澳門科技大學
MACAU UNIVERSITY OF SCIENCE AND TECHNOLOGY

創新工程學院
Faculty of Innovation Engineering

Interdisciplinary Science and Engineering

Lecture Series

3.14 10:00 - 11:15
Prof. **Arlindo Oliveira**
Megatrends in Digital Technologies

3.14 11:30 - 12:45
Prof. **Zhigang Zou**
Extraterrestrial Survival and Artificial Photosynthetic Materials for Deep Space Exploration

3.20 14:30 - 15:45
Prof. **Yu-Zhong Wang**
How to Address the Issue of Plastics Waste Pollution

4.12 14:30 - 15:45
Prof. **Yao He**
Nanotechnology for Precision Diagnosis and Treatment of Diseases

4.17 14:30 - 15:45
Chair Prof. **Songxi Chen**
Data Experiments and Statistical Analysis in Atmospheric Environment Studies

4.25 14:30 - 15:45
Prof. **Liang Li**
Synthesis of Ultra-stable Quantum Dots and their Applications

5.2 14:30 - 15:45
Chair Prof. **Kang Zhang**
Transforming Healthcare Delivery and Biomedical Research by Big Data and AI

5.8 14:30 - 15:45
Prof. **Baiyan Li**
Application of Functional Framework Materials in Green Chemistry

5.22 14:30 - 15:45
Prof. **Yu Han**
Electron Microscopy Imaging of Electron Bean-sensitive Crystalline Materials

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Faculty of Innovation Engineering

Interdisciplinary Science and Engineering Lecture Series

Megatrends in Digital Technologies

Speaker:

Prof. Arlindo Oliveira

Distinguished Guest Professor,
Department of Engineering Science
Faculty of Innovation Engineering, M.U.S.T.

2024 **3.14**
(Thursday)
10:00 - 11:15

MUST LIU's Innovation and Technology Center

Abstract

Digital technologies, which became widely available less than half a century ago, are changing the world, more rapidly than any other technology developed in the history of humanity. In this talk, I will discuss the principles and the potential societal impact of four key digital technologies: quantum computing, blockchain, internet of things and artificial intelligence. I will propose strategies for the positioning of higher education and research institutions, relatively to each one of these technologies, and discuss how people, institutions and society in general can maximize the potential benefits while minimizing the risks involved.

Biography

Arlindo Oliveira was born in Angola and lived in Mozambique, Portugal, Switzerland, United States and Japan. He obtained his BSc and MSc degrees in Electrical Engineering and Computer Science (EECS) from Instituto Superior Técnico (IST) and his PhD degree, also in EECS, from the University of California at Berkeley, where he was a Fulbright scholar. He was invited professor at MIT and a researcher at INESC, CERN, the Electronics Research Laboratory of UC Berkeley, the Berkeley Cadence Laboratories and the University of Tokyo. He is a distinguished professor of IST, president of INESC, distinguished visiting professor at Macau University of Science and Technology, member of the board of Caixa Geral de Depósitos and a researcher at INESC-ID. He authored four books, translated into different languages, and more than two hundred articles in international conferences and journals, in the areas of algorithms, artificial intelligence, machine learning, bioinformatics and computer architecture. He has been on the boards of several companies and institutions and is a past president of Instituto Superior Técnico, of INESC-ID and of the Portuguese Association for Artificial Intelligence. He is a member of the Portuguese Academy of Engineering, of the National Council for Science Technology and Innovation, of the Advisory Board of the Science and Technology Options Assessment (STOA) Panel of the European Parliament, of IEEE and of ACM. He received several prizes and distinctions, including the Technical University of Lisbon / Santander prize for excellence in research, in 2009.

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Interdisciplinary Science and Engineering Lecture Series

Extraterrestrial Survival and Artificial Photosynthetic Materials for Deep Space Exploration

Speaker:

Prof. Zhigang Zou

Academician of CAS
Distinguished Guest Professor,
School of Computer Science and Engineering
Faculty of Innovation Engineering, M.U.S.T.

2024 3.14
(Thursday)
11:30 - 12:45

MUST LIU's Innovation and Technology Center

Abstract

As the core of space exploration, extraterrestrial survival is the basic ability for humans to achieve long-term space flight, long-term extraterrestrial habitation, and immigration. Converting the carbon dioxide produced by respiration into oxygen and achieving the regeneration of waste resources in enclosed spaces can greatly reduce the material supply demand for manned spacecraft. Simultaneously utilizing the abundant in situ CO2 and H2O resources of extraterrestrial atmospheric environments such as the Moon and Mars to produce oxygen and fuel can meet the material supply for human long-term survival and deep space transportation on other celestial bodies. It is an important foundation for supporting affordable and sustainable manned deep space exploration. This study focuses on the basic material and energy needs faced by manned deep space exploration and human long-term extraterrestrial survival. It focuses on lunar minerals and energy resources, develops 2-3 types of extraterrestrial artificial photosynthetic materials and their controllable preparation technologies based on the lunar soil of Chang'e-5, constructs an efficient extraterrestrial artificial photosynthetic material system, elucidates the mechanism of action of extraterrestrial artificial photosynthetic materials in special environments, and develops extraterrestrial artificial photosynthetic systems, To achieve experimental verification of space environment and provide a revolutionary technological route for extraterrestrial survival.

Biography

Engaging long-term in the fundamental and application research of energy and environmental materials, Prof. Zou is now a member of Chinese Academy of Science, Academician of the World Academy of Sciences,the chief scientist of the "973" projects, director of the innovation team of the Ministry of Education,Chairman of the Chinese Committee of Photochemistry and Photocatalysis, member of the strategic steering committee of the China Hydrogen Alliance, co-chairman of the Space Station Science and Technology Experimental Science Committee and the Space Exploration Experimental Science Committee of China, an adjunct professor of University of Electrical and Communications in Japan, and a visiting fellow of the Japanese National Research Institute of Materials (NIMS). He has made systematic and original contributions to the academic fields of the new-generation energy and environmental materials, including superconductive, photocatalytic materials, etc. by developing the design theories, critical syntheses, and application fundamentals. He has published over 660 research articles, SCI cited for over 30,000 times without self-citation, with an H index of 86. He also achieved over 90 Chinese, 1 US, and 2 Japanese patents. He won the International Centre for Diffraction Data Certificate Award twice in 1999 and 2003, the best paper award of the American Society of Mechanical Engineers (ASME) International in 2003, the first prize of Jiangsu Science and Technology Award twice in 2012 (first contributor) and 2016, and the second prize of Chinese National Science Award as the first contributor in 2014, In 2018, he won the gold medal of the 46th Geneva International Invention Exhibition and the special award of King Abdullah University in Saudi Arabia as the first finisher. In 2019, he won the Science and Technology Progress Award of He Liang He Li Foundation.

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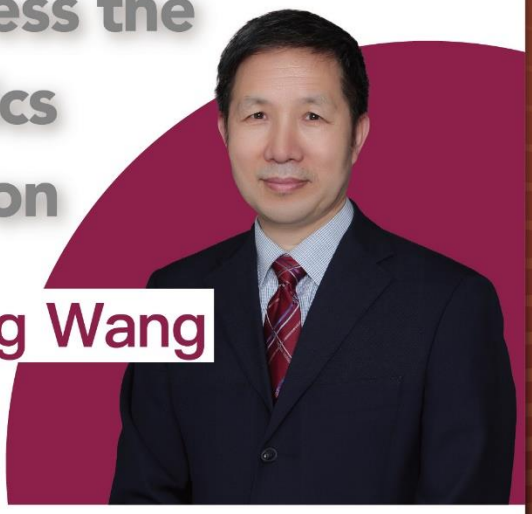
Interdisciplinary Science and Engineering Lecture Series

How to Address the Issue of Plastics Waste Pollution



Speaker:

Prof. Yu-Zhong Wang

Academician of CAE
Professor, College of Chemistry
Sichuan University

2024 **3.20**
(wednesday)
14:30 - 15:45

MUST LIU's Innovation and Technology Center

Abstract

Plastics, as one kind of indispensable materials for social development, are receiving more and more attentions, and their current global annual production reaches up to 0.4 billion tons. However, the recycling rate of out-of-service plastics is low, which has caused serious ecological and environmental problems as well as a significant waste of resources. Meanwhile, the current recycling methods generally suffer from large energy consumption and lead to recycled products with low added values, as well as the recycling process can produce other kinds of undesirable wastes. To solve these problems, a series of novel upcycling methods should be established to convert these bulk wastes into value-added chemicals, monomers/oligomers and high-performance materials. In addition, new polymers that are easy to be recycled should be designed and synthesized. In this lecture, I will focus on new upcycling strategies for traditional plastics and new polymeric materials based on monomer recovery, respectively.

Biography

Dr. Yu-Zhong Wang is the Professor of Sichuan University (SCU), China, and is the directors of National Engineering Laboratory for Eco-Friendly Polymeric Materials (Sichuan) and the National Engineering Research Center for Advanced Fire-Safety Materials Development and Applications (Shandong), which were founded by him. He has published over 600 papers in SCI journals, and holds over 180 patents in his research areas such as fire-retardant materials, bio-based/biodegradable polymers, and recycling and upcycling of polymeric materials.

Prof. Wang is an Academician of Chinese Academy of Engineering, the Vice Presidents of China Materials Research Society, China Composites Society, China Textiles Engineering Society, and Degradable Plastic Committee of CPPIA, and Director of National Technical Committee for Standardization of Bio-Based and Biodegradable Products. He is the editorial members of 15 journals such as Polymer Degradation and Stability, Journal of Applied Polymer Science, Journal of Fire Science, Engineering, etc. , and the editor-in-chief of Journal of Sichuan University (Science Edition). He was granted the National Innovation Excellence Award, Science & Technology Progress Award of the Ho-Leung-Ho-Lee Foundation, and thirteen Science & Technology Awards by the State Council, Ministry of Education, Provincial Governments of China, etc.

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Interdisciplinary Science and Engineering Lecture Series

Nanotechnology for Precision Diagnosis and Treatment of Diseases

Speaker:

Prof. **Yao He**

Professor, Department of Materials Science and Engineering
Faculty of Innovation Engineering, M.U.S.T.

2024 **4.12**
(Friday)
14:30 - 15:45

MUST LIU's Innovation and Technology Center

Abstract

In the past several decades, we have witnessed the giant advancement of nanotechnology, which provides exciting new opportunities for myriad electronic, energetic, environmental, biological and biomedical applications. Among them, the exploration of nanotechnology for biological and biomedical applications is one of the most important branches, receiving extensive attentions and revolutionizing basic research and clinical applications in recent years. Therefore, based on the previous elegant work of scientists worldwide and recent efforts of our group, we herein introduce nanotechnology for biological and biomedical applications. It is worthwhile to point out that, this presentation particularly focuses on the development of nanotechnology for biosensing, bioimaging, as well as diseases diagnosis and therapy, which will be of interest to chemists, materials scientists, biologists and clinicians.

Biography

Prof. Yao He focuses on the development of nanotechnology for biological and biomedical applications, with an aim to provide new powerful tools for the diagnosis and therapy of diseases. He has authored over 150 SCI papers, with a number of citations larger than 13000. He served as the chief scientist of the "youth 973" project (National key scientific research projects, China) in 2013. He received the National Science and Technology Leading Talent Award in 2012, the First prize of Jiangsu Science and Technology Award in 2017 (Ranking the first), and the Science and Technology Award for Chinese Youth in 2022. He was supported by National High-Level Talents Special Support Program (Leading Talent of Technological Innovation of Ten-Thousands Talents Program) in 2014 and the National Natural Science Funds for Distinguished Young Youths in 2018.

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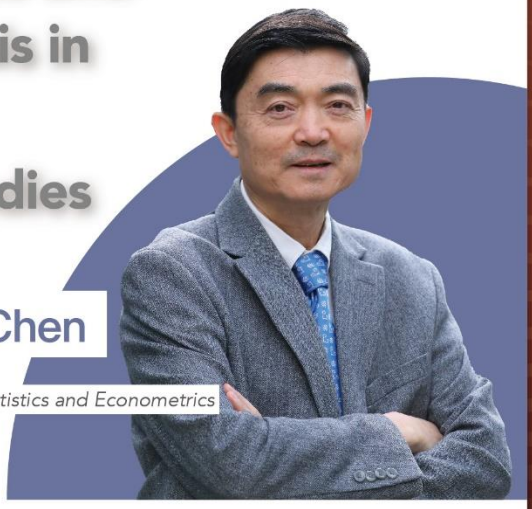
Interdisciplinary Science and Engineering Lecture Series

Data Experiments and Statistical Analysis in Atmospheric Environment Studies



Speaker:

Chair Prof. **Songxi Chen**

Academician of CAS
Chair Professor, Department of Business Statistics and Econometrics
Guanghua School of Management
Peking University

2024 **4.17**
(Wednesday)
14:30 - 15:45

MUST LIU's Innovation and Technology Center

Abstract

The talk presents research effort designed to extract underlying emission information from air pollution monitoring network data, and part of our effort on the analysis and tracking of air pollution situation in northern China since 2014. The talk gives mathematical and statistical formulation as well as data experiments constructed to gain underlying emission information from meteorologically confounded air quality data. This includes methods to remove meteorological confounding, indices to measure man-made vs natural meteorological effects on the air pollution, and data experiments to measure local emissions.

Biography

Dr. Songxi Chen is a University Chair Professor at School of Mathematical Sciences, Guanghua School of Management and Center for Statistical Science of Peking University, Peking, China. He received his B.Sc. and M.Sc. in Mathematics from Beijing Normal University in 1983 and 1988, respectively, and his Ph.D. in Statistics from Australian National University in 1993. His primary research interests include inference for high-dimensional data, environmental modeling, empirical likelihood, econometric theory and financial econometrics. He became a member of Chinese Academy of Sciences in 2021 and was elected as Fellow of the American Statistical Association and Fellow of the Institute of Mathematical Statistics (IMS) in 2009. He is also an Elected Member of International Statistical Institute, an Elected Council Member of IMS during 2016 – 2019 and an Elected Board Member of the International Chinese Statistical Association (ICSA) during 2008 – 2013. He is currently serving as Scientific Secretary of Bernoulli Society since 2019 and was selected to give Peter Hall Lecture at the 12th ICSA International Conference.

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Interdisciplinary Science and Engineering Lecture Series

Synthesis of Ultra-stable Quantum Dots and their Applications

Speaker:

Prof. **Liang Li**

Professor, Department of Materials Science and Engineering
Faculty of Innovation Engineering, M.U.S.T.

2024 **4.25**
(Thursday)
14:30 - 15:45

MUST LIU's Innovation and Technology Center

Biography

Dr. Liang Li is a professor at MIMSE, Macau University of Science and Technology. In 2006, he received a Ph.D. degree from Shanghai Jiaotong University of China, and then worked as a postdoctoral researcher at the French Atomic Energy Commission, the University of California, Santa Barbara, and the Los Alamos National Laboratory. In 2011, he joined a LED phosphor company in Silicon Valley as a senior scientist for the commercialization of quantum dots. In 2013, he returned Shanghai Jiaotong University and started his independent research career, and in 2022 he moved to Macau University of Science and Technology. In recent years, his research interests have focused on improving the stability of quantum dots and fabrication of quantum dot-based LED devices. He has published more than 110 papers in academic journals (10000+ citations, h-index = 43), including Nature Photonics, Nature Nanotechnology, Nature Communications, Journal of the American Chemical Society and many others.

Abstract

In recent years, Quantum Dots (QDs) have been regarded as outstanding emitters for in the fields of light-emitting diodes (LEDs), lighting, backlit displays and bio-imaging due to their high photoluminescence quantum yield, narrow full width at half maximum, and tunable emission color over the visible spectrum. However, due to their ionic structure and low formation energy, their intrinsic poor stability under external environmental factors such as moisture, oxygen, heat, and light irradiation limits their practical applications. Generally speaking, poor stability, especially photostability, will lead to rapid fluorescence decay during long-term operation. In my talk, I will provide a brief overview of our recent progress in improving the stability of quantum dots. I have developed a series of synthesis methods and surface treatment methods for different types of QDs, especially InP, CuInS2 nanocrystals and perovskite nanocrystals, and some of my synthesis methods or modified versions are widely used industrial production of quantum dots. Recently, I have improved the stability of perovskite quantum dots to the level of ceramic phosphors, enabling "on-chip" applications of quantum dots, which will pave the way for large-scale, low-cost commercial backlight applications of perovskite quantum dots including backlight films, and micro LEDs. Finally, I will discuss a range of other potential applications of quantum dots including displays, biotechnology, environmental pollution remediation, and more.

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Interdisciplinary Science and Engineering Lecture Series

Transforming Healthcare Delivery and Biomedical Research by Big Data and AI

Speaker:

Chair Prof. **Kang Zhang**

Vice Dean, Faculty of Medicine
Macau University of Science and Technology

2024 **5.2** (Thursday)
14:30 - 15:45

MUST LIU's Innovation and Technology Center

Abstract

AI and its applications has recently experienced explosive growth across many industries, and the healthcare industry is no exception. With the accumulation of electronic health data, scientists were able to employ AI to mimic the diagnostic abilities of physicians across many medical specialties. Increasingly studies show that AI technologies can perform a wide array of functions, such as intergation of immense clincal and high throughput biological data, aiding in diagnosis generation and therapy selection, multi-task learning on disease diagnoses, therapy and outcome predictions, making risk predictions and stratifying disease, reducing medical errors, and improving productivity. The eventual goal is that AI enables a much better healthcare delivery and biomedical research.

Biography

Kang Zhang, MD, PhD is the Professor of the Faculty of Medicine, Macau University of Science and Technology (MUST). Dr. Zhang obtained his M.D. with Magna Cum Laude honors from Harvard Medical School and MIT joint MD program and his PhD in genetics from Harvard University. He did his postdoctoral training also at Harvard. He completed his residency in ophthalmology at Johns Hopkins University and his retina surgery fellowship at University of Utah. He was a faculty member at Johns Hopkins University, Cleveland Clinic Foundation, University of Utah, and University of California San Diego.

Among his honors include AAAS fellow, fellow of American Institute for Medical and Biological Engineering, memberships in Association of American Physicians and American Society of Clinical Investigation; Outstanding Achievement Award of Chinese Ophthalmological Society, Burroughs Wellcome Clinical Scientist Award in Translational Research; Lew R. Wasserman Merit Award and Senior Investigator Award from Research to Prevent Blindness; Charles Schepens Award for Excellence in Retina Research; and Johns Hopkins Medical Institutions Clinician Scientist Award, the Ophthalmologist 100 Powerlist, American's Top Ophthalmologists.

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Interdisciplinary Science and Engineering Lecture Series

Application of Functional Framework Materials in Green Chemistry

Speaker:

Prof. **Baiyan Li**

Professor, School of Materials Science and Engineering
Nankai University

2024 **5.8** (Wednesday)
14:30 - 15:45
MUST LIU's Innovation and Technology Center

Abstract

Functional framework materials including metal organic frameworks (MOFs) and porous organic frameworks (POFs) have been widely applied in green chemistry including pollutant treatment and heterogeneous catalyst with outstanding performances. In our previous works, a series of adsorbents based on functional framework materials have been developed for CO2 adsorption, heavy metals capture and radioactive pollutant removal etc. Furthermore, some heterogeneous catalysts were investigated and applied in Friedel-Crafts reaction, epoxidation of alkenes as well as cascade reactions. In addition, the investigation of general industrial preparation of these functional framework materials were also studied as well.

Biography

Prof. Baiyan Li, doctoral supervisor, the overseas high-level talents in China, and one of the "100 Young Discipline Leaders" of Nankai University. In 2010, he graduated as a doctor at Jilin University (under the supervision of Professor Zhan Shi). Later, he worked as a postdoctoral scholar under the supervision of Professor Shengqian Ma (USF), Professor Jing Li (Rutgers University), and Professor Yu Han (KAUST). In recent years, he have published over 50 papers as the first and corresponding author, including Nature Communications, JACS, and Angew Chem, Chem Sci and etc., with a total citation of over 4000 times. The research project includes National Natural Science Foundation of China, the Youth Thousand Talents Program, and the National Key Research and Development Program and so on.

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Interdisciplinary Science and Engineering Lecture Series

Electron Microscopy Imaging of Electron Bean-sensitive Crystalline Materials

Speaker:

Prof. Yu Han

Professor, School of Emergent Soft Matter
South China University of Technology

2024 5.22 (Wednesday)
14:30 - 15:45

MUST LIU's Innovation and Technology Center

Biography

Dr. Yu Han obtained his PhD from Jilin University in 2003 and served as a research scientist at A-Star in Singapore from 2003 to 2008. Between 2009 and 2023, he worked at King Abdullah University of Science and Technology in Saudi Arabia as a professor in the Department of Chemistry and Chemical Engineering. In September 2023, he joined South China University of Technology as the Director of the Center for Electron Microscopy.

Dr. Han's research primarily focuses on the synthesis and application of porous materials (catalysis, separation, water treatment) and high-resolution electron microscopy imaging of electron beam-sensitive materials. He is a co-inventor of ultralow-dose electron microscopy imaging technology. He has published over 400 academic papers, including in prestigious journals such as Nature, Science, Nature Nanotechnology, Nature Chemistry, and Nature Materials, with a total citation count exceeding 45,000 and an H-index of 106.

Dr. Han was recognized as one of the top 100 young inventors by MIT's Technology Review magazine in 2004, received the Young Scientist Award in Singapore in 2006, the Thomson Reuters Research Fronts Award in 2008, was named a Chang Jiang Scholar Lecture Professor by the Ministry of Education of China in 2016, received the Humboldt Research Award in 2021, and was a Clarivate Analytics Highly Cited Researcher for five consecutive years from 2019 to 2023.

Abstract

This presentation will focus on our recent works pertaining to the high-resolution imaging of electron beam-sensitive materials using ultralow electron doses. The following technological advances will be discussed. First, the development of a suite of methods to address the challenges peculiar to low-dose TEM imaging, including rapid search for crystal zone axes, precise alignment of the image stack, and accurate determination of the defocus value, enables efficient imaging of electron beam-sensitive crystalline materials in the high-resolution TEM (HRTEM) mode [1-3]. Second, integrated differential phase contrast STEM (iDPC-STEM) has proven to be an effective method for acquiring directly interpretable atomic-resolution images under low-dose conditions [4]. Third, cryogenic focused ion beam (cryo-FIB) has demonstrated a unique power to prepare (S)TEM specimens for highly sensitive materials [5]. Finally, I will share my views on the great potential of four-dimensional STEM (4D-STEM) in imaging highly electron beam-sensitive materials and provide preliminary results to demonstrate its feasibility [6].

References

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[3] Imaging defects and their evolution in a metal-organic framework at sub-unit-cell resolution. Nat. Chem. 2019, 11, 622-628.

[4] Direct Imaging of Atomically Dispersed Molybdenum that Enables Location of Aluminum in the Framework of Zeolite ZSM-5, Angew. Chem. Int. Ed., 2020, 59, 819-825

[5] Cryogenic focused ion beam enables atomic-resolution imaging of local structures in highly sensitive bulk crystals and devices. J. Am. Chem. Soc. 2022, 144, 3182-3191.

[6] Three-dimensional inhomogeneity of zeolite structure and composition revealed by electron ptychography. Science 2023, 380, 633-638.

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