsequent morphological and molecular identification.

Keywords: Taiwan, Marine fishes, Freshwater fish, Nematode, Cestode, Trematode, Acanthocephalan

Panelist

國立交通大學
National Chiao Tung University

Dr. Hsiao-Wen ZAN

Professor, Department of Photonics,
National Chiao Tung University

Dr. Hsiao-Wen Zan joined the Department of Photonics, National Chiao Tung University as an Assistant Professor in 2003, then she was promoted as an Associate Professor and a full Professor in 2008 and 2012. With a background education on semiconductor technology, Professor Hsiao-Wen Zan well combines her expertise in novel semiconducting devices using new materials such as organic semiconductor material and sol-gel metal oxide semiconductor material. Her recent research focuses on developing flexible transistors and sensors with nano structure or composite layer for bio-medical applications. By collaborating with medical doctors to do clinical trials, new health care applications were demonstrated. The interdisciplinary works were published in 44 SCI papers on leading journals such as Advanced Materials, ACS Nano, Biosensors and Bioelectronics, Sensors and Actuators B, etc. To promote commercialization, Professor Zan is also the inventor of 82 invention patents (including 22 US invention patents).

LASer Direct Writing for Metal Oxide Electronic Devices for Health Monitoring (Lastronic)

Hsiao-Wen Zan[1] and Olivier Soppera[2,3]

[1] *Department of Photonics and Institute of Electro-Optical Engineering, National Chiao Tung University, Hsinchu 30010, Taiwan.*
[2] *Université de Haute-Alsace, CNRS, IS2M UMR 7361, F-68100 Mulhouse, France*
[3] *Université de Strasbourg, F-67081 Strasbourg, France*
E-mail addresses: hsiaowen@mail.nctu.edu.tw (H.-W Zan), olivier.soppera@uha.fr (O. Soppera)

Abstract

Technological advances in health care have contributed greatly to improve our quality of life over the last few decades. Today, however, the high cost of many technologies brings questions in long-term financial sustainability, even in developed countries, and also their global deployment, especially in countries with fewer resources for health. One possible solution lies in the deployment of portable/wearable electronics in the health sector. To improve the quality of care while reducing costs and offering personalized treatment to realize early detection of fatal and chronic diseases, the convergence of the development of portable/wearable devices, the inventing of sensitive and reliable physical and chemical sensors, and the processing of big data opens up infinite possibilities.

The development of these technologies is based on the development of new materials and new integration processes, not only to develop simpler manufacturing processes but also to lift certain locks, such as those of integrating functional materials on flexible and biocompatible substrates. Solution processed metal oxide with semiconductor properties are the materials of choice because of their superior electronic properties and low production cost. However, their integration on wearable electronics remains delicate. Cutting edge sensors to meet clinical need are not yet ready. It is our goal to use laser-based processes (from Deep-UV to Near-IR) to realize simple direct-write integration of conductive and semiconducting metal oxide materials on flexible/wearable substrates to fulfill concrete clinical sensing needs.

Our project integrates fundamental aspects related to the synthesis by liquid (sol-gel) means of stable solutions of photosensitive precursors showing suitable electrical properties after laser treatment. The understanding of the phenomena induced by laser irradiation as well as the relationships between process parameters and final properties are at the heart of the project. Micro/nano structure can be implemented to improve sensor performance. Manufacturing of prototypes to validate concepts, notably through the inventions of sensors for monitoring patients suffering from chronic kidney disease, will also be emphasized.

Keywords: Health monitor, Metal oxide, Electronic device, Sensor, Laser direct write

Panelist

中央研究院
ACADEMIA SINICA

Dr. Shi-Bing YANG

Assistant Research Fellow,
Institute of Biomedical Sciences,
Academia Sinica

I am Shi-Bing Yang and currently I am an assistant research fellow at the Institute of Biomedical Sciences, Academia Sinica Taiwan. I obtained my PhD in Neuroscience at the University of Goettingen, Germany then I did my postdoctoral training at the University of California, San Francisco. My research mainly focuses on ion channel physiology and channelopathies in metabolic and neurological diseases and my lab has established several animal models to study ion channel functions in vivo.

A Remote-control Mechanism for Sensing pH_o in TALK1 Channels

Wen-Hao Tsai[1,2], Cedric Grauffel[1], Sandra Postic[3], Marjan Slak Rupnik[3], Carmay Lim[1] and Shi-Bing Yang[1,2*]

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[2] *Taiwan International Graduate Program in Molecular Medicine, National Yang-Ming University, Taipei, Taiwan*
[3] *Department of Physiology, Medical University of Vienna, Vienna, Austria*
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Abstract

Two-pore domain K^+ channels (K2P) are dimeric potassium channels that set the resting membrane potentials, and malfunctioning of K2P channels often causes diseases in humans, including cancer, migraine, and diabetes. K2P channels are gated by various external and internal signals, such as temperature, pressure, oxygen and pH. These stimulus modalities are first sensed by various specialized parts on the K2P channels, and later converged onto the selectivity filter via a mechanism that is similar to the C-type inactivation. TALK1, pancreatic specific K2P channels, are gated by pH_o, but how this channel senses pH_o is still unknown. Here, we identified an arginine (R233) located on the periphery of the TALK1 that serves as a remote-control for sensing pH_o, and the channel gating is regulated by tuning the occupancy on S_0 of the selectivity filter. Mutating R233 to the neutral alanine (A) or negatively-charged glutamic acid (E) on TALK1 eliminated or inverted its sensitivity to pH_o, respectively. We further identified that high concentration (100 mM) of tetraethylammonium (TEA) can block the TALK1 channel from the external side. Alkalic pH_o prolonged the dissociation time constant (τ_{off}) of TEA inhibition in wild-type but not R233A TALK1, and these results further supported that the S_0 is involved in sensing pH_o. In conclusion, we have identified that R233 remotely controls the S_0 binding site and consequently, regulates the pH_0-dependent TALK1 gating.

Keywords:Two-pore-domain potassium channel, pH-sensing, selectivity filter, gating

Panelist

林口長庚紀念醫院
Chang Gung Memorial Hospital, Linkou

Dr. Po-Liang LAI

Professor and Chief,
Spine Section of Department of Orthopedic Surgery &
Director, Bone and Joint Research Center,
Chang Gung Memorial Hospital Linkou Branch

[redacted] the Chief of Spine Section, Department of Orthopedic Surgery, [redacted] Hospital LinKou Branch, and the Professor of Medical College, [redacted]. Dr. Lai received his MD from National Taiwan University in 1993 [redacted] Engineering from National Tsing Hua University, in 2014. He [redacted] residency at the Chang Gung Memorial Hospital in 1998 and [redacted] at the State University of New York Health Science Center [redacted].

[redacted] dedicated to spine surgery, with emphasis on complex problems [redacted] and acquired deformity as well as minimally invasive spine surgery. [redacted] surgeries each year. His research includes biomaterial for bone [redacted] and biomechanics of spinal internal fixators. He has authored over [redacted] patents. He has also received numerous awards, including the [redacted] Innovation Award Taiwan.

Monocarboxylate Transporter -1-Mediated Lactate Accumulation Promotes Nucleus Pulposus Degeneration Under Hypoxia in 3D Multilayered Intervertebral Disc Degeneration Model

Chi-Yun Wang[1,2,3], Ming-Kai Hsieh[2,3,4], Yu-Jung Hu[2,3], Arindam Bit[5], Po-Liang Lai[2,3,4*]

[1.] *International Ph.D. Program in Innovative Technology of Biomedical Engineering and Medical Devices, Ming Chi University of Technology, New Taipei City, 243303, Taiwan.*
[2.] *Bone and Joint Research Center, Chang Gung Memorial Hospital, Taoyuan City, 33305, Taiwan.*
[3.] *Department of Orthopaedic Surgery, Chang Gung Memorial Hospital, Taoyuan City, 33305, Taiwan.*
[4.] *College of Medicine, Chang Gung University, Taoyuan City, 33302, Taiwan.*
[5.] *Department of Biomedical Engineering, National Institute of Technology, Raipur, 492010, India.*

Abstract

For intervertebral disc degeneration (IVDD), due to the calcification of endplate, diminished oxygen and nutrients, as well as accumulated lactate, are present in the microenvironment of the nucleus pulposus (NP). The disadvantage of 3D layered culture is uneven oxygen and nutrient gradient. Here, to mimic the in vivo microenvironment of the nucleus pulposus, 5-layered 3D culture was constructed using clinical hemostatic gelatin sponge and developed as an IVDD model. Then, in this 5-layered NP cell-loaded sponges model, cell distribution, gradient mRNA expression of decreased NP chondrogenic markers, including glycosaminoglycans (GAGs), COL2A1 and ACAN, as well as an increased degeneration marker, such as MMP3, were clarified from the top to the bottom layer. However, in a single NP cell-loaded disc model, the chondrogenic potency in the middle or bottom layer is better than that in the top layer. To further study the mechanism underlying the degeneration of NP cells in this IVDD model, we examined the contribution of secreted metabolites. Lactate was identified in the supernatant to modulate GAGs and MMP3 expression. Inhibition of lactate influx by MCT-1 inhibitor, AZD3965, reversed the effect of lactate on GAGs and MMP3 expression and further improved the NP cell degeneration in the IVDD model. Thanks to the homogenous expression of lactate in the model, we further identified that the combination of lactate and hypoxia enhanced MMP3 expression. Taken together, multilayered cell-loaded sponges with oxygen and nutrient gradient and lactate accumulation can be a 3D multilayered IVDD model for exploring potential agents for IVDD.

Keywords: Intervertebral disc degeneration, 3D cell culture, hemostatic gelatin sponge, chondrogenic-like nucleus pulposus differentiation

Session I

Panel B: Medical Science & Application

Moderator

- **Dr. Cheng-Chang LIEN**

Distinguished Professor & Director, Institute of Neuroscience,
National Yang-Ming University

Panelists

- **Dr. Fan-Gang TSENG** (Taiwan-Mongolia)

Distinguished Professor, Department of Engineering and System Science &
Deputy Director of the Biomedical Technology Research Center &
Vice President for Research and Development, National Tsing Hua University

- **Dr. Gou-Jen WANG** (Taiwan-Russia)

Distinguished Professor, Department of Mechanical Engineering &
Dean of College of Engineering, National Chung Hsing University

- **Dr. Yun-Ming WANG** (Taiwan-Russia)

Professor, Department of Biological Science and Technology &
Vice Dean of the College of Biological Science and Technology,
National Chiao Tung University

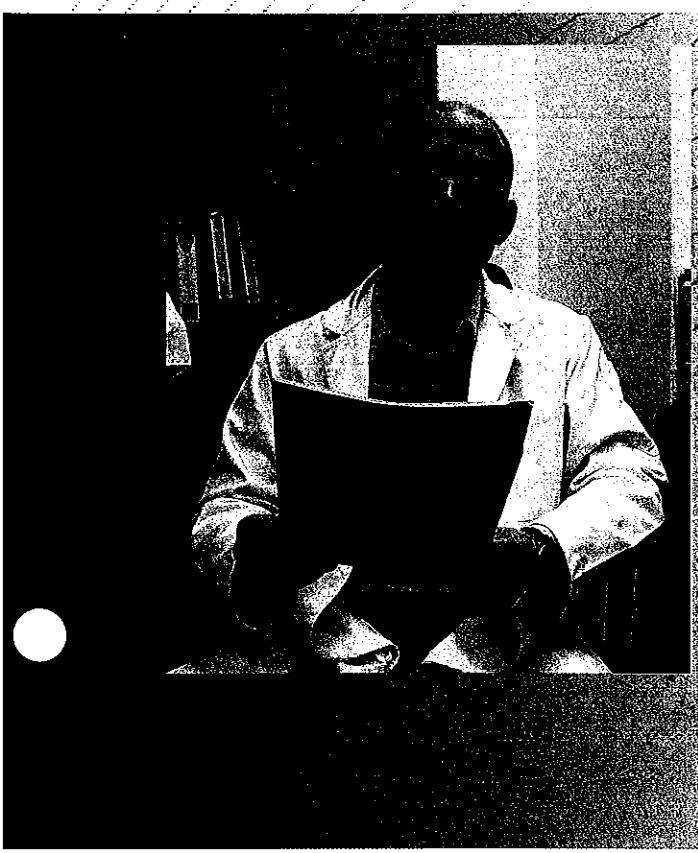
- **Dr. Eagle Yi-Kung HUANG** (Taiwan-Poland)

Professor and Director, Department of Pharmacology,
National Defense Medical Center

- **Dr. Day-Yu CHAO** (Taiwan-The Philippines)

Professor, Institute of Microbiology and Public Health,
National Chung Hsing University

Moderator



國立陽明大學

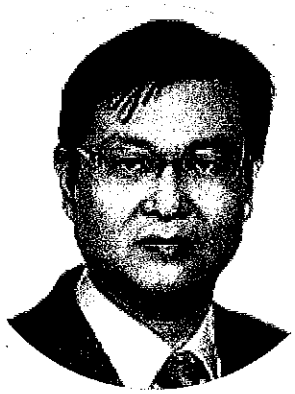
Dr. Cheng-Chang LIEN

Distinguished Professor and Director,
Institute of Neuroscience,
National Yang-Ming University

Memeber of Task Force (Central Europe),
MOST GASE

Dr. Lien received his MD from China Medical University in 1997 and earned his PhD in 2003 with the grade "summa cum laude" at the University of Freiburg, Germany. Then following a short postdoc period at UC Berkeley, he became a faculty member of the Institute of Neuroscience at the National Yang-Ming University (NYMU) in 2006. He became Professor in 2015 and is currently the Director of the Institute of Neuroscience at NYMU. His laboratory studies brain circuits and behavior in health and disease. In addition to holding the highest faculty position, he was elected as Distinguished Professor and has been named as an Alexander von Humboldt fellow. He has also received a couple of awards, including the MOST Outstanding Research Award (2016), the TienTe Lee Young Scientist Research Award (2016), the NHRI Award (2015) for Integrated Research Grants in Health and Medical Sciences, and the NYMU Academic Excellence Awards.

Panelist



國立清華大學
NATIONAL TSING HUA UNIVERSITY

Dr. Fan-Gang TSENG

Distinguished Professor,
Department of Engineering and System Science
Deputy Director, Biomedical Technology Research Center &
Vice President for
Research and Development,
National Tsing Hua University

Fan-Gang (Kevin) Tseng received his Ph.D. degree in Mechanical Engineering [illegible], U.S.A. in 1998. He is currently a Distinguished Professor of ESS Dept. as [illegible], and the Vice President for R&D at NTHU. He was elected as an ASME [illegible] 2014. His research interests are in the fields of BioNEMS, Biosensors, Micro-[illegible] and Fuel Cells. He received 60 patents, wrote 8 book chapters, [illegible] more than SCI 220 Journal papers and 360 conference technical papers. [illegible] several awards, including, Shakelton Scholar, twice National Innovation [illegible] Outstanding in Research Award, and Ta-You Memorial Award from [illegible], and more than twenty best papers and other awards in various [illegible] conferences and competitions.

High Efficient and Selectable Concentration of Bacteremia and Rapid Bacterial Antibiotic Susceptibility Test through Electrokinetic Concentration Microdevice

Kuan-Hung Chen[1,2], Shih-Han Lee[1], Chun-Wei Lee[1,2], Tseren-Onolt Ishdorj[3*], and Fan-Gang Tseng[1,2,4*]

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[2] *Frontier Research Center on Fundamental and Applied Sciences of Matters, National Tsing Hua University, TAIWAN*
[3]*School of Information and Communication Technology, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[4]*Research Center for Applied Sciences, Academia Sinica, Taipei, TAIWAN*

Abstract

This study proposes a microfluidic device to selectively concentrate bacteria and rule out blood cells in a three-dimensional manner through the synergic effects of AC electroosmotic flow (ACEOF) and dielectrophoresis (DEP). This significant concentration not only reduced background noises from blood but also increased 3 orders of magnitude in signals. Gram-negative (Staphylococcus aureus) and gram-positive (Esherichia coli) strains were identified via Raman unique fingerprints with a detection limit as low as 10^2 cfu/ml. Moreover, a rapid antibiotic susceptibility test (AST) was operated in two hours, which showed high potentiality to help mitigate the challenge of drug resistance in clinical microbiology.

Keywords: Bacteremia, AC electroosmotic flow, dielectrophoresis (DEP), antibiotic susceptibility test (AST)

Panelist

國立中興大學
National Chung Hsing University

Dr. Gou-Jen WANG

Distinguished Professor, Department of Mechanical Engineering & Dean of College of Engineering, National Chung Hsing University

Dr. Wang received the B.S. degree in 1981 from National Taiwan University and the M.S. and Ph.D. degrees in 1986 and 1991 from the University of California, Berkeley, all in Mechanical Engineering. Dr. Wang joined the Mechanical Engineering Department of the National Chung Hsing University, Taiwan in 1992 as an Associate Professor and has become a Professor in 1999. From 2003-2006, he was the Division Director of Curriculum of the Center of Nanoscience and Nanotechnology. From 2007 to 2011, he had been the Chairman of the Graduate Institute of Mechanical Engineering, National Chung Hsing University, Taiwan. From August 2015, he has been the Dean of the College of Engineering. In 2010, he received the Outstanding Research Award from the Ministry of Science and Technology, Taiwan. His research interests include MEMS/NEMS, nanostructured materials, microfabrication, and tissue engineering.

Dual Application of Pt/Au Nano-Alloy Electrode in Neutral Enzyme-Free Glucose Detection and Biofuel Cell

Fang-Yu Lin[a], Tien-Fu Chu[b], Chang-I Peng[b], Iren Kuznetsova[c], and Gou-Jen Wang[a,b*]

[a] *Graduate Institute of Biomedical Engineering, National Chung-Hsing University, Taichung, Taiwan*
[b] *Department of Mechanical Engineering, National Chung-Hsing University, Taichung, Taiwan*
[c] *Kotelnikov Institute of Radio Engineering and Electronics, Russian Academy of Science, Russia*

Abstract

Enzyme-free is the development trend of glucose detection technology. The ability to operate in a neutral environment is the key technology of wearable continuous glucose monitoring (CGM). We integrated Taiwan's superior industries such as semiconductor micro-electromechanical manufacturing processes, precision micro-molding, hot embossing, and chip packaging to develop Pt/Au nano-alloy electrodes with applications in neutral non-enzymatic glucose biosensors and neutral non-enzymatic glucose biofuel cell. This novel Pt/Au nano-alloy electrode possesses advantages of technology foresight, good detection performance, and high feasibility of mass production. We have cooperated with the Plastics Industry Development Center to link upstream and downstream manufacturers in Taiwan for trial production of electrodes and sensors. In the future, we will further develop an autogenous power supply implantable continuous glucose sensor by integrating the glucose detection sensor and the glucose biofuel cell.

Keywords: Pt/Au nano-alloy electrode, neutral non-enzymatic glucose detection, continuous glucose monitoring, neutral non-enzymatic glucose biofuel cell

Panelist

國立交通大學
National Chiao Tung University

Dr. Yun-Ming WANG

Professor, Department of Biological Science and Technology &
Vice Dean, College of Biological Science and Technology,
National Chiao Tung University

[redacted] Dr. Wang obtained his Ph.D. in 1990 in National Tsing Hua [redacted] Dr. Wang became a faculty member in the Chemistry Department [redacted] University in 1993. In 2008, Dr. Wang became a faculty member [redacted] of Biology and Technology, National Chiao Tung University. In [redacted] is currently also the Vice Dean of the College of Biological Science [redacted] National Chiao Tung University.

[redacted] include: (A) Application of Thermal Sensitive Multifunctional [redacted], (B) Synthesis of NO Releasing Agents for Angiogenesis, [redacted] and Alzheimer's disease, (C) Optical Fluorescent Probe [redacted], NO, H_2S, $ONOO^-$, Cysteine, and (D) Development of Gold Nano- [redacted] and Photodynamic Therapy.

Anti-cancer Cellular Immunotherapy Using Activated Macrophages with MR/Optical Imaging

Wen-Han Chuang[1], Nein-Chueh Chen[1], Evgeny Pislyagin[2], Ekaterina Menchinskaya[2], Ekaterina Chingizova[2], Irina Agafonova[2], Alexandra Silchenko[2], Dmitry Aminin[2,3], Yun-Ming Wang[1*]

[1] *Department of Biological Science and Technology, National Chiao Tung University, Hsinchu, Taiwan*
[2] *G.B. Elyakov Pacific Institute of Bioorganic Chemistry, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok, Russia*
[3] *Taiwan Kaohsiung Medical University, Kaohsiung, Taiwan*

Abstract

Cucumarioside A_2-2 (CA_2-2), an extract of sea cucumber, has been proven to exhibit a variety of biological activities, including antibacterial, anti-inflammatory, anti-oxidant, anticancer and immunomodulatory effects. In vivo study has shown that CA_2-2 can effectively convert mouse monocyte into activated macrophages in mouse spleen. The activated macrophages can divide into two phenotypes: classically activated macrophage (M1), alternatively activated macrophage (M2). Several studies have shown that M1 macrophages are capable of killing cancer cells through producing anti-cancer factors such as tumor necrosis factor (TNF-α), interleukin -12 (IL-12), nitric oxide (NO), and hydrogen peroxide (H_2O_2). The aim of this study is to determine whether CA_2-2 can act as anti-cancer agent through activated macrophages. In this study, mouse macrophage cells were treated with CA_2-2, LPS, and IFN-γ for the polarization of macrophages. Meanwhile, the near-infrared fluorescent dye CyTE777 was conjugated with SPIO nanoparticles, an optical imaging contrast agent, for cancer diagnosis and immunotherapy. Co-treatment of CA_2-2 with LPS and IFN-γ can effectively convert mouse monocyte into M1 macrophages and increase anti-cancer activity through enhancing the production of anti-cancer factors such as tumor necrosis factor alpha (TNF-α). The cell viability of 4T1 mouse breast cancer cells was significantly decreased in the conditioned medium(CM) of CA_2-2-activated macrophages.

Keywords: Cancer, cellular immunotherapy, macrophages, sea cucumber triterpene glycosides

Panelist

國防醫學院
National Defense Medical Center

Dr. Yi-Kung Eagle HUANG

Professor and Director, Department of Pharmacology,
National Defense Medical Center

Eagle Yi Kung Huang is a professor and director of the Department of Pharmacology at the National Defense Medical Center, Taipei, Taiwan. His work focuses specifically on the functions of neuropeptides in connection with drug addiction and pain. His publications are over 65 in peer international journals and include several books since 1996. Professor. Huang is well-known as a peptide pharmacologist. His recent research on orexigeninsin IV, oxytocin, and hemorphin haves drawn attention to the fellows working in the same field.

LVV-hemorphin-7 (LVV-H7) Plays a Role in Antinociception in a Rat Model of Alcohol-induced Pain Disorders

Hao-Yuan Hung[1,2,3], Lok-Hi Chow[4,5,6], Jolanta H. Kotlińska[7], Anna Drabik[8], Jerzy Silberring[8], Yuan-Hao Chen[1,9], Eagle Yi-Kung Huang[1]*

[1] *Department of Pharmacology, National Defense Medical Center;*
[2] *Graduate Institute of Medical Sciences, National Defense Medical Center;*
[3] *Department of Pharmacy Practice, Tri-Service General Hospital, National Defense Medical Center;*
[4] *Department of Anesthesiology, Tri-Service General Hospital, National Defense Medical Center;*
[5] *Department of Anesthesiology, Taipei Veterans General Hospital;*
[6] *School of Medicine, National Yang-Ming University, Taipei, Taiwan;*
[7] *Department of Pharmacology and Pharmacodynamics, Faculty of Pharmacy with Division of Medical Analytics, Medical University of Lublin, Lublin;*
[8] *Department of Biochemistry and Neurobiology, Faculty of Materials Science and Ceramics, AGH University of Science and Technology, Krakow, Poland;*
[9] *Department of Neurological Surgery, Tri-Service General Hospital, National Defense Medical Center, Taipei, Taiwan.*

Abstract

Alcohol can increase the sensitivity to painful stimulation or convert insensibility to pain at different stages. We hypothesized that chronic alcohol consumption changes the level of LVV-H7 (an opioid-like peptide generated from hemoglobin β-chain), thereby affecting pain sensation. In the chronic alcohol-exposed animal model, we confirmed that alcohol first induced analgesia followed by hyperalgesia during alcohol withdrawal, which could be driven by the quantitative change of LVV-H7. Moreover, we revealed that the LVV-H7 levels were determined by the activity of cathepsin D and red blood cell/hemoglobin counts, which could be affected by alcohol. These results suggest that the deterioration of anti-nociception induced by alcohol is correlated to the altered level of LVV-H7, and this could be due to alcohol-induced anemia. This study may help to develop LVV-H7 structure-based novel analgesics for treating alcohol-induced pain disorders and thus ameliorate the complications in alcoholics.

Keywords: alcohol; alcohol withdrawal; anemia; LVV-hemorphin-7; pain

Panelist

國立中興大學
National Chung Hsing University

Dr. Day-Yu CHAO

Professor, Institute of Microbiology and Public Health,
National Chung Hsing University

received epidemiology training from National Taiwan University, and molecular biology training in the Centers for Disease Control and (US CDC). With years of field work experiences and influential zoonotic and vaccine-related work, she has been pointed to and government position, such as Review Editor of "Frontiers Top Ten Best Paper with Destructive Innovation" awarded Selected 45 Spotlight Laboratories in Taiwan by Center for and Science Engagement (GASE), MOST, 2020 and Academic Assessment Advisory Committee of Bureau of Animal and Inspection and Quarantine (BAPHIQ), Council of Agriculture Her research interests mainly focus on antigen development and vaccine development, the discovery of human with various approaches.

Point-of-Care diagnostic kits from dengue to COVID-19

Day-Yu Chao[1], Raul V. Destura[2]

1. *Graduate Institute of Microbiology and Public Health, National Chung-Hsing University, Taichung, Taiwan*
2. *National Institutes of Health-UP Manila, Manila, Philippines*

Abstract

Flavivirues, members of flaviviridae family, include several medical important mosquito-transmitted viruses worldwide. While dengue viruses (DENV) continues to impose a great economic and public health burden in tropical and subtropical countries of Southeast (SE) Asia, the emergence of zika virus (ZIKV) since 2013 has resulted in terrifying outbreaks with severe health outcomes, including Guillain-Barre syndrome in adults as well as microcephaly, congenital neurologic malformations, and fetal demise in fetuses. Since December 2019, a novel coronavirus, now named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in Wuhan, China and subsequently spread to the rest of the world and caused a pandemic of severe pneumonia, now called coronavirus disease (COVID-19). As of 15 September 2020, more than 29.4 million cases worldwide were reported to the World Health Organization (WHO), with more than 931, 000 deaths. As such, COVID- 19 has become a major global concern that greatly affected health systems, economy and society. Nucleic acid-based diagnostic assays are currently prevalent in clinical diagnosis. As WHO urges all countries to scale up the testing capacity, the ideal diagnostic test should follow ASSURE criteria, including Affordable, Sensitive, Specific, User-friendly, Rapid and robust, Equipment-free and Deliverable to end-users. There is an urgent need to develop a rapid test for timely and accurate diagnosis for controlling the outbreaks of the disease. A finger-prick test to tell the results in 20 minutes if a person is infected with the virus with high accuracy is highly desirable. More importantly, a multiplex assay to differentiate different human coronavirus or respiratory viral infection is needed in facing the lift of lockdown and the durability of antibody after infection. A combined POC test to detect both nucleic acid and antibody will be crucial when the vaccine is available with only moderate efficacy. Thus far, do we have an ideal diagnostic test for both dengue and COVID-19? Not yet but it's not too far.

Keywords: Diagnosis, dengue, flavivirus, COVID-19, POC

Session II

Panel A: Basic Sciences

Moderator

- **Dr. Henry Tsz-King WONG**

Research Fellow and Deputy Director, Institute of Physics,
Academia Sinica

Panelists

- **Dr. Jiun-Jih MIAU** (Taiwan-Russia)

Distinguished Professor, Department of Aeronautics and Astronautics,
National Cheng Kung University

- **Dr. Ru-Shi LIU** (Taiwan-Poland)

Distinguished Professor, Department of Chemistry, National Taiwan University

- **Dr. Chen-Wei LIU** (Taiwan-France)

Professor, Department of Chemistry, National Dong Hwa University

Moderator

中央研究院
ACADEMIA SINICA

Dr. Henry Tsz-King WONG

Research Fellow and Deputy Director,
Institute of Physics, Academia Sinica

Henry T. Wong studied physics and got his B.A. from Oxford University and Ph.D. from the California Institute of Technology. After holding junior research positions at CERN (the European Laboratory in Particle Physics), he joined the Institute of Physics at Academia Sinica (AS) in 1997, and is currently a Research Fellow and Deputy Director. His research interests are on experimental neutrino and dark matter physics, in particular their low energy and low background instrumentation. He initiated and spearheads the international TEXONO research program at AS, conducting experiments at the Kuo-Sheng Reactor Neutrino Laboratory in northern Taiwan with participating groups from China, India and Turkey. The TEXONO group is a founding partner of the CDEX Dark Matter experiment at the Jinping Underground Laboratory in Sichuan, and participates in the international LEGEND double beta decay experiment at the Gran Sasso Underground Laboratory in central Italy, and the PIRE-GEMADARC program pursuing R&D on germanium detector technology.

Panelist

國立成功大學
National Cheng Kung University

Dr. Jiun-Jih MIAU

Distinguished Professor,
Department of Aeronautics and Astronautics,
National Cheng Kung University

Jiun-Jih Miau obtained his B.S. degree in Mechanical Engineering from National [illegible] University, Taiwan, in 1976, and his PhD degree in Engineering from Brown [illegible]ty, USA, in 1984. Since then, he has engaged in teaching and research at the Department of Aeronautics and Astronautics, National Cheng Kung University [illegible], Taiwan. His research interests are mainly in the areas of fluid dynamics [illegible] engineering. Dr. Miau has published more than 90 papers in the peer-[illegible] journals. Dr. Miau is an Associate Fellow of AIAA, a Corresponding Member [illegible] International Academy of Astronautics), and a Fellow of AASRC (Aeronautical [illegible] Astronautical Society of Republic of China). During the years of 2008 and 2009, [illegible] served as the Director General of National Space Organization, Taiwan. He [illegible] awarded with the Honorary Doctor of Siberian Branch of Russian Academy of [illegible] in September 2019.

A Note on the Onset of the Critical Transition Phenomenon in Flow Over a Smooth Circular Cylinder

Jiun-Jih Miau,[1] Chung-Hao Fang,[1] Meng-Chiao Chen,[1] Chin-Tsung Wang,[1] Yi-Huei Lai,[1] Sergey A. Isaev,[2] and Vadim A. Lebiga[3]

[1]*Department of Aeronautics and Astronautics, National Cheng Kung University,Tainan, Taiwan 70101*
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[3]*Khristianovich Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk, Russia 630090*

Abstract

A comprehensive discussion on the flow development at the initiation of the critical transition in flow over a smooth circular cylinder is made in this study. In particular, in the pre-critical state the physical dimensions of the two separation bubbles situated on the shoulders of a circular cylinder are clarified. Namely, the streamwise extent of the separation bubbles is about 1% of the perimeter of the circular cylinder. The effective height of the separation bubbles is comparable to their streamwise extent, as deduced from the difference between the characteristic vortex shedding frequencies corresponding to the sub-critical and pre-critical states. Subsequently, a schematic drawing depicting the physical size of the separation bubbles and their locations on the circular cylinder is given.

The authors would like to express their sincere appreciations to Ministry of Science and Technology for the research funding support under the project numbers: MoST 109-2923-H-006-001 and MoST 107-2923-E-006-003-MY3.

Keywords: circular cylinder, critical transition, separation bubble, non-stationary phenomenon, vortex shedding

Panelist

國立臺灣大學
National Taiwan University

Dr. Ru-Shi LIU

Distinguished Professor, Department of Chemistry,
National Taiwan University

Ru-Shi Liu is a Distinguished Professor of the Department of Chemistry, National Taiwan University. He received his Bachelor's degree in Chemistry from Soochow University, in 1981. He got his Master's degree in nuclear science from the National Tsing Hua University, in 1983. He obtained two PhD degrees in Chemistry from National Tsing Hua University in 1990 and the University of Cambridge in 1992. His research focuses on light-conversion materials including light-emitting diode phosphor, energy conversion and storage devices, and nano-bio therapies. He is the author and co-author of more than 700 publications in scientific international journals with total citations >19,840, h-index: 77. He has also been granted more than 100 patents. He got "Highly Cited Researchers" by Clarivate Analytics in 2018 and 2019. He got Hou Chin-Tui Award in 2018. He got the Yun Y. Y. Hsu Chair Professor and the 26th TECO Awards in 2019.

Narrow Band Phosphors for the Application in Lighting and Backlighting of Light-Emitting Diodes

Ru-Shi Liu,[a*] Mu-Huai Fang,[a] Sebastian Mahlik,[b] Marek Grinberg,[b*]

[a]*Department of Chemistry, National Taiwan University, Taipei 106, Taiwan*
[b]*Institute of Experimental Physics, Faculty of Mathematic, Physics and Informatics, Gdańsk University, Wita Stwosza 57, 80-308 Gdańsk, Poland*

Abstract

Light-emitting diodes (LEDs) are widely used around the world. Scientists are attempting to develop LED devices that not only have high brightness but also have a high color rendering index (CRI). Phosphor materials play important roles in tuning and optimizing the final luminescent spectrum. Narrow-band emission phosphors must be incorporated into LED chips to achieve high CRI and efficacy. From this report, we introduce and discuss key points in the narrow-band emission spectrum. The phosphor of UCr_4C_4-type structure is used to explain these points. First, we discuss the highly symmetrical local coordination environment of activators, which include cuboid and nine-coordinate structures. Second, we reveal the second shell effect of the substituted cation channel. Third, we discuss the interaction between the electron from the activator and the vibration from the host lattice (electron-lattice interaction). These model systems help establish and design rules for narrow-band emission phosphors and may guide future studies in discovering potential phosphor candidates for practical applications.

Keywords: Narrow Band Phosphors, Light-emitting diodes, UCr_4C_4-type structure, brightness, color rendering index.

Panelist

國立東華大學
NATIONAL DONG HWA UNIVERSITY

Dr. Chen-Wei LIU

Professor, Department of Chemistry,
National Dong Hwa University

Dr. Chen Wei Liu graduated with a B.S. in Chemistry from Fu Jen Catholic University in Taiwan in 1986 and went to Texas A&M where he received his PhD in 1994 with Distinguished Professor John P. Fackler. After an additional year of postdoctoral work at A&M he took a postdoctoral position at Academia Sinica in Taipei. In 1997 he accepted an Associate Professor position at Chung Yuan Christian University and was promoted to Professor in 2002. In 2005 he took a professorial position at National Dong Hwa University. He has received many accolades which include: Distinguished Young Investigator Award of the Chinese Chemical Society, 2002; Outstanding Research Award, Chung Yuan Christian University, 2004; France-Taiwan Scientific Prize, 2016; Outstanding Research Award, Ministry of Science and Technology, 2016; the 15th Y. Z. Hsu Science Paper Award; and Chin-Tui Ho Distinguished Honor Award (fundamental science), 2019.

Synthesis of Superatomic Alloys Stabilized by Dichalcogenolates

Jean-Yves Saillard[2] and Chen-Wei Liu[1]

[1] *Department of Chemistry, National Dong Hwa University, Hualien 974301, Taiwan (R.O.C.)*
[2] *Univ Rennes, CNRS, ISCR-UMR 6226, F-35000 Rennes, France*

Abstract

Our interests in the fundamental studies of superatomic alloys are a part of the adventure derived from a systematic investigation of polyhydrido copper(I) clusters supported by dichalcogenolates (L). Copper hydrides, for which the hydride positions have been accurately determined by single crystal neutron diffraction are $Cu_{20}H_{11}L_9$, $[Cu_{28}H_{15}L_{12}]^+$, $Cu_{30}H_{18}L_{12}$, and $Cu_{32}H_{20}L_{12}$. Later we uncovered that the protons of terminal alkynes are acidic enough to remove most of the hydrides to induce cluster degradations from which two-electron superatoms, $[Cu_{13}L_6(alkynyl)_4]^+$, a Cu-centered Cu_{12} cuboctahedron, were characterized. Subsequently $[MCu_{12}L_6(alkynyl)_4]^+$ (M = Au, Ag) were readily fabricated from Cu_{13} clusters via a template galvanic replacement method.

Unfortunately, the synthetic protocol used to prepare copper hydrides did not work on its heavier congener, silver. Instead, two eight-electron superatoms, $Ag_{20}L_{12}$ and $[Ag_{21}L_{12}]^+$, which have a silver-centered Ag_{12} icosahedral core capped by seven or eight silver atoms, were isolated. Alloys of $Au@Ag_{19}$ and $Au@Ag_{20}$ were synthesized accordingly. The extension of this methodology in doping group 10 metals appears to fail. We therefore shifted our attention to a co-reduction synthesis. Results presented here are the structures and bonding of three homoleptic dithiolate-protected Pt/Ag superatoms, $PtAg_{20}L_{12}$, $Pt_2Ag_{33}L_{17}$, and $Pt_3Ag_{44}L_{22}$, where the inner cores can be visualized as assembled linearly by one, two, and three centered icosahedral $Pt@Ag_{12}$ building blocks and their cluster electron count is 8, 16 and 22 of which the latter species is isolobal to a linear triiodide anion. The lowest energy absorption shifts to near-IR region as the number of centered icosahedral $Pt@Ag_{12}$ unit increases from one (412 nm) to three (956 nm). Also presented is a new eight-electron alloy, $[IrAg_{20}L_{12}]$, characterized by ESI-MS.

Keywords: Superatomic alloys, Copper hydrides, Structure and bonding

Session II

Panel B: Biological & Agricultural Sciences

Moderator

- **Dr. Te-Yu LIAO**

Associate Professor, Department of Oceanography &
Associate Vice President for Research & Development, National Sun Yat-sen University

Panelists

- **Dr. Wen-Hsin CHUNG** (Taiwan-The Philippines)

Professor, Department of Plant Pathology, National Chung Hsing University

- **Dr. Chun-Yen CHU** (Taiwan-United Kingdom)

Professor, Graduate Institute of Animal Vaccine Technology &
Director of the International Degree Program in Animal Vaccine Technology,
National Pingtung University of Science and Technology

Dr. Hsing-Chieh WU
Assistant Professor, International Degree Program in Animal Vaccine Technology &
Chief of Strategic Development Division of the Office of International Affairs,
National Pingtung University of Science and Technology

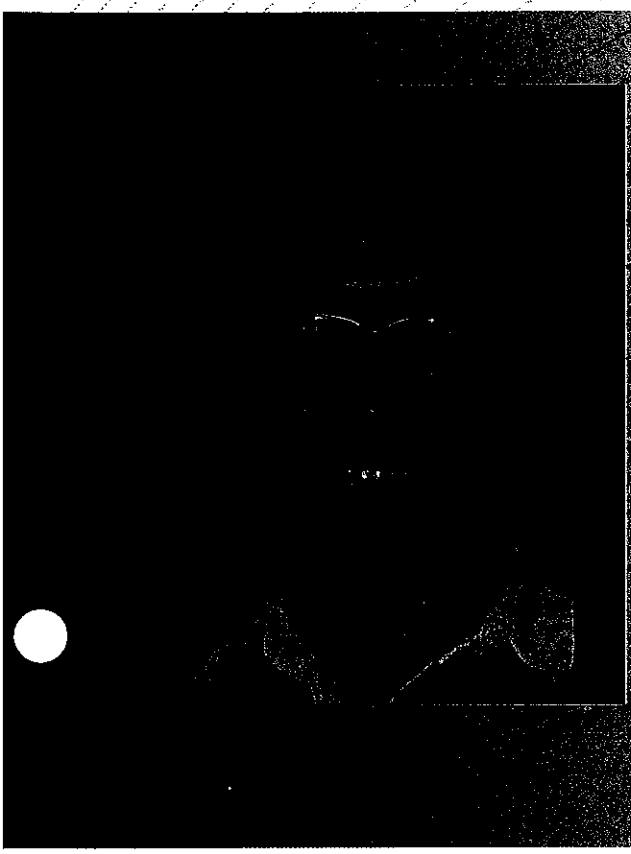
- **Dr. Kwok Kan CHAN** (Taiwan-Russia)

Research Fellow and Deputy Director, Biodiversity Research Center,
Academia Sinica

- **Dr. Sen-Lin TANG** (Taiwan-Mongolia)

Research Fellow, Biodiversity Research Center, Academia Sinica

Moderator



Dr. Te-Yu LIAO

Associate Professor,
Department of Oceanography &
Associate Vice President for Research & Development,
National Sun Yat-sen University

My interest is focused on systematics, biodiversity and ecology of fishes, especially gobies in East and Southeast Asia using molecular and morphological characters. My team also uses molecular tools to reconstruct the population genetics of fishes and combine them with information of pelagic larvae duration. We infer the influence of ocean currents on the genetic structure of fishes. Environmental DNA is a developing field in my lab to study ecological aspects of fishes, especially for fish fauna of a given locality and the roles of fishes in the food web.

Panelist

國立中興大學
National Chung Hsing University

Dr. Wen-Hsin CHUNG

Professor, Department of Plant Pathology,
National Chung Hsing University

[illegible] working in the Department of Plant Pathology, NCHU, got Bachelor and [illegible] the Department of Plant Pathology, NCHU, in 1991 and 1993. After that, Dr. Chung [illegible] Ph.D. in Agriculture Science from Tsukuba University in 2004. He was a postdoc [illegible] Tsukuba University and National Institute for Agro-Environmental Sciences from [illegible]

[illegible] to Taiwan to work at the Department of Plant Pathology, NCHU in 2005/08. His [illegible] fields include plant pathology, mycology, non-chemical control, scanning [illegible] microscopy.

[illegible] member of the Taiwan Phytopathological Society, The Plant Protection Society [illegible] China, Mycological Society of Taiwan and Chinese Sustainable Agriculture [illegible] He is also a member of board of directors of The Plant Protection Society of [illegible] China and Mycological Society of Taiwan. He has published about 50 refereed [illegible] and over 70 conference proceeding papers.

Integrated Pest Management in GAP and Organic Production of Broccoli and Strawberry Under Protected Structures in Benguet and Mt. Province

Chih-Li Wang[a], Yi-Yuan, Chuang[b], Jocelyn C. Perez[c], Teresita K. Mangili[c], Jovita M. Sim[c] and Wen-Hsin Chung[a]

[a] *Department of Plant Pathology, National Chung Hsing University, Taichung, 402*
[b] *Department of Entomology, National Chung Hsing University, Taichung, 402*
[c] *College of Agriculture, Benguet State University, La Trinidad, Benguet, the Phillippines*

Abstract

Subproject I was aimed to classify the species of Colletotrichum gloeosporioides species complex and evaluate non-chemical control on strawberry anthracnose. More than two species of Colletotrichum were identified and one new record disease (leaf blight) was observed. The non-chemical control showed that Bacillus, essential oil and smoke-water have efficacy on inhibiting mycelia growth of Colletotrichum.

Subproject II was aimed to design PCR primers and conditions for the detection of pathogens that causing Fusarium wilt of Brassica vegetables and strawberry. Through DNA sequence comparisons, a primer set specific to Fusarium oxysporum f.sp. rapae was designed from a SIX gene while a primer set successfully designed from an effector gene of Fusarium oxysporum f.sp. fragariae from strawberry was able to detect pathogens of strawberry Fusarium wilt in Taiwan. The primer specificity and sensitivity were proven and determined. A multiplex PCR was further developed to distinct three formae speciales of cruciferous plant yellowing in one reaction. Results indicated that these primer sets will be useful to identified pathogens in few hours without pathogenicity assays. Subproject III was aimed to evaluate non-pesticide materials against Tetranychus urticae Results showed that after 48 hours, mineral oil possessed 85.0% of mortality rate against female adult mite, showing no significant difference with 2% sucrose ester (83.7%) after 48 hours treated. Besides, applying mineral oil or sucrose ester on controlling T. urticae on strawberry (Fragaria x ananassa) wouldn't affect Orius strigicollis used as biological control. The test results may be extended to the usage of integrated management on strawberry production.

Keywords: Strawberry, Brassica vegetable, Anthracnose, Fusarium wilt, Tetranychus urticae

Panelist

國立屏東科技大學
National Pingtung University of Science and Technology

Dr. Hsing-Chieh WU

Assistant Professor, International Degree Program in Animal Vaccine Technology &
Chief of Strategic Development Division,
Office of International Affairs,
National Pingtung University of Science and Technology

Dr. Hsing-Chieh Wu is an Assistant Professor of International Degree Program in Animal Vaccine Technology (IAVT) and Chief of Strategic Development Division in Office of International Affairs at the National Pingtung University of Science and Technology (NPUST), Taiwan. She studied Veterinary Medicine as an undergraduate at NPUST and went on to carry out a PhD studying animal vaccine and adjuvant at the National Chung Hsing University, Taiwan. This generated a long-standing interest in animal vaccine development which has remained a dominant interest in her research group. After completing her PhD she went on to work in the Graduate Institute of Animal Vaccine Technology in Taiwan as a postdoctoral researcher and in the Biomedical Sciences Research Complex at University of St Andrews in UK as a visiting researcher before coming to the IAVT, NPUST. She aims to develop multivalent vaccines and attenuated virus vaccines and she holds two patents for veterinary vaccines.

Replicons and Infectious Copies in the Study of Animal Pathogens

Hsing-Chieh Wu[1,2], Yi-Ting Lo[1], Garry A. Luke[3], Fiona Tulloch[3], Martin D. Ryan[3*], Chun-Yen Chu[1,2*]

[1] *International Degree Program in Animal Vaccine Technology, International College, National Pingtung University of Science and Technology, Taiwan*
[2] *Graduate Institute of Animal Vaccine Technology, College of Veterinary Medicine, National Pingtung University of Science and Technology, Taiwan*
[3] *Biomedical Sciences Research Complex, School of Biology, University of St Andrews, UK*

Abstract

Vaccines are central to the future success of animal agriculture because they can help minimize the need for antibiotics by preventing and controlling infectious diseases in animal populations. Safe and effective animal vaccines are essential to modern society. The aim of this project was to link laboratories in Taiwan and UK, using replicons and infectious copies technology on controlling animal diseases. The study of virus replication that requires high bio-secure facilities can be accomplished with less stringent containment using non-infectious 'replicon' systems. Develop a virus replicon system by replacing sequences encoding the structural proteins of the infectious cDNA copy with reporter proteins. Such genomes replicate within cells, but cannot form infectious particles: entirely bio-security. It has shown the value of being able to conduct fundamental research on pathogens' 'classically' requiring high-containment but out with such facilities. Characterization in tissue-cultures cells, latterly animals, allow us to create a 'design cycle' such that the right level of attenuation (lower morbidity, induction of a protective immune response) can be achieved. This procedure potentially provides the means to create vaccines for economically significant animal virus pathogens.

Keywords: Replicons, Infectious copies, Animal pathogens, Food security

Panelist

中央研究院
ACADEMIA SINICA

Dr. Kwok Kan CHAN

Research Fellow and Deputy Director,
Biodiversity Research Center,
Academia Sinica

Dr. Benny K.K. Chan is a Research Fellow and Deputy Director in the Biodiversity Research Center, Academia Sinica, Taiwan. His research field covers the phylogeny and phylogeography of intertidal and deep-sea barnacles and the larval-biology of coral and sponge associated barnacles. Dr. Chan has spent 24 years in the research of barnacles starting from his Ph.D. studies in 1996. In the past 5 years, Dr. Chan published 80 SCI papers in the field of ecology, phylogeny and phylogeography of barnacles. At present, Dr. Chan is the President-elect in The Crustacean Society. Dr. Chan is the Editor-in-chief of the Taiwanese SCI Journal Zoological Studies, Associate Editors of the Journal of the Marine Biological Association of the United Kingdom, Diversity, Zookeys and PLoS ONE.

Ascothoracida (Thecostraca, Crustacea) - Parasites of Cnidarians and Echinoderms. The first in the world to reconstruct the phylogeny by using morphological and molecular approaches and evolution of the parasitism within this group.

Benny K.K. Chan[1], Alexandra Petrunina[2], Gregory Kolbasov[2]

[1] *Biodiversity Research Center, Academia Sinica, Taipei, Taiwan*
[2] *White Sea Biological Station, Biological Faculty of Moscow State University, Moscow 119899, Russia*

Abstract

Within the Crustacea, there are several infraclasses in the subclass Thecostraca that are parasitic mode of life, yet the knowledge of phylogeny and morphology in these groups are poorly studied. The Ascothoracida is one of the most plesiomorphic taxa within the Thecostraca in crustacea. Ascothoracida are parasites of anthozoans and echinoderms and they are very common in the marine environment. However, studies on the diversity, biology and ecology of Ascothoracida are very rare. The present morphological based taxonomy of Ascothoracida is divided into two orders. Dendrogastrida is composed of meso- and endoparasites in echinoderms. Laurida composed of species that are ectomeso- and endoparasites of anthozoans (except genus Waginella from crinoids). However, this taxonomic relationship has never been tested by molecular methods. Part of the result of our collaboration project, we have successfully collected 7 genera of the Ascothoracida, successfully get multiple DNA markers (18S, 28S, 16S, 12S and COI). Molecular phylogenetic pattern supported all the Ascothoracida genera are monophyletic groups and generally the morphological phylogenetic relationship is supported by molecular evidence. Two papers were already published from this project to described new species of Synagoga and Sessilagoga from Green Island Taiwan.

Keywords: Ascothoracida, Thecostraca, biodiversity, parasitism, molecular phylogeny

Panelist

中央研究院
ACADEMIA SINICA

Dr. Sen-Lin TANG

Research Fellow,
Biodiversity Research Center,
Academia Sinica

Sen-Lin Tang received his Ph.D. from The University of Melbourne in 2002. Tang continued his post-doctoral work in the School of Veterinary of the same university until 2006, and he took a faculty position at Biodiversity Research Center, Academia Sinica, Taiwan.

In 2016, Tang was awarded a full research fellowship in the same research institute. His research interests comprise coral-associated bacteria and their functions in coral holobiont, and ecology and ecophysiology of a sponge-killer sponge, Terpios hoshinota, and their cyanobacterial symbionts. Tang is also interested in lake microbes in Siberia and West Mongolia. Tang is a co-Editor-in-Chief of Zoological Studies, and the Senior/Associated Editor of Microbes and Environments and Scientific Reports.

Microbiomes in Meromictic Lakes in Siberia and West Mongolia

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Abstract

Meromictic Lake is one of the hot studying habitats for aquatic microbiology, biogeochemistry, paleontology and paleoclimatology. The main reason is irreplaceable features of the meromictic lake, including long-term stratification water body without holomixing, a clear structure for oxic and anoxic water zones, and its laminated sediment for deduction of climate and environmental changes over ten of thousand years. These features facilitate the studies of how microbes and environmental factors interact with each other without too complicated, uncertain factors involved in analyses. Over the past decade, we conducted several microbiome surveys in three meromictic lakes (Lakes Shira, Shunet and Uchum) in Siberia and one (Lake Oigon) in Mongolia supported by joint MOST projects between Taiwan and Russia or Mongolia. By 16S rRNA amplicon sequencing, we detected different unique bacterial groups in oxic and anoxic zones in different lakes, suggesting strong geographic specificity for microbes in those four lakes and no relationship with geographic distance between lakes. Through seasonal surveys, the dynamics of bacterial profiles were revealed, and the changes in bacterial community were related to changes in environmental factors, such as temperature, oxygen and H_2S. Moreover, we deeply characterized metagenomic features in microbial and viral communities in Lake Shunet, and built the putative metabolic networks between different water zones in the lake with respect to carbon, nitrogen and sulfur cycles. This is the first high-latitude, land-locked meromictic lake metagenome study that paves a new way for an in-depth understanding of meromictic lake metabolism.

Keywords: Meromictic lake, Microbial community, Metagenome

Session III

Panel A:
Public Well-Being Technology & Energy Resources

Moderator

- **Dr. Ching-Ting LEE**

Honor Chair Professor, Department of Electrical Engineering and Vice President,
Yuan Ze University

Panelists

- **Dr. Chi-Chang HU** (Taiwan-United Kingdom)

Chair Professor, Department of Chemical Engineering,
National Tsing Hua University

Dr. Tzu-Ho WU
Assistant Professor, Department of Chemical and Materials Engineering,
National Yunlin University of Science and Technology

- **Dr. Yeong-Bin YANG** (Taiwan-Czechia)

Distinguished Professor, Department of Civil Engineering,
National Taiwan University

Dr. Jong-Dar YAU
Professor, Department of Architecture, Tamkang University

- **Dr. Shiu-Wu CHAU** (Taiwan-Czechia)

Professor, Department of Engineering Science and Ocean Engineering &
Team Leader at the Energy Research Center, National Taiwan University

- **Dr. Shing-Jiang Jessie LUE** (Taiwan-EU)

Professor, Department of Chemical and Materials Engineering,
Chang Gung University

- **Dr. Yu-Wen CHEN** (Taiwan-India)

Professor, Department of Chemical and Materials Engineering,
National Central University

- **Dr. Hong-Ming LIN** (Taiwan-Poland)

Professor, Department of Materials Engineering, Tatung University

Moderator

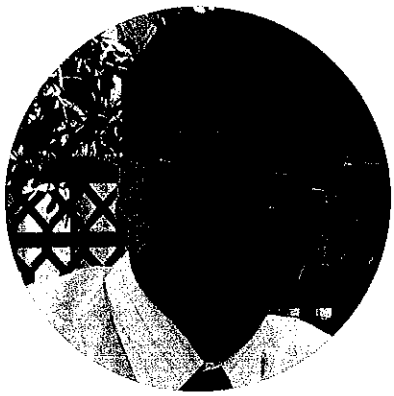
元智大學
Yuan Ze University

Dr. Ching-Ting LEE

Honor Chair Professor,
Department of Electrical Engineering &
Vice President, Yuan Ze University

Ching-Ting Lee received his B.S. and M.S. degrees at National Cheng Kung University. He received Ph.D. degree from Electrical Engineering Department of Carnegie-Mellon University, USA. He worked at National Cheng Kung University as the Dean of College of Electrical Engineering and Computer Science from 2003 to 2009. He also worked as Engineering director of National Science Council. Now, he is the Chair Professor and Vice President at Yuan Ze University. Among the awards and honors, he has received IEEE Fellowship and IET Fellowship, Outstanding Research Professor Fellowship from the National Science Council (NSC), Optical Engineering Medal from Optical Engineering Society, and Distinguished Engineering Professor Award from the Chinese Institute of Engineers. He received the ASIA's Education Excellence Awards from Le Meridien Singapore. His current research interests include nano materials and devices, biosensors, and GaN-based electrooptical devices. His research activities have also investigated their associated integration for electrooptical integrated circuits.

Panelist



國立清華大學
NATIONAL TSING HUA UNIVERSITY

Dr. Chi-Chang HU

Chair Professor,
Department of Chemical Engineering,
National Tsing Hua University

Memeber of Task Force (Central Europe), MOST GASE

Chi-Chang Hu received his Bachelor's degree and Ph.D. in Chemical Engineering from National Cheng Kung University in 1991 and 1995, respectively. After his two-year national service, he joined NCCU as Assistant (1997), Associate (2000), and Full Professors (2003). He joined National Tsing Hua University (NTHU) in 2007 and works as University Chair Professor at Chemical Engineering Department, NTHU. He has published about 280 SCI publications with a total number of citations >15,200 and h-index = 66 until June 2020. He has been awarded several international/national prizes/awards (e.g., Thomson Scientific Citation Laureate Award, ISE Tajima Prize, SCEJ Award for Outstanding Asian Researcher and Engineer, and Outstanding Scholar, MOST-Taiwan, etc.). He concurrently serves as an editorial/advisory board member in three SCI journals, Vice Chair in Division 4 of ISE, and member in the ECS Individual Membership Committee. His current research projects include designing/tailoring functional materials for applications in supercapacitors, rechargeable batteries, electrochemical desalination, etc.

Mn Oxide-based Materials for Aqueous Asymmetric Supercapacitors

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Abstract

Manganese oxide-based materials have been under intense investigation as a pseudocapacitor electrode materials. In this work, sodium pre-intercalated MnO_2 (denoted as $Na_{1/3}MnO_2$) was synthesised by a warm-water procedure at a low temperature of 75 °C. The microstructure and surface morphologies of $Na_{1/3}MnO_2$ were analysed by powder X-ray diffraction, scanning electron microscopy, Raman spectroscopy, and electrochemical analysis. Cyclic voltammetry and galvanostatic charge/discharge measurements in a 0.5 M Na_2SO_4 aqueous electrolyte demonstrated that $Na_{1/3}MnO_2$ exhibits superior rate capability, outstanding capacitance retention, and a high total specific capacitance of 190 $F \cdot g^{-1}$ at a current density of 200 $A \cdot g^{-1}$. The excellent rate capability of $Na_{1/3}MnO_2$ is clearly demonstrated by the variation in scan rate of CV from 5 to 1000 $mV \cdot s^{-1}$ with 95% capacitance retention when the mass loading of $Na_{1/3}MnO_2$ was increased from 0.5 to 1.0 $mg \cdot cm^{-2}$. Moreover, by increasing the mass loading of $Na_{1/3}MnO_2$ up to 2.0 $mg \cdot cm^{-2}$, the electroactive material possesses a fairly high specific capacitance of 136 $F \cdot g^{-1}$ and excellent capacitance retention (81%) as the scan rate is varied from 5 to 500 $mV \cdot s^{-1}$. From these results, $Na_{1/3}MnO_2$ (i.e., Mn oxide pre-intercalated with electrolytic cations) may contribute to faster mobility and exchange of cations in the electrolyte. This enables the surface and internal mass of active material to involve the redox transitions in order to provide high pseudocapacitance and outstanding rate capability. An aqueous asymmetric supercapacitor with a cell voltage of 2.4 V is demonstrated using activated carbon as the negative electrode and $Na_{1/3}MnO_2$ composite as the positive electrode. The specific energy and power of this device (based on the total mass of active materials) measured at 20 $A \cdot g^{-1}$ are equal to 22.72 $Wh \cdot kg^{-1}$ and 24.41 $kW \cdot kg^{-1}$, respectively.

We present powders of 2D-ordered manganese dioxide that comprised of randomly distributed manganese oxide layers, size 2′4 nm, and sodium atoms located amongst them, also without forming a regular pattern. The dimensionality of the ordered domain is established by Debye refinement, an unrivalled tool for the task. Due to such an arrangement of the oxide layers, this ionic conductor was found to be genuinely pseudocapacitive, with charge storage not limited by diffusion of ions between stacked layers. Under substantial current rates, up to 200 $A \cdot g^{-1}$, a capacitance greater than 190 $F \cdot g^{-1}$ was maintained. The material was incredibly stable, with no significant capacitance loss (<5%) after 5000 charge-discharge cycles. The synthesised $Na_{0.35}MnO_2$ exhibits fast ion mobility due to the formation of short interlayers (2′4 nm) and significantly capacitance was found to be not limited by the solid-state diffusion. The distinctive material property is its capacitance retention at exceptionally high current rates, thereby opening up a new approach of material design to take full advantage of surface redox sites to store and deliver charge.

Keywords: manganese oxide, in-situ Raman spectroscopy, asymmetric supercapacitor.

Panelist

國立雲林科技大學
National Yunlin University of Science & Technology

Dr. Tzu-Ho WU

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Department of Chemical and Materials Engineering,
National Yunlin University of Science and Technology

Dr. Tzu-Ho Wu is currently the Assistant Professor of the Department of Chemical & Materials Engineering at National Yunlin University of Science and Technology (NYUST), Taiwan. He received his dual PhD degrees from Chemical Engineering, National Tsing Hua University and Chemistry, The University of Liverpool, the UK in 2016 under the guidance of Professor Chi-Chang Hu and Professor Laurence J. Hardwick. He continued his academic research as a postdoctoral fellow in Dr. Nian Liu's group at Chemical & Biomolecular Engineering, Georgia Institute of Technology from 2018 to 2019 before he joined NYUST. His current research interests mainly include nanoscale materials for the applications in rechargeable zinc-ion battery, supercapacitors, and electrocatalysis.

Quantitative Resolution of Complex Stoichiometric Changes in NiOOH/Ni(OH)$_2$ Redox Reactions

Tzu-Ho Wu[†,‡,ǁ], Ivan Scivetti[‡,§], Jia-Cing Chen[†], Jeng-An Wang[†], Gilberto Teobaldi[‡,z,ʃ], Chi-Chang Hu[†], and Laurence J. Hardwick[‡]

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Abstract

Ni(OH)$_2$, one of the promising 2D layered materials, has been widely used for a variety of electrochemical applications. Redox transitions for this material are generally described by the Bode diagram.[1] g-NiOOH/a-Ni(OH)$_2$ redox reaction involves the transfer of more than one electron per Ni atom. Thus, this redox reaction is favourable for energy storage applications. However, the reversibility of the g-NiOOH/a-Ni(OH)$_2$ redox couple is compromised by a gradual conversion of a-Ni(OH)$_2$ to b-Ni(OH)$_2$. Therefore, understanding the atomistic mechanisms of this degradation process is crucial to develop strategies stabilising a-Ni(OH)$_2$. Previously, Electrochemical Quartz Crystal Microbalance (EQCM) has been used to study the phase transition of Ni(OH)$_2$.[2] In principle, quantitative resolution of the stoichiometry of the electroactive sample during electrochemical cycling can be obtained by solving the system of equations for the EQCM mass and charge balance. Unfortunately, the complex g-NiOOH/a-Ni(OH)$_2$ redox reaction involves more than two chemically inequivalent species. As a result, the system of equations is mathematically 'undetermined', having more variables (stoichiometric coefficients) than equations. Here, we present a simple, yet to date unprecedented approach to quantitatively interpret the evolution of a-Ni(OH)$_2$ during the initial stages of electrochemical cycling. DFT-energy based screening of the stoichiometries compatible with the EQCM measurements reveals an unexpected role for intercalated alkali ions in displacing the structural water molecules from the layered host structure, promoting the irreversible collapse of the a-Ni(OH)$_2$ into b-Ni(OH)$_2$. EQCM, in situ Raman and DFT results demonstrate that the degradation of a-Ni(OH)$_2$ is directly related to the size of the intercalated ion, with larger ions displacing a larger amount of water, thus accelerating the a-Ni(OH)$_2$ to b-Ni(OH)$_2$ ageing process.

Keywords: Ni(OH)$_2$, Phase transition, EQCM, in situ Raman, DFT

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Panelist

淡江大學
Tamkang University

Dr. Jong-Dar YAU

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In 1996, Dr. J.D. Yau received his Ph.D. in the field of Civil Engineering from National Taiwan University (NTU) for vibration problems of vehicle-bridge interaction of high speed rails. He joined the faculty at TamKang University (TKU, 1999) where he has served as Assistant Professor (1999-2003), Associate Professor (2003-09), and Chair (2004-2007) in the Department of Architecture and Building Technology. In 2010, Dr. Yau became a Professor of the Department of Architecture in TKU. Since 2013, Dr. Yau was a Jointly Appointed Professor of the Department of Architecture and Department of Civil Engineering in TKU. Dr. Yau has published over 60 referred journal papers and articles. His major research area is centered on moving load problems, vibrations of high speed rails, maglev dynamics, and nonlinear analysis of framed structures.

Theoretical Predictive Models of Interaction Between Varying and Moving Loads and Bridges for Structural Health Monitoring

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Abstract

The joint research project between the National Taiwan University (NTU) group of Taiwan and the Institute of Theoretical and Applied Mechanics (ITAM) group of Czech is focused on the theoretical development and experimental verifications for structural health monitoring (SHM) of bridge structures using an innovative contact-point method by a moving instrumented vehicle. The solution to the problem will combine the experimental research on the real structures and the models carried out in the laboratory. All applied loads will be determined based on operational load, i.e. for bridge structures it is under normal road or railway operation and wind load. The present experience has proven that the load with exciter is not economic and such methods require stopping of traffic. The three-year project is given in two parallel and interrelated parts for the convenience of division of research work. Emphasis is placed on the cooperation of the two groups to develop theories and experimental verifications that integrate the advantages of each side and implement such theories and predicted results for practical applications. For the division of research works, the following joint research project is carried out in two parallel and interrelated parts: (1) Fundamental theory of contactpoint measurements for bridge frequencies; (2) Experimental verifications of contactpoint methods for bridge frequencies; (3) On-site measurement of cable supported bridge in Czech. Due to the spreading of Covid-19 in 2020, the 3rd part to carry out onsite measurement with ITAM colleagues was suspended.

Keywords: Bridge structure, Contact-point measurement, Frequency, Structural health monitoring, Vibration,

Panelist

國立臺灣大學
National Taiwan University

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Shiu-Wu Chau is a Professor at the Department of Engineering Science and Ocean Engineering, National Taiwan University. He received Bachelor and Master degrees from National Taiwan University, and a degree of Dr.-Ing. from Universität Hamburg. His main research interests are computational fluid dynamics and heat transfer with the development and application of high-performance computation tools for advanced scientific and industrial applications in the fields of thermal plasma, non-thermal plasma, ship hydrodynamics, wind energy technology and polymer processing.

Experimental Investigation and Numerical Modeling of Tetrafluoromethane Abatement via Thermal Steam Plasma

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Abstract

Perfluorinated compounds (PFCs) increasingly utilized in electronic manufacturing represent a potent source of the global warming effect. Because of the extremely high stability of PFCs only very high temperature is effective for their destruction. Thermal plasma offers higher destruction and removal efficiency as compared to conventional methods allowing to reach a sufficiently high temperature as well as suitable conditions, including high enthalpy and reactive environment for destruction even of the most persistent PFCs. The aim pursued by this work is to apply water and gas stabilized DC-plasma torch for generating steam plasma for efficient abatement of the most persistent PFC, i.e., CF_4, and to observe a dependence of destruction and removal efficiency on operational conditions, including the concentration of CF_4, input arc power of the plasma torch and influence of additional gas. The experiments were carried out at 20 kW and 40 kW of torch power in the concentration range 1–20% of CF_4 in mixture with both nitrogen and argon and total feed rate 50 L/min in plasma chemical reactor. The mixture with argon exhibits considerably higher destruction efficiency than that with nitrogen. The highest destruction efficiency was attained in the mixture CF_4/argon at 40 kW of torch power. Among other gases (CO_2, O_2, H_2) added to CF_4 the only hydrogen exhibited a positive effect on destruction performance. It was found an optimal feed rate of additional hydrogen corresponding to the maximum of destruction efficiency. Numerical simulations based on magnetohydrodynamics and reaction kinetics are also applied to explore the species distribution in the reaction chamber as well as to give an insight into the abatement process. Good agreement between experimental measurements and numerical modeling justifies the adopted theoretical approach.

Keywords:Tetrafluoromethane, Abatement, Thermal Steam Plasma, Experiment, Modeling.

Panelist

長庚大學
CHANG GUNG UNIVERSITY

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Chang Gung University

Professor Shingjiang Jessie LUE is a Professor of the Department of Chemical and Materials Engineer and Group Leader of Green Technology Research Center at Chang Gung University (CGU), Taiwan. Prof. Lue obtained a B.S. and M.S. degrees from National Taiwan University, and a Ph.D. degree in Biotechnology Engineering from the University of Missouri-Columbia, USA, in 1990. She joined Chang Gung University in 1996 and was promoted to a Full Professor in 2007. She was the Chair of the Department of Chemical and Materials Engineering at CGU during 2014-2016. Her research interest focuses on the development of high-performance materials for separation, energy, and biotechnology applications. Professor Lue has published more than 110 SCI papers and 2 book chapters, given 140 conference presentations, and applied 3 patents.

Designing New Renewable Nano-structured Electrode and Membrane Materials for Direct Alkaline Ethanol Fuel Cell

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Abstract

In this work, a series of novel nitrogen doped graphene oxide derivatives (N-GO) were successfully synthesized and blended with chitosan polymer in order to produce anion exchange membrane (AEM) composites. To investigate their applicability in direct ethanol fuel cells, the membranes were characterized in terms of their structural properties, chemical and alkaline stability and ionic properties. Chitosan-$Mg(OH)_2$ based AEMs with 0.01 wt.% melamine-functionalized GO filler have achieved a maximum power density of 149 ± 2.2 mW cm^{-2} at 80 °C, which is significantly higher than that of the benchmark commercial FAA Fumapem® and polybenzimidazole with values of 11 and 60 mW cm^{-2}, respectively. This is the highest reported power density value for chitosan based membranes. Obtained results demonstrate that the obtained membranes are promising AEM candidates for direct alkaline alcohol fuel cell applications.

Keywords: Graphene oxide nanocomposites, Cross-linked chitosan membranes, Alkaline fuel cells, Direct ethanol fuel cells, Cell performance.

Panelist

國立中央大學
National Central University

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Department of Chemical and Materials Engineering,
National Central University

Yu-Wen Chen received his BS degree from National Central University in 1975, MS and PhD degree in chemical engineering, University of Pittsburgh, USA, in 1980 and 1982, respectively. He worked at SRI International in 1982-1983. Since 1983, he has worked at National Central University, Taiwan. His major research is nano-material and catalysis. He has served as the expert witness in several lawsuits of fire incidents in semiconductor fab. He is the Fellow of AIChE, RSC, and IET, and was the President of the Taiwan Institute of Chemical Engineers. He has published 285 papers and filed 75 patents.

Heterogeneous CaO/SBA-15 Catalysts for Biodiesel Production from Jatropha Seed Oil

Jai-Ying Wu,[1] Yu-Wen Chen[1*] and N.R. Sasirekha[2*]

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Abstract

Biodiesel has attracted much attention due to the energy crisis and CO_2 issue. Using an efficient processing technology to prepare biodiesel from Jatropha seed oil is a competitive way to produce biodiesel. The biodiesel was obtained by trans-esterification reaction using a solid base catalyst in this study. Since the side reactions occur when water and free fatty acids (FFA) exist, a pretreatment is needed. The pre-esterification was used to reduce the amount of FFA. The optimum pre-esterification reaction conditions were 70°C, 12 wt.% methanol, 1 wt.% sulfuric acid, and 2 h reaction time. CaO is used for transesterification. However, it will leach out in the presence of methanol. SBA-15 was synthesized and various MgO and CaO contents were added by incipient-wetness impregnation method. These samples were characterized by small-angle X-ray diffraction, BET method. The transesterification reaction of oil was carried out in a batch reactor. Both MgO/ and CaO/SBA-15 were successfully synthesized, as evidenced by small-angle X-ray diffraction patterns. The surface area of MgO- and CaO-SBA-15 decreased with increasing MgO and CaO-content. Since some MgO and CaO aggregates were present, the surface area decreased upon increasing MgO and CaO contents. Reaction conversion results show that SBA-15 did not have any activity. MgO/SBA-15 also had low activity. CaO-SBA-15 was active and its activity increased with an increase of CaO content. It is well known that CaO has much stronger basicity than MgO. Therefore its activity was much higher than MgO/SBA-15. CaO/SBA-15 can suppress the leaching of CaO, and maintain high activity.

Keywords: Basicity, Solid base, Transesterification, CaO, MgO, SBA-15.

Panelist

大同大學
Tatung University

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Dr. Hong-Ming Lin is a Professor in the Department of Materials Engineering of the Tatung University. Dr. Lin received his MS in Chemistry at the University of Georgia at Athens, Georgia and PhD in Materials Science at the University of Wisconsin-Madison. He served as Chairman of the Department and the Dean of the Research and Development Office of Tatung University during August 1995 to July 2001 and Oct. 2006 to July 2009, respectively. Dr. Lin also served as a member of the director board of China Picture Tubes Co., Ltd. between 2000 and 2010. He has more than 400 publications in international journals, edited volumes, conference proceedings and patents. He has been invited to talk and chair at many international conferences. He has co-authored of 178 scientific papers published in international journals with H-index > 32 and >3579 citations.

Direct Formic Acid Fuel Cell Based Power Supply for Portable Electric Devices (Project Number MOST 108-2923-E-036 -002 -MY3)

Hong-Ming Lin[1*], Yuh-Jing Chiou[2], Andrzej Borodzinski[3], Piotr Kedzierzawski[3]

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Abstract

Fuel cells operating on liquid fuels for small and medium scale applications have prospects of commercialisation because of ease of fuel handling and distribution. The newest of low temperature liquid fuel cells: DFAFC, appear among the most promising in this respect. Palladium catalysts are very active in the oxidation of high purity formic acid, which is very expensive. In low purity formic acid, the Pd catalysts become poisoned by CO originating from oxidation of impurities. While some of the catalysts prepared during previous projects by promoting commercial Pd/C catalyst are poisoning-resistant in the long term, their activity is still too low. This problem will be solved by the refinement of our highly active anodic Pd/MWCNTs catalyst. This Pd catalysts will be promoted with Ru, Pt, Ir, B, Ni_2P promoters to increase their activity and stability. This will allow to operate the DFAFC with inexpensive formic acid of lower purity. Because of sluggish oxygen reduction on the cathode of PEM fuel cells, considerable amounts of precious metal (usually Pt) have to be used. In the case of DFAFC, there is also cathode performance degradation caused by fuel crossover. Recently, we have developed a fuel crossover resistant Pd/C catalyst. Further progress may be achieved by promoting it with Pt, either by alloying or by surface decoration. Optimization of the Pt:Pd ratio should allow to combine high activity of Pt with crossover resistance of Pd and allow to reduce the cost of precious metals on the cathode. Comprehensive physicochemical characterization of the anodic and cathodic catalysts will be performed to correlate their activity and stability with composition and morphology. The kinetic studies of formic acid electrooxidation on selected catalysts will be performed. Formic acid being an aggressive medium poses serious corrosion problems to the materials used for the construction of fuel cells. The stack will be tested for initial voltage-current characteristic, long term stability and fuel efficiency. The optimum working conditions of the stack will be established. The realistic investment and operating costs of the stack will be estimated for preparation of business plan for future investors.

Keywords: DFAFCs, Pd based catalyst, carbon nanotube, Cell Stack, power supply

Session III

Panel B: Earth and Environmental Science

Moderator

- **Dr. You-Hua CHU**

Distinguished Research Fellow, Institute of Astronomy and Astrophysics, Academia Sinica

Panelists

- **Dr. Lung-Chih TSAI** (Taiwan-Germany)

Professor, Center for Space and Remote Sensing Research &
Director, GPS Science and Application Research Center,
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- **Dr. Chao-Hung LIN** (Taiwan-The Philippines)

Professor, Department of Geomatics, National Cheng Kung University

- **Dr. Hong-Chun LI** (Taiwan-Russia)

Professor, Department of Geosciences, National Taiwan University

- **Dr. Loren CHANG** (Taiwan-Russia)

Professor, Department of Space Science & Engineering,
National Central University

Moderator

中央研究院
ACADEMIA SINICA

Dr. You-Hua CHU

**Distinguished Research Fellow,
Institute of Astronomy and Astrophysics,
Academia Sinica**

You-Hua Chu graduated from NTU Physics in 1975 and obtained her Ph.D. in Astronomy from UC Berkeley in 1981. She was a postdoc at the University of Wisconsin-Madison and a Lindheimer Fellow at Northwestern University. She went to the University of Illinois at Urbana-Champaign in 1985, and became Professor in 1997 and served as the Chair of the Astronomy Department in 2005-2011. She returned to Taiwan to work at Academia Sinica Institute of Astronomy and Astrophysics as Director (2014-2020) and Distinguished Research Fellow (2014-present). She was the President of the Astronomical Society of the Republic of China (2014-2020). Her main research fields include Interstellar and circumstellar medium, star formation and feedback, Magellanic Clouds, dust disks around white dwarfs. She is a member of the American Astronomical Society (AAS) and International Astronomical Union (IAU), and was President of Division VI (Interstellar Matter) of IAU in 2009-2012. She has served on numerous review and award committees for NASA, NSF, AAS, and AURA. She received the Outstanding Alumni Award from NTU Physics in 2016. She has published about 250 refereed journal papers and over 100 conference proceeding papers.

Panelist

國立中央大學
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Lung Chi Tsai is the Director of the GPS Science and Application Research Center, National Central University, Taiwan. His research focuses on the study of the ionosphere and upper atmosphere: theory and instrument of ionospheric sounders, data processing and analysis to GPS receiver and radio occultation system, satellite beacon receiver, and JASON.

Software-based GPS Receiver Development and Its Applications on Ionospheric Scintillation and Ocean Wave Observations

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Abstract

A software-based GPS receiver and a receiving network are proposed to be developed and built to monitor the ionospheric irregularity and the sea state over/around the Taiwan area. In this study we have designed and implemented an appropriate software receiving system in order to receive and perform data acquisition on GPS L1-band Coarse/Acquisition code signals. Each receiving system is capable of receiving the L1-band GPS signals from more or less six satellites simultaneously. The software-based signal processor could execute data acquisition and tracking algorithms to identify different GPS signal amplitudes and satellite Doppler and receiver frequency offsets, which can be used to observe ionospheric amplitude and phase scintillations separately. The software-based GPS receiving network in Taiwan will include four receivers and could provide about twenty-four ionospheric pierce point observations on ionospheric scintillation. It is shown that a software-based GPS receiving network will enable us to study the dynamics and characteristics of ionospheric irregularities continuously under various solar and geophysical conditions and for space weather research. In addition, we also utilize the software-based GPS receiver equipped with a left-handed circular polarization antenna to be a GPS reflectometer (GPS-R). The GPS-R system can observe special kind of GNSS multi-path delay reflected from the Earth's surface and could be used to remotely sense the Earth's surface environments such as ocean altimetry and sea state.

Keywords: software-based GPS receiver, ionospheric scintillation, GPS reflectometer

Panelist

國立成功大學
National Cheng Kung University

Dr. Chao-Hung LIN

Professor,
Department of Geomatics,
National Cheng Kung University

- Professor, Department of Geomatics, National Cheng-Kung University 2014~present.
- Chairman, Department of Geomatics, National Cheng-Kung University 2017~2020.
- Chair, ISPRS Technical Commission V8
(Promotion of Open Source on Geospatial Technology), 2016~2021.

WaterNet: A Convolutional Neural Network for Chlorophyll-a Concentration Retrieval

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[3] *Institute of Geography, Vietnam Academy of Science and Technology, Vietnam*
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Abstract

The retrieval of chlorophyll-a (chl-a) concentrations relies on empirical or analytical analyses, which generally experience difficulties from the diversity of inland waters in statistical analyses and the complexity of radiative transfer equations in analytical analyses, respectively. Recent studies proposed the utilization of artificial neural networks (ANNs) to alleviate these problems. However, ANNs do not consider the problem of insufficient in situ samples during model training, and they do not fully utilize the spatial and spectral information of remote sensing images in neural networks. In this study, a two-stage training is introduced to address the problem regarding sample insufficiency. The neural network is pretrained using the samples derived from an existing chl-a concentration model in the first stage, and the pretrained model is refined with in situ samples in the second stage. A novel convolutional neural network for chl-a concentration retrieval called WaterNet is proposed which utilizes both spectral and spatial information of remote sensing images. In addition, an end-to-end structure that integrates band expansion, feature extraction, and chl-a estimation into the neural network leads to an efficient and effective chl-a concentration retrieval. In experiments, Sentinel-3 images with the same acquisition days of in situ measurements over Laguna Lake in the Philippines were used to train and evaluate WaterNet. The quantitative analyses show that the two-stage training is more likely than the one-stage training to reach the global optimum in the optimization, and WaterNet with two-stage training outperforms, in terms of estimation accuracy, related ANN-based and band-combination-based chl-a concentration models.

Keywords: chlorophyll-a concentration estimation, convolutional neural network, Sentinel-3 imagery

Panelist

國立臺灣大學
National Taiwan University

Dr. Hong-Chun LI

Professor,
Department of Geosciences,
National Taiwan University

I got my PhD degree in geochemistry at the University of Southern California (USC) in 1995. After 3 year research faculty position at USC, I got a professor position at National Cheng-Kung University in Taiwan in 2006. Since 2010, I have been a full professor in the Department of Geosciences at National Taiwan University (NTU). I am in charge of the NTUAMS Lab (http://www.ntuams.com/index.asp). I am specialized in geochronological dating (14C, 230Th/234U/238U), stable isotope and elemental geochemistry. My major research projects involve the reconstruction of paleoclimate and paleoenvironmental changes using speleothem records, lake and marine sediment cores, peat profiles, tree rings and corals. The paleoclimate records obtained have contributed to our understanding of forcing factors such as solar activity, PDO, ENSO, Subtropical High, and Siberian High on monsoonal and westerly climates. Recently, I have also used AMS 14C dating for archaeological and oceanographic studies.

Paleoclimate Change in Russian Altai During the Past 60Ka: Evidence from Cave Records and Lake Sediments

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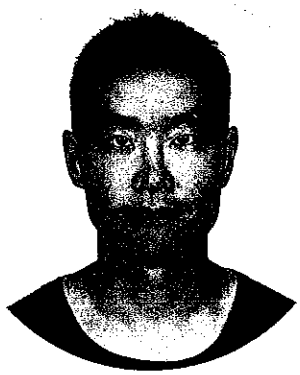
Abstract

This presentation summarizes the study results of a 3-yr Taiwan-Russia collaborated research project: "Study of vegetation dynamics and climatic changes in Altai-Sayan region since Late Glacial by method of complex palaeoecological and isotopic research" during 2017-2020. As Siberian region is one of the key areas for global climate change concerning permafrost melting due to the current warming, it is necessary to understand paleoclimate in the past and forcing factors in this area. Russian Altai is the southwestern part of Siberia, with a typical continental climate under influence of Westerly, polar easterly, polar front and Siberian High. During the past four years, we have reconstructed paleoclimate history of the Altai region with lake sediment records and cave stalagmite records over the past 60 ka. Using detailed palaeopollen and diatom data, and high-resolution geochemical record from Manzherok Lake in a forest–steppe zone on the western piedmonts of Altai Mountain, we built up detailed lake history and local climatic changes over 1,500 years. Two stalagmite records from Nadezhda Cave (H1) and Lunnaya Cave (L2) in north Altai Mountain provide high-resolution climatic records during the past 14 Ka. One stalagmites (K5 and K6) from Kyok-Tash Cave in south Altai Mountain show a climatic record during 33~60 Ka. The K6 record compares with the original GISP2 ice core record, but not well with the age-adjusted ice core records using Hulu Cave record. The climatic variations in Altai shown by the K6 record show some differences from the monsoonal climates shown by the Hulu record, mainly attributed to the influence of Siberian High on Westerly, Polar front and summer monsoon. The climatic conditions were cold and dry during stadials (e.g., H4 and H5), and warm and wet during interstadials (e.g., D-O events). During the Last Glacier Maximum (LGM) climatic record was absent due to lack of deposits. Since LGM, climates in the Altai region have resumed. The conditions were relatively cold but not very dry. The Holocene Optimum showed between 10.5 Ka and 7.5 Ka with warm and wet conditions. The climate started to cool down and dry at the beginning of 7.5 Ka. This arid condition lasted until 5.5 Ka, which is quite different from the monsoonal climate. The climatic conditions were relatively warm and wet during 5~3 Ka, 1.8~1.4 Ka and the Medieval Warm Period (900~1100 CE), but cold and dry during 3~1.8 Ka and the Little Ice Age (1300~1850 CE). These warm periods during Holocene were warmer than the present condition. Whether the permafrost land in northern Siberia was gone is unknown. Change in the total solar irradiance (TSI) is an important factor to influence the climate in the Altai Mountains. With decreased TSI, the Siberian High became strong, which led to the Westerly and the polar front being pushed away from this region, resulting in arid climates. The situation was reversed vice versa.

Keywords: Paleoclimate, stable isotopes, Lake sediment, Stalagmite, Siberia, Russia

Panelist



國立中央大學
National Central University

Dr. Loren CHANG

Professor,
Department of Space Science & Engineering,
National Central University

Dr. Loren Chang is a Professor at the Department of Space Science and Engineering at National Central University (NCU) in Taiwan. Dr. Chang conducts research on the Earth's upper atmosphere and its role in space weather, analysis of satellite data from the COSMIC/FORMOSAT-3 and TIMED missions, and serves as the Taiwan lead for the International Satellite Program in Research and Education (INSPIRE) consortium. Dr. Chang is currently leading the development of the IDEASSat (Ionosphere Dynamics Explorer and Attitude Subsystem Satellite)/INSPIRESat-2 spacecraft, as well as the SCION-X (SCintillation and IONosphere Research eXtended) mission. Dr. Chang is working to establish spacecraft design and operations capability, as well as an academic program focused on astronautics at NCU. Prior to joining NCU, Dr. Chang served as a postdoc at National Cheng Kung University and Boston College. Dr. Chang received his PhD in Aerospace Engineering Sciences from the University of Colorado at Boulder in 2010, specializing in mesosphere and lower thermospheric dynamics.

Developing Spaceflight and Space Weather Capacity in the Era of New Space

Loren C. Chang

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Abstract

Over the past decade, reduced launch costs and the growing maturity of small satellite platforms has greatly increased access to space for scientific, commercial, and government purposes. Beyond currently existing Global Navigation Satellite Systems (GNSS), the proliferation of space technology in everyday life is expected to continue to grow with the introduction of Low Earth Orbit (LEO) communications satellites constellations as part of Beyond 5G (B5G) networks. The research and development work being performed under the Columbus Grant to Professor Loren Chang addresses the growing needs for spaceflight capacity development in Taiwan, through the development of the IDEASSat (Ionospheric Dynamics and Attitude Subsystem Satellite) and SCION-X (Scintillation and Ionosphere Extended) small satellites to execute ionospheric and atmospheric science missions, as well as associated ground systems and personnel training. Research is also being performed on applications of satellite and ground-based data to understanding and predicting ionospheric space weather effects, which can cause scintillation and fading in satellite communications and navigation signals. The objective is to deliver a space weather data product to B5G operators that can be applied to mitigate the effect of communications outages due to ionospheric effects. Tracking data from LEO satellites will also be utilized to understand the effects of drag from thermospheric neutral density, which are expected to increase with solar activity.

Keywords: spaceflight, small satellite, space weather, ionosphere, thermosphere, B5G, scintillation, drag, orbit perturbation.

Session IV

Panel A: Nanotechnology & Materials Science

Moderator

- **Dr. Ta-Jen YEN**

Professor, Department of Materials Science and Engineering &
Vice President for Global Affairs, National Tsing Hua University

Panelists

- **Dr. Kung-Hwa WEI** (Taiwan-USA)

Chair Professor, Department of Materials Science and Engineering &
Dean, College of Engineering, National Chiao Tung University

- **Dr. Show-An CHEN** (Taiwan-Russia)

Honorary Chair Professor, Department of Chemical Engineering,
National Tsing Hua University

- **Dr. Ying-Hao CHU** (Taiwan-Germany)

Distinguished Professor, Department of Materials Science and Engineering,
National Chiao Tung University

- **Dr. Yu-Lun CHUEH** (Taiwan-Korea)

Professor, Department of Materials Science and Engineering,
National Tsing Hua University

- **Dr. Tien-Lung CHIU** (Taiwan-USA)

Professor, Department of Electrical Engineering,Yuan Ze University

- **Dr. Jwo-Huei JOU** (Taiwan-Lithuania)

Professor, Department of Materials Science and Engineering,
National Tsing Hua University

- **Dr. Kuo-Ping CHEN** (Taiwan-USA)

Associate Professor, Institute of Imaging and Biomedical Photonics,
National Chiao Tung University

Moderator

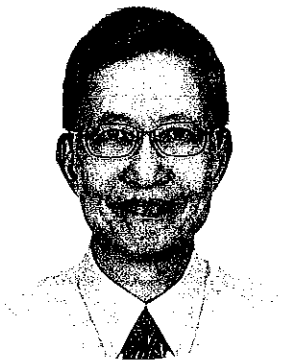
國立清華大學
NATIONAL TSING HUA UNIVERSITY

Dr. Ta-Jen YEN

Professor,
Department of Materials Science and Engineering &
Vice President for Global Affairs,
National Tsing Hua University

Professor Ta-Jen Yen received his M.S. degree from National Taiwan University in 1995. After working for ASUSTeK Computer Inc. for 2 years, Professor Yen returned to school in 2000 and obtained his Doctoral degree from UCLA in 2005. In the past decade, Prof. Yen served as a Director at the Division of Student Activities, a Director at the Division of Intellectual Property and Technology Licensing, and a Chair of the Department of MSE. Currently, Prof. Ta-Jen Yen is the Vice President at National Tsing Hua University (for global affairs), a Director at Material Research Society and an Executive Director at TISA in Taiwan. Professor Ta-Jen Yen is the winner of the 1st and 2nd Outstanding Young Researcher Scholarship in 2006 and 2007, sponsored by NDL and UMC respectively, the Outstanding Young Researcher Award of NTHU (2009), Excellent Teaching Award of NTHU (2009), and Excellent Teaching Award of Engineering College at NTHU (2012). He also received Ta-You Wu Memorial Award (2012), the Excellent Service Award of MRS-Taiwan (2017), the and 17th Far Eastern Y. Z. Hsu Science and Technology Paper Award (2019) in Taiwan.

Panelist



國立交通大學
National Chiao Tung University

Dr. Kung-Hwa WEI

Chair Professor,
Department of Materials Science and Engineering &
Dean of College of Engineering,
National Chiao Tung University

Dr. Wei has been involved in the field of polymers for more than 30 years — focusing on the development of conjugated polymers. Previously, he worked in the Air Force Research Laboratory and General Electric company in the US. Professor Wei has been taking advantage of the facile molecular-structure of organic materials — with one- and two-dimensional architectures — and tunable optoelectronic properties of nano inorganic materials to fabricate nanocomposites that can be tailored for organic photovoltaics, organic light-emitting diode, transparent and flexible electrodes and organic memory devices. He recently also developed two-dimensional composite materials with plasma processes for hydrogen evolution reactions. Dr. Wei has published more than 220 peer-reviewed papers and received over 15,500citations and has an H-index of 63 along with 10 highly cited papers in Science, Nature Nanotechnology and Advanced Materials, etc. He also holds 19 patents, and he has been awarded MOST Outstanding Research Awards (2003, 2010 and 2014), Lu Tze Hung Memorial Award (2019), Ho Chin Tui Award—Materials Science (2014), Y. Z. Hsu Science Award-Green Technology (2017) and Outstanding Research Award, Polymer Society, Taiwan (2010). He is a Fellow of the Materials Research Society of Taiwan (2011) and Fellow of Asia-Pacific Academy of Materials (2017) and Fellow of the International Association of Advanced Materials (2019).

High-performance Organic Photovoltaic with Fluorinated Conjugated Polymers and Potassium-treated Zinc Oxide Electron Transport Layer

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Abstract

In this report, we selected four bulk heterojunction active layer blends that incorporated fluorinated or nonfluorinated materials for investigating the role of the fluorine in the nano-structural morphology and the energy level alignment, and then envisaging a selection rule to deliver high-performance organic photovoltaics (OPVs). We found that when both donor and acceptor are fluorinated, or both are not fluorinated, high-performance OPVs can be realized, owing to the optimized morphology and sufficient driving force for charge separation. PCEs as high as 14.8% and 15.9% were achieved for the fluorinated PBDB-T-F/Y1-4F and PBDB-T-F/Y6 blends, respectively. Moreover, we propose a new interface modification approach—treating the surface of the zinc oxide (ZnO) electron transport layer with potassium hydroxide—for inducing vertical phase separation of an active layer incorporating the nonfullerene acceptor IT-4F. Density functional theory calculations suggested that the binding energy difference between IT-4F and the PBDB-T-2Cl, to the potassium (K)-presenting ZnO interface, is twice as large as that for IT-4F and PBDB-T-2Cl to the untreated ZnO surface, such that it would induce more IT-4F diffuses toward the K-presenting ZnO interface than the untreated ZnO interface thermodynamically, providing better charge extraction because of the field gradient. Benefiting from the induced morphology that provides efficient charge extraction, the best PCEs increased to 12.8% from 11.8% for PBDB-T-2Cl:IT-4F-based devices, to 12.6% from 11.6% for PBDB-T-2Cl:Y1-4F-based devices, to 13.5% from 12.2% for PBDB-T-2Cl:Y6-based devices, and to 15.7% from 15.1% for PM6:Y6-based devices.

Keywords: organic photovoltaics, fluorinated polymers, morphology, treated ZnO layer

Panelist

國立清華大學
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Dr. Show-An CHEN

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National Tsing Hua University

Prof. Show-An Chen received BS degree from National Cheng-Kung University, Chemistry Engineering Department in 1962 and PhD degree in Chemistry Engineering from Washington University in 1969. He has engaged in polymer science research for 50 years. He focuses on research in semiconductive polymers in recent 37 years. Currently, he is the Lifetime National Chair Professor in the Chemical Engineering Department, National Tsing Hua University (NTHU). Professor Chen has published 333 research articles with H-index 63 and citation number more than 14,000, and has been granted 41 patents (in Taiwan, US, Japan, Germany). The selective honors that he has been granted are Member of Asian-Pacific Academy of Advanced Materials (1998), Science and Technology Award by Executive Yuan of ROC (2003), Life-time National Chair (since 2005), Chairman of the Polymer Society (Taipei) 2002-2004 and 2010-2012, Chairman of IUPAC Macro Congress on 2008, Doctor Honoris Causa of Russian Academy of Sciences 2016, and Member of EU Academy of Sciences (since 2018).

Conjugated Polymer/Nanoparticle Hybrid Systems for Opto-electronic Interconversion: Experiment, Theory and Computer Simulation

Shuo-En Wu[a], Dang-Trung Nguyen[a], Sunil Sharma[a], Yi-Lun Li[a], Hsin-Lung Chen[a], Show-An Chen[a]*, Pavel V. Komarov[b], Viktor A. Ivanov[c], and Alexei R. Khokhlov[d]*

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[b] *Laboratory of Physical Chemistry of Polymers, A.N. Nesmeyanov Institute of Organoelement Compounds RAS, Moscow 119991, Russia; General Physics Department, Tver State University, Tver 170002, Russia*
[c] *Faculty of Physics, Moscow State University, Moscow 119991, Russia; Institut für Physik, Martin-Luther-Universität, Halle 06120, Germany*
[d] *Laboratory of Physical Chemistry of Polymers, A.N. Nesmeyanov Institute of Organoelement Compounds RAS, Moscow 119991, Russia; Faculty of Physics, Moscow State University, Moscow 119991, Russia*
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Abstract

This joint project is undertaken to integrate the advantages of organic conjugated polymer (CP) and quantum dot (QD) for light-emitting diode (LED) and photovoltaic (PV) applications. For the LED part, the key problems of deep HOMO level in QD and shallow HOMO level of CP are solved in the system of core-shell QD, CdSe/ZnS, as emitter with CP as a hole transport layer. A novel graded 4-stepwise HOMO levels hole transport polymer (g-HTP) is proposed for the first time with spiro-polyfluorene (sPF) as the main chain and the three hole-transporting moieties as side chains for effective hole injection across the large barrier 1.4 eV into the green emission core-shell quantum dot (QD), CdSe/ZnS, in the inverted QLED (i-QLED). The LED device performance is η_{max} 36.1 cd/A and B_{max} 208,600 cd/m^2, which is the highest performance among the reported i-QLED with single HTL ever documented. For PV part, the key problem in the hybrid solar cell system is to establish bi-continuous network morphology in the active layer composed of CP and QD. Here two blend systems are studied: poly(3hexylthiophene) (P3HT)/ PbS QD and P3HT-b-polystyrene (PS) for the reason of low material cost and simple fabrication process. Theoretical computations by the Russia team using coarse-grained simulations and multiscale modeling for such systems show that at low weight ratio of P3HT or P3HT-Pb-PS to QD (1:20 for example), both systems give such morphology, especially for the latter system. The Taiwan team performs the experimental works to confirm the calculation result. For further improving the morphology of P3HT/PbS QD system, adding 1 volume % of the high boiling additive anisaldehyde (AA) gives further rise in PCE from 4.14% to 4.94%. For the system of P3HT-b-PS/PbS QD, introducing polystyrene block leads to an improvement in QD dispersion and formation of very clear bicontinuous network morphology for the first time for the hybrid system since PS block is more compatible with oleic acid (OA) capped QD. Further efforts along this direction by replacing PS block with photo-active conjugated polymer block compatible with ligand capped QD could lead to higher performance.

Keywords: Conjugated polymer, nanoparticle, light emitting diode, photovoltaics

Panelist

國立交通大學
National Chiao Tung University

Dr. Ying-Hao CHU

Distinguished Professor,
Department of Materials Science and Engineering,
National Chiao Tung University

Professor Chu received his PhD from the Department of Materials Science and Engineering at National Tsing-Hua University in 2004. In 2008, he acquired an assistant professorship in the Department of Materials Science and Engineering at National Chiao Tung University. He was promoted to an Associate Professor in 2015, and then he was promoted to a Professor in 2018. From 2019, he was appointed as a Distinguished Professor and he has an appointment with ACS Applied Electronic Materials to be an Associate Editor. His research is highly focused on complex functional oxides and strongly correlated electron systems. He has extensive experience in the use of advanced characterization techniques to understand and manipulate functional oxide heterostructures, nanostructures, and interfaces. His current goal is to create a pathway to use high quality oxide heteroepitaxy for soft transparent technology. Now, he is a pioneer with the most publication in this research direction. He has published >300 papers (Web of Science: >18000 citations, h-index=64; Google Scholar: >24000 citations, h-index=73) in academic journals.

Tailoring of All Oxide Heterostructures by Ion Beams

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Abstract

Inter-relations among charge, spin, orbital and lattice parameters are largely demonstrated in multi-functional oxide materials which exhibit a variety of exotic properties, ranging from superconductivity, insulator-metal transition, colossal magnetoresistance, charge ordering, and orbital ordering, etc. In particular, tilting a delicate energy balance in lattice interactions and kinetics, achieved by temperature, pressure or chemical control, may result in exotic phenomena in these systems. However, fine-tailoring such interactions have proven difficult. In this research program, defect engineering by ion irradiation, which can introduce strain and electronic disorder, has emerged as a powerful technique to fine tune inaccessible complex phases of oxide thin films. In this talk, we will show you several examples, including $SrRuO_3$, rare-earth nickelates, and $NiCo_2O_4$, aiming at the modulation of the magnetic, electrical and ferroic properties by ion irradiation. The final goal is to exam such tuned heterostructures as a venue of novel spintronics devices. The National Chiao Tung University group is well versed in the fabrication of epitaxial oxide thin films. The group at HZDR has the possibility of irradiating these films with ions of different specimens and energies on demand. The detailed structural, magnetic and electric characterization were performed using the techniques at HZDR. The group at TU Chemnitz used spin-polarized electronic structure calculations with density functional theory (DFT) in understanding the changes. Therefore, the combination of scientists from these groups can establish a new pathway of 3D tailoring of oxide heterostructures useful for designing new functionalities.

Keywords: oxide heteroepitaxy, magneto-transport, ion beam, DFT

Panelist

國立清華大學
NATIONAL TSING HUA UNIVERSITY

Dr. Yu-Lun CHUEH

Professor,
Department of Materials Science and Engineering,
National Tsing Hua University

Prof. Yu-Lun Chueh received his Ph.D degree from the Department of Materials Science and Engineering, National Tsing Hua University, Taiwan in 2006 and worked as Post-doctor in Electrical Engineering and Computer Science, UC Berkeley from 2007-2009. He joined Department of Materials Science and Engineering, National Tsing Hua University in 2009. Currently, he is a Professor in the Department of Materials Science and Engineering, National Tsing Hua University, Taiwan. He has published 285 peer-reviewed papers and 25 patents with total citations >13000 and h-index of 54. The research activities of his lab are highly interdisciplinary and are committed to exploring new unpredicted levels of functional materials to enable new schemes on manipulating and processing of engineering nanomaterials in nanoelectronics and energy harvesting applications. He is currently committed to realizing intellectual visions through studies on five major areas toward New Material Technologies: (1) Cu(In,Ga)Se2 solar cell (2) Low dimensional materials (3) Low power resistive random access memory (4) Two-dimensional Materials (5) Batteries and Energy Storage materials

Two-Dimensional Layered Materials Toward Phase-Engineered Hybrid Films for Innovative Nanoelectronics

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Abstract

2D materials have attracted much attention because of frontier electronic materials due to its superior electronic transport properties and mechanical flexibility in the future, making it a potential material for high performance and wearable electronics. Graphene is a typical 2D material with high carrier mobility; however, it still cannot be applied in a transistor due to the lack of bandgap. A new type of 2D semiconducting materials called transition metal dichalcogenides (TMDCs), which are layered structure with the strong in-plane bonding and weak out-of-plane interactions similar to graphite, have been intensively studied. Recent studies have predicted exceptional physical properties upon reduced dimensionality attracting lots of attention due to the versatile physical chemical behaviors. Nevertheless, the synthesis and the study of the fundamental physical properties of TMDs are still in the early stages. The lack of a large-area and reliable synthesis method restrict exploring all the potential applications of the TMDs. Chemical vapor deposition (CVD) is a traditional approach for the growth of TMDs; nevertheless, the high growth temperature is a major drawback for its to be applied in flexible electronics. In this talk, an inductively coupled plasma (ICP) was used to synthesize Transition Metal Dichalcogenides (TMDs) through a plasma-assisted selenization process of metal oxide (MO_x) at a low temperature, as low as 250 °C, which was called a plasma-assisted chemical vapour reaction (PACVR) process. Compared to other CVD processes the use of ICP in the PACVR facilitates the decomposition of the precursors at lower temperatures. Therefore, the temperature required for the formation of TMDs can be drastically reduced. WSe_2 was chosen as a model material system due to its technological importance as a p-type inorganic semiconductor with an excellent hole mobility. Large-area synthesis of WSe_2 on polyimide (30 x 40 cm^2) flexible substrates and 8-inch silicon wafers with good uniformity was demonstrated at the formation temperature of 250 °C as confirmed by Raman and X-ray Photoelectron (XPS) spectroscopy. Furthermore, the collaborations with Russia and Korea groups on applications based on the plasma-assisted selenization process including (1)nanoelectronics (2) gas sensors and (3) batteries will be reported.

Keywords: Transition Metal Dichalcogenides, nanoelectronics, gas sensors, Ion batteries, Chemical vapor deposition, plasma-assisted chemical vapour reaction

Panelist

元智大學
Yuan Ze University

Dr. Tien-Lung CHIU

Professor,
Department of Electrical Engineering,
Yuan Ze University

Tien-Lung Chiu got his PhD degree from the Graduate Institute of Photonics and Optoelectronics, National Taiwan University in 2009. In the same year, he joined the faculty as an Assistant Professor in the Photonic Engineering Department at Yuan Ze University, Taiwan. Right now, he is a Full Professor in the Electrical Engineering Department at Yuan Ze University. His research focuses on the field of organic semiconductor optoelectronics and display technologies such as organic light emitted device (OLED), organic solar cell, quantum-dot light emitting diode, and emerging display devices.

Triplet-Triplet Annihilation Upconversion Organic Light Emitting Diode

Tien-Lung Chiu[1]*, Chia-Hsun Chen[2], Jiun-Haw Lee[2] and Christopher J. Bardeen[3]

[1]*Department of Electrical Engineering, Yuan Ze University, Taiwan*
[2]*Graduate Institute of Photonics and Optoelectronics and Department of Electrical Engineering, National Taiwan University, Taiwan*
[3]*Department of Chemistry, University of California, Riverside, Riverside, CA 92506, USA*
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Abstract

For high-end display applications, the urgent demands for high efficiency and good reliability organic light-emitting diode (OLED) materials and devices are still raising, especially for the blue one. Currently, the reliable blue OLED employed the pure fluorescent (F) or triplet-triplet fluorescent (TTF) emitter, but the low efficiency is still an issue. Although the high efficiency emission mechanisms such as phosphorescent, thermal delayed active fluorescent emitter were developed, the reliability for the blue OLED was not qualified. In this report, an emission mechanism of blue OLED utilizing triplet-triplet annihilation up conversion (TTAUC) was demonstrated. The reliability and efficiency performance is better than commercial F and TTF OLED because the emitting layer was separated into two parts. One is the carrier recombination layer and then exciton energy transfer to the emitter layer. The carrier recombination layer generates the 100% triplet excitons and then energy transfer to the TTA emitter to achieve 50% internal quantum efficiency. Especially, the low energy bandgap material could be the candidate for the carrier recombination layer to decrease the driving voltage and turn on voltage, which benefits the power efficiency. In addition, the lower triplet excitons energy transferred to the TTA emitter and emitted a higher energy blue photon.

Keywords: organic light-emitting diode, fluorescent, triplet-triplet annihilation up conversion.

Panelist

國立清華大學
NATIONAL TSING HUA UNIVERSITY

Dr. Jwo-Huei JOU

Professor,
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Professor Jou's research interest includes high-efficiency and natural-light like organic light emitting diodes (OLEDs), polymer, thin film stress, and expert system applications. He had been granted/filed more than 75 OLED-related patents (US, ROC, Japan, Korea and Canada), and published 155 OLED-related journal papers with an average Impact Factor of 4.5 and over 50 conference proceeding papers. He also published 46 papers on solvent diffusion in polyimide films, thin-film stress and polymer modification techniques. He has written 3 textbooks and 16 book chapters and magazine articles.

Blue Hazards and Candlelight OLED Based Resolutions

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Abstract

Blue light caused health issues could be treated as a new epidemic. The issues would become more severe since the outbreak of COVID-19 pandemic. People are thence forced to stay at home, skyrocketing online activities. The consequent surge in 3C browsing would further jeopardize human health, especially eyes. Moreover, increasing studies revealed that light sources with a high color temperature or enriched with blue emission would markedly suppress the secretion of melatonin at night. Long lack of melatonin would in turn increase the risks of breast, prostate, and pancreatic cancers. In fact, most of the modern lighting is rich in blue light, greatly endangering our health. Carefully selecting an appropriate light source that is free from blue hazards is hence extremely crucial in order to safeguard the health of our children and ourselves.

Keywords: *Blue hazards, Candlelight OLED, Melatonin, Human health.*

Panelist

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Kuo-Ping Chen is an Associate Professor of the Institute of Imaging and Biomedical Photonics, National Chiao-Tung University. He earned the Ph.D. degree in Electrical and Computer Engineering at Purdue University in 2011. After graduating from school, Kuo-Ping worked in Intel Corp. for one year (2011-2012) and was responsible for advanced lithography technology. Kuo-Ping joined National Chiao-Tung University in 2012 and became the Associate Professor since 2017. He was awarded the MOST Young Talent Research Project (2020- 2023). Kuo-Ping's research interests are in nanophotonics and metamaterials, which include nanofabrication, plasmonics, bio-sensor, nanoantennas, and metasurfaces.

Structural Colors and Absorption Enhancement in Dielectric Metasurfaces

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Abstract

High-refractive-index (HRI) nanostructures support optically induced electric dipole (ED) and magnetic dipole (MD) modes that can be used to control scattering and achieve narrowband absorption. In this work, a high absorptance device is proposed and realized by using amorphous silicon nanoantenna arrays (a-Si NA arrays) that suppress backward and forward scattering with engineered structures and in particular periods. The overlap of ED and MD resonances, by designing an array with a specific period and exciting lattice resonances, is experimentally demonstrated. The absorptance of a-Si NA arrays increases 3-fold in comparison to unpatterned silicon films. Nonradiating a-Si NA arrays can achieve ~90 % absorptance and high absorptance resonance is observed not only due to the intrinsic loss of material but by overlapping the ED and MD resonances.

In addition, artificial color pixels based on dielectric Mie resonators are appealing for scientific research as well as practical design. Vivid colors are imperative for displays and imaging. Dielectric metasurface-based artificial pixels are promising candidates for developing flat, flexible, and/or wearable displays. Considering the application feasibility of artificial color pixels, wide color gamuts are crucial for contemporary display technology. To achieve a wide color gamut, ensuring the purity and efficiency of nanostructure resonance peaks in the visible spectrum is necessary for structural color design. Low-loss dielectric materials are suitable for achieving vivid colors with structural color pixels. However, high-order Mie resonances prevent color pixels based on dielectric metasurfaces from efficiently generating highly saturated colors. In particular, fundamental Mie resonances (electric/ magnetic dipole) for red can result in not only a strong resonance peak at 650 nm, but also high-order Mie resonances at shorter wavelengths, which reduces the saturation of the target color. To address these problems, we fabricated silicon nitride metasurfaces on quartz substrates and applied Rayleigh anomalies at relatively short wavelengths to successfully suppress high-order Mie resonances, thus creating vivid color pixels. We performed numerical design, semianalytic considerations, and experimental proof-of-concept examinations to demonstrate the performance of the silicon nitride metasurfaces. Apart from traditional metasurface designs that involve transmission and reflection modes, we determined that lateral light incidence on silicon nitride metasurfaces can provide vivid colors through long-range dipole interactions; this can thus extend the applications of such surfaces to eyewear displays and guided-wave illumination techniques.

Keywords: dielectric metasurfaces, structural colors, near band-gap absorption enhancement

Session IV

Panel B: Mechanical Sciences & ICT

Moderator

- **Dr. Faa-Jeng LIN**

Chair Professor, Department of Electrical Engineering, National Central University
Member, Science and Technology Policy Advisory Office,
Board of Science & Technology, Executive Yuan, Taiwan

Panelists

- **Dr. Ai-Chun PANG**

Professor, Department of Computer Science and Information Engineering &
Associate Dean of the College of Electrical Engineering and Computer Science,
National Taiwan University

Dr. Te-Chuan CHIU
Postdoctoral Research Fellow,
Research Center for Information Technology Innovation, Academia Sinica

- **Dr. Wei-Ta CHU**

Professor,
Department of Computer Science and Information Engineering,
National Cheng Kung University

- **Dr. Wei-Cheng HUANG**

Research Fellow, National Center for High-performance Computing,
National Applied Research Laboratories

Moderator

國立中央大學
National Central University

BOST 行政院科技會報

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Faa-Jeng Lin received PhD degree from National Tsing Hua University, Taiwan, in 1993. He is a Chair Professor at the Department of Electrical Engineering, National Central University, Taiwan. His research interests include AC motor drives, power electronics, renewable energies, smart grids, intelligent and nonlinear control theories. Several of his papers have helped to establish research areas such as fuzzy neural network control of motor drives and motion control systems. He was Associate Editor of IEEE Transactions on Fuzzy Systems and IET Electrical Power Applications; the President, Taiwan Smart Grid Industry Association; the Chair and Principal Investigator of Smart Grid Focus Center, National Energy Project. He is now Associate Editor of IEEE Transactions on Power Electronics and the Executive Director of Taiwan Power Company. He received the Outstanding Research Awards from the National Science Council, Taiwan, in 2004, 2010 and 2013. He is also an IEEE Fellow.

Panelist

中央研究院
ACADEMIA SINICA

Dr. Te-Chuan CHIU

Postdoctoral Research Fellow,
Research Center for Information Technology Innovation,
Academia Sinica

Te Chuan Chiu received his B.S. degree in Computer Science from National Tsing Hua University, Taiwan, in 2010, M.S. and Ph.D. degrees in Computer Science and Information Engineering from National Taiwan University, Taiwan, in 2012, and 2018, respectively. He was a Research Scholar of the School of Electrical, Computer and Energy Engineering from Arizona State University, USA, in 2016-2017. He is currently a Postdoctoral Research Fellow at the Research Center for Information Technology Innovation, Academia Sinica. His research interests include 5G communications, edge intelligence, fog computing, AIoT, and energy harvesting technology. Dr. Chiu was awarded the 2018 Member of the Phi Tau Phi Scholastic Honor Society of the Republic of China.

Roadmap from Latency-Driven Cooperative Fog Computing to Energy-Aware Collaborative Beamforming and Edge Computing

Te-Chuan Chiu[1], Ai-Chun Pang[2], Chun-Ting Chou[3], Hung-Yu Wei[3], Hanna Bogucka[4], and Filip Idzikowski[4]

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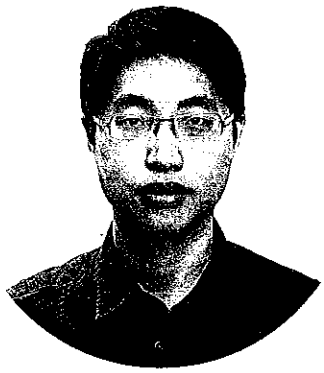
Abstract

In the traditional Information and Communication Technology (ICT), cloud computing can provide abundant computing and storage resources as a centralized resource pooling to meet various applications. However, new challenges are raising when jointly considering AI+IoT services in the upcoming 5G cellular networks. Enormous data transmission from the end-devices to the cloud might lead to a heavy burden on the core network and make end-to-end latency unfeasible to achieve ultra-low latency. Fortunately, the brand-new concept of fog/edge computing shifting the computing power from the cloud to the edge allows AIoT services to be served at the network edge with the help of edge power. Via the forward-looking perspective, we advocate a Fog Radio Access Network (F-RAN) model, which leverages the existing infrastructure such as small cells with limited computing power, to achieve the ultra-low latency by joint edge computing and near-range communications across multiple Fog groups. We formulate the low latency design as an NP-hard optimization problem, which demonstrates the tradeoff between communication and computing in the time domain and propose a dynamic programming solution to solve it. The numerical results show that the low latency services can be accomplished by F-RAN via latency-driven Fog cooperation approach. Next, we focus on the computing-near-the-edge scenario, each IoT device can either execute local computing or offload their computing tasks to the neighboring wireless powered Fog networks. (e.g., the nearby small cells with directional switched beam antennas as Fog nodes.) However, the effective collaborative energy beamforming and edge computing in joint data communication and ambient wireless power provision among multiple Fog nodes is a challenging and non-trivial issue to tackle. Therefore, we observe that the beam-ripple phenomenon, which takes advantage of side lobes to deliver energy to IoT devices, is the key to addressing these two issues jointly. The proposed solution based on an approximation algorithm effectively shows that the energy minimization goal among IoT devices can achieve and the developed harvest-then-transmit protocol is fundamentally evolved by collaborative energy beamforming and edge computing.

Keywords: Fifth-generation (5G) cellular networks, ultra-low latency, green communication, fog/edge computing, cooperative task offloading, energy harvesting technology, wireless power transfer.

Panelist



國立成功大學
National Cheng Kung University

Dr. Wei-Ta CHU

Professor,
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Wei-Ta Chu received the BS and MS degrees from National Chi Nan University, Taiwan, in 2000 and 2002, and received the Ph.D. degree in Computer Science from National Taiwan University, Taiwan, in 2006. He was a Professor at National Chung Cheng University from 2007 to 2019. He is now a Professor at National Cheng Kung University, Taiwan. His research interests include digital content analysis, multimedia indexing, deep learning, and pattern recognition.

He won the Best Full Technical Paper Award in ACM Multimedia 2006. He was awarded the Outstanding Youth Electrical Engineer Award by the Chinese Institute of Electrical Engineering in 2017, the Distinguished Alumni Award presented by National Chi Nan University in 2014, Best GOLD Member Award presented by IEEE Tainan Section in 2013, the K. T. Li Young Researcher Award presented by Institute of Information & Computing Machinery in 2012, and the Young Faculty Awards presented by National Chung Cheng University in 2011. His advised master students have received several thesis awards from Taiwan Institute of Electrical and Electronic Engineering, Institute of Information & Computing Machinery, and the Chinese Institute of Electrical Engineering. He was a visiting professor at Nagoya University from January to March 2017, and a visiting scholar at Columbia University, from July to August 2008.

Attention-Guided Weakly Supervised Deep Hashing through Tag Embeddings

Wei-Ta Chu and Ching-Ching Yang

National Cheng Kung University

Abstract

In contrast to supervised image hashing methods that utilize images and label information to learn binary hash codes, weakly-supervised methods were proposed to well utilize more widely available (but noisy) tag information to learn the hash functions. In this paper, we propose to incorporate the idea of residual attention into an existing weakly-supervised image hashing framework, and show significant performance boost can be obtained. Based on the NUS-WIDE dataset and the MIR-FLICKR25K dataset, the proposed attention-guided weakly-supervised image hashing method improves mean average precision by around 5% to 10% based on learnt hash codes of various lengths.

Keywords: Weakly-supervised hashing, attention-guided, tag embeddings

Panelist

NARLabs 財團法人國家實驗研究院
國家高速網路與計算中心
National Center for High-performance Computing

Dr. Wei-Cheng HUANG

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Graduated from UIUC with profession in Numerical Simulation Applied Aerodynamics, Dr. Weicheng Huang has rich experience in the area of supercomputing and its related fields. He has served as a member of the SC program committee for several years and is currently a member of the program committee of ISC for continuously many years. He is always on top of the development of advanced computing technologies. From Parallel Processing, Grid Computing, Cloud Computing and Big Data, he has devoted himself to boosting the progress and development of modern ICT technologies of his fellow country. Currently, as a research fellow of National Center for High-performance Computing, he serves as the AIoT Architect of the center and is pushing the maturity of the AIoT environment with supercomputers serving the community.

In this international collaboration project between AIST Japan and NCHC Taiwan, Dr. Huang serves as the project PI of the Taiwan side as well as the software architect and leads the team from NCHC to work with the counterpart of AIST. The progress of the work has been demonstrated on several occasions including SC and ISC. This year is the third year into the project and is a little bit slow down due to the pandemic. However, after this year, a more concrete platform is expected after two years of exploration. The development of AI application which is used as an example of using the data platform is underway.

Secure and Distributed Data Cloud for AI Platform between Taiwan and Japan

Weicheng Huang

National Center for High-performance Computing
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The Big Data analysis and application have become one of the most important domains in both IT and applications over the past few years. Data Science can be used in various areas, including disaster mitigation, disease prevention, medical and health care, environment protection, quality of life, food safety, and so on. It is indeed at the top of the tide wave for governments over the world. The data economy has emerged silently and smoothly. The strategies of Big Data from different countries are not the same. However, it is obvious that the data sources can be categorized into government open/non-open data, enterprise industrial data from the private sector, scientific research data, and so on. The management of such data has evolved into the balance between both the centralized as well as the distributed data resources. For example, although there is no single data marketplace operated by the government, the NSF of the US has funded 4 Regional Data Hubs in the US, with National Data Service together. Data management and exchange have become crucial to the development of data science and its application. It is therefore recommended by the research team of this proposal that a 4-year project of joint efforts between NCHC Taiwan and the AIST Japan should be devoted to tackling the issues regarding sharing of data as well as IT resources, including computing and storage, between the two nations. The issues such as the safety of data flow between core facilities and the end devices, the authentication and authorization of users, resource sharing mechanisms, and so on, should be tackled and implemented.
Over the past 3 years, the project has evolved into the arena of AI application. With the data from Satellite images from Taiwan and the AI specialty from AIST Japan, an AI model which is designed to detect solar panels has been implemented and shared among the two institutes. Currently, the joint work has expanded its scope to include air quality data and involves another partner from Thailand.

Keywords: Data Cloud, Big Data, Artificial Intelligence, Interoperability, IoT, Heterogeneous, Security