NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Jointly Organised by:

Institute of Advanced Studies and

Talent Recruitment & Career Support (TRACS) Office

MAY 8, 2019
1 PM - 4.30 PM
SPMS LT 3

SPMS-03-02, NTU (map)

PRESIDENTIAL POSTDOCTORAL RESEARCH SYMPOSIUM - 2019 Pt. 2

Co-Creating Ideas | Generating Network | Fostering Collaborations

The NTU Presidential Postdoctoral Fellowship provides the opportunity for early career scientists, engineers and scholars from Singapore and around the world to conduct independent investigations in any discipline at NTU. In this series, seven Postdoctoral Fellows are sharing with us their groundbreaking research relating to the topics of **Life Sciences & Environmental Science** and **Nanoscience & Nanotechnology**. This provides a platform for our audiences and researchers to co-create ideas, generate network and foster research collaborations in future.

KEYNOTE SPEAKER :

Asst Prof Justin Song

Provost's Chair in Physics & Nanyang Assistant Professor, SPMS

1 pm - 1.45 pm, SPMS LT 3

'Electronic Quantum Metamaterials: Engineering the Electron'

PARALLEL SESSION SPEAKERS:

SESSION A: LIFE SCIENCES & ENVIRONMENTAL SCIENCE @ SPMS LT 5

- **Dr Guy S Jacobs, Complexity Institute**
  2pm – 2.30pm
  'Archaic Introgression in Island Southeast Asia'
- **Dr Dorrain Low, LKC School of Medicine**
  2.30pm – 3pm
  'An Untargeted Metabolomics Approach to Identify Diet-Derived Biomarkers and Dietary Exposures Associated with Age-Related Cognitive Decline'
- **Dr Olusegun K. Abass, CEE**
  3.30pm – 4pm
  'Development of Novel Multifunctional Nanomaterials for Environmental-related Applications'

SESSION B: NANOSCIENCE & NANOTECHNOLOGY @ SPMS LT 3

- **Dr Parth Vashishtha, MSE**
  2pm – 2.30pm
  'Perovskite Nanocrystals for Light Emitting Diodes'
- **Dr R. Lakshmi Narayan, MAE**
  2.30pm – 3pm
  'Structure-Mechanical Property Correlations at Different Length Scales Applied to 3D Manufactured Metals and Alloys'
- **Dr Genevieve Lau, SPMS**
  3.30pm – 4pm
  'Exploring the Chemical Reactivity of Nanoscale 3D Printed Metals'
- **Dr Andrés Granados Del Águila, SPMS**
  4pm – 4.30pm
  'Optical Spectroscopy in Atomically-thin Semiconductors: Optical Design for Unconventional Electronics'

Admission is free. Lunch and Tea Break to be served at 12pm and 3pm, respectively.

For more information and registration, scan QR code or visit https://bit.ly/2It8oG1

PRESIDENTIAL POSTDOCTORAL RESEARCH SYMPOSIUM - 2019 Pt. 2

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ASST PROF JUSTIN SONG

Provost's Chair in Physics & Nanyang Assistant Professor,
School of Physical and Mathematical Sciences

BIOGRAPHY

Justin Song is a Condensed Matter theorist working on unraveling the unusual electronic behavior of quantum materials. He is Provost's Chair in Physics and a Nanyang Assistant Professor at NTU; he is also a Senior Scientist at the Institute of High Performance Computing. Previously he was a Burke fellow at Caltech, and received his PhD from Harvard in 2014. He is the recipient of a number of awards including the Young Scientist Award (2017), a National Research Foundation Fellowship (2016), Sherman Fairchild Prize and Burke Fellowship (2014).

ABSTRACT

Title: Electronic Quantum Metamaterials: Engineering the Electron

1pm – 1.45pm, SPMS LT 3

Exerting control over the electron has been a recurring challenge of materials science and device technology. I will highlight the intriguing potential of designer structuring of electronic matter at scales at and below the electron wavelength, which affords a new range of synthetic quantum metamaterials with unconventional responses. These can be achieved in a range of stacked two-dimensional materials that naturally possess features at or smaller than the size of the electron wavelength, mean-free path, or screening length – providing the ability to structure the electron. Strikingly, electronic metamaterials promise far richer categories of behaviour than those found in conventional optical metamaterial technologies, and may provide new means to translate quantum materials science into quantum device engineering. To this end, I will discuss our group's recent efforts in artificially engineering the electron in quantum metamaterials.

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DR GUY S JACOBS

Complexity Institute

BIOGRAPHY

Dr Guy S Jacobs studied biological anthropology at Cambridge before receiving a PhD in complex systems simulation at Southampton University. He joined the Complexity Institute at NTU in 2016 as a Postdoc working on human population genetics, with a focus on demographic and evolutionary history in Indonesia. In his current NTU fellowship, he is specifically studying genomic signals of archaic introgression in island Southeast Asia, using patterns of variation in modern genetic data to identify genomic regions that were contributed by our closest evolutionary relatives – Neanderthals and Denisovans.

ABSTRACT

Title: Archaic Introgression in Island Southeast Asia

2pm – 2.30pm, SPMS LT 5

Humans are known to have mixed with at least two ancient hominin groups after their exodus from Africa – Neanderthals and Denisovans. The historical distribution, morphology and cultural complexity of Neanderthals, who contributed about 2% ancestry to all non-African groups, is relatively well understood. Denisovans are far more mysterious – recently identified through ancient DNA from a finger bone excavated from a Siberian cave, the peak introgression signal in modern humans lies far to the southeast, over persistent sea channels, in Papua New Guinea. Recently, I have been studying this introgression history using newly sequenced human genomes from the Indonesian archipelago and Papuan region. I will discuss methods to disentangle the mosaic genome generated by introgression events, inferences about the evolutionary history of archaic hominins made possible by studying the genetic material they contributed to modern populations, and ongoing projects seeking to understand human diversity, both in terms of archaic introgression and more broadly, in island Southeast Asia.

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DR DORRAIN LOW

LKC School of Medicine

BIOGRAPHY

Dr Low completed her PhD at The University of Queensland (Brisbane, Australia) with a focus on applying mass spectrometry tools to study gut microbiota-mediated polyphenol biotransformations, and phytonutrient metabolism in a dietary intervention pig model. Her keen interest in the significance of metabolite biomarkers in diseased states led to a postdoctoral position of the AgreenSkills+ Young Incoming Fellow in nutritional metabolomics at INRA (Clermont Ferrand, France). In October 2018, she was awarded the NTU Presidential Postdoctoral Fellowship by LKCMedicine, where she carries out independent research on the role of gut microbiome in dietary choline and tryptophan metabolism and their effects on healthy ageing.

ABSTRACT

Title: An Untargeted Metabolomics Approach to Identify Diet-Derived Biomarkers and Dietary Exposures Associated with Age-Related Cognitive Decline

2.30pm – 3pm, SPMS LT 5

With a global rise in ageing population and age-associated diseases, understanding how diet modifies cognitive ageing represents key revenues for prevention. In my recent project in the discovery phase of the DCogPlast consortium, I have identified a 22-metabolite baseline serum profile associated with age-related cognitive decline. Interestingly, seven of the metabolites were food-derived metabolites including coffee-derived metabolites, a biomarker of citrus juice intake, a cocoa-derived metabolite and two unknown metabolites putatively linked to fish and wine intakes. This untargeted metabolomics approach suggests a role for the food metabolome (in addition to the endogenous metabolome) in better brain aging, and may potentially lay the basis for future dietary prevention strategies. Presently I am studying vulnerable populations responding to the impact of nutritional exposures on healthy ageing in a Singapore population.

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DR OLUSEGUN K. ABASS

School of Civil and Environmental Engineering

BIOGRAPHY

Dr Olusegun K. Abass is an Environmental Engineer and a Presidential Postdoctoral Fellow at the School of Civil and Environmental Engineering, NTU. He received his PhD from the Chinese Academy of Sciences in advanced oxidation processes and membrane bioreactor applications. During his career, he served as the Science Communication Officer of the Global Interdisciplinary Program on "Health and Urban Wellbeing (an interdisciplinary body of the International Science Council) based in China and Italy. His current research focuses on development of novel multifunctional nanomaterials and 2D-based quantum membranes for environmental-related applications. His futuristic idea is to create enabling environment for an all-inclusive human health and well-being.

ABSTRACT

Title: Development of Novel Multifunctional Nanomaterials for Environmental-related Applications

3.30pm – 4pm, SPMS LT 5

The discovery of engineered nanomaterials such as single layered graphene in 2004 via isolation of its aggregates has increased the impetus for utilization of two-dimensional (2D) nanomaterials owing to their distinctive properties relative to their bulk form. This breakthrough opened new possibilities for extensive research on all engineered nanomaterials, and has stimulated new science and technology across a huge range of fields. In this talk, I will present some emerging engineered nanomaterials and demonstrate their novel applications for efficiency enhancement and affordability in water treatment and wastewater reuse.

PRESIDENTIAL POSTDOCTORAL RESEARCH SYMPOSIUM - 2019 Pt. 2

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DR PARTH VASHISHTHA

School of Materials Science & Engineering

BIOGRAPHY

Dr Parth Vashishtha is currently a Presidential Postdoctoral Fellow (PPF) at School of Materials Science and Engineering, NTU. His current research project is focused on synthesising novel lead free perovskite nanocrystals in order to build thin film optoelectronic devices. He started his research career at University of South Australia, where he completed his Masters project on non-toxic quantum dots with Prof Thomas Nann. He then worked in the group of Prof Jonathan E. Halpert on "Nanostructured Metal Halide Perovskites for Optoelectronic Applications" and attained his PhD at Victoria University of Wellington, New Zealand. He also worked on Si quantum dots in Prof Jonathan Veinot's group at University of Alberta, Canada as a visiting researcher.

ABSTRACT

Title: Perovskite Nanocrystals for Light Emitting Diodes

2pm – 2.30pm, SPMS LT 3

Quantum dots are one of the most promising candidates for lighting applications due to their size tunable emission spectra, thin emission line width, and better colour rendering.[1] Recently, lead halide perovskite material has shown exceptional optoelectronic properties. Nanocrystal of these perovskite material have displayed very high (50-100%) quantum yield in RGB region.[2] However, the stability of these perovskites are yet to be improved. Recently triple cation perovskite containing cesium (Cs), methlammonium (MA), and farmamidinium (FA), have not only shown the recorded power conversion efficiency (PCE) for solar cells but also offered higher stability.[3] In this talk, I will share on the role of triple cation for LEDs application; as well as our work on making lead free direct band gap perovskite nanocrystals.

References:

1. Anikeeva, P. O.; Halpert, J. E.; Bawendi, M. G.; Bulovic, V., Quantum dot light-emitting devices with electroluminescence tunable over the entire visible spectrum. Nano letters 2009, 9 (7), 2532-2536.
2. Protesescu, L.; Yakunin, S.; Bodnarchuk, M. I.; Krieg, F.; Caputo, R.; Hendon, C. H.; Yang, R. X.; Walsh, A.; Kovalenko, M. V., Nanocrystals of cesium lead halide perovskites (CsPbX3, X= Cl, Br, and I): novel optoelectronic materials showing bright emission with wide color gamut. Nano letters 2015, 15 (6), 3692-3696.
3. Saliba, M.; Matsui, T.; Seo, J.-Y.; Domanski, K.; Correa-Baena, J.-P.; Nazeeruddin, M. K.; Zakeeruddin, S. M.; Tress, W.; Abate, A.; Hagfeldt, A., Cesium-containing triple cation perovskite solar cells: improved stability, reproducibility and high efficiency. Energy & environmental science 2016, 9 (6), 1989-1997.

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DR R. LAKSHMI NARAYAN

School of Mechanical and Aerospace Engineering

BIOGRAPHY

Dr. Lakshmi Narayan R received a Ph.D. degree in Materials Engineering from Indian Institute of Science in 2015, where he received the K.P. Abraham Gold Medal for the Best Thesis for his work on fracture and deformation on metallic glasses and composites. Following that he was a Post-Doctoral Fellow at Carnegie Mellon University, USA and a part-time visiting scientist at Xi'an Jiaotong University, China. During this stint he worked in the field of in situ mechanical testing in the TEM and tested both crystalline and amorphous metals and composites. For his academic services he was also awarded the outstanding reviewer for the Journals Acta Materialia and Scripta Materialia twice, in 2014 and 2018. Currently, he works on understanding the structure-property correlations in 3D printed metals and alloys (Ti, Al, Steels) and conducts fracture and fatigue tests as well as small scale tests such as nanoindentation on them.

ABSTRACT

Title: Structure-Mechanical Property Correlations at Different Length Scales Applied to 3D Manufactured Metals and Alloys

2.30pm – 3pm, SPMS LT 3

In metals and alloys prepared by conventional manufacturing techniques, the mechanical properties are intimately connected to the microstructure. Some of the microstructural features in crystalline materials include grain size, brain boundary energy, texture and precipitates. Alternately, the relevant structural parameters in amorphous alloys are associated with the local order in their atomic arrangements. Nevertheless, in both these material classes, structural parameters have a contrasting influence on different mechanical properties. In this talk, different aspects of the mechanical behaviour of amorphous alloys will be presented. This discourse is intended to demonstrate the success of guiding materials design via a systematic understanding of structure- property correlations. Next, the mechanical behaviour of metals and alloys in small volumes will be considered to highlight the length scale aspects of material design. Specific issues concerning the structure-property correlations in metals and alloys developed by additive manufacturing; and limitations, challenges and opportunities presented by the existence of a unique meso-structure and porosity will also be presented.

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DR GENEVIEVE LAU

School of Physical and Mathematical Sciences

BIOGRAPHY

Dr Genevieve Lau is a physical chemist at the School of Physical and Mathematical Sciences, NTU. She obtained her Ph.D. in Chemistry and Chemical Engineering in 2015 from the Swiss Federal Institute of Technology Lausanne (EPFL), where she studied dye-sensitized solar cells and the electrochemical reduction of CO2. Prior to joining NTU, Genevieve was a *Career Development Postdoctoral Fellow* at Yale-NUS College (Singapore), and she also held a visiting scholar position at the Swiss Federal Institute of Technology Zürich (ETH Zürich). At NTU, Genevieve is establishing a new laboratory for nanoscale metal 3D printing, and her research interests include materials synthesis, surface science, sensing, and electrocatalysis.

ABSTRACT

Title: Exploring the Chemical Reactivity of Nanoscale 3D Printed Metals

3.30pm – 4pm, SPMS LT 3

Despite its central position within the chemical industry, heterogeneous catalysis has long been characterized by poorly-defined active sites and poorly-understood reaction mechanisms. In this talk, I will share about new technologies at the forefront of additive manufacturing research, and how they may be applied to the chemical sciences for advancing our understanding of nanoscale phenomena. This represents an entirely new approach towards research in catalysis, which I hope will one day see widespread adoption in the field.

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DR ANDRÉS GRANADOS DEL ÁGUILA

School of Physical and Mathematical Sciences

BIOGRAPHY

Dr Andrés Granados Del Águila is a Presidential Postdoctoral Fellow in the School of Physics and Mathematical Sciences, NTU. His research interest focuses on understanding light-matter interactions in solid- and soft-matter systems by means of optical spectroscopy. After the completion of his degree in Physics at the Complutense University of Madrid (Spain), he obtained his PhD in Science in 2015 from the High Field Magnet Laboratory (HFML) at the Radboud University of Nijmegen (The Netherlands). At the HFML, he was involved in high-field optical measurements, mostly focusing on the investigations of low-temperature luminescence in colloidal semiconductor heteronanocrystals. In 2016, he joined NTU where he continued studying emergent semiconductor nanostructures through optical spectroscopy. At present, he pursues an understanding of light-induced unconventional electronic transport in atomically-thin crystals.

ABSTRACT

Title: Optical Spectroscopy in Atomically-thin Semiconductors: Optical Design for Unconventional Electronics

4pm – 4.30pm, SPMS LT 3

At the nanoscopic level, new and exotic physical phenomena appear, pushing the frontier of quantum mechanics. In this regard, the interaction of light with matter is a central research topic for investigating and measuring matter at the nanoscale. A particularly interesting group of nanomaterials are semiconducting layered crystals, such as WS_2, WSe_2, MoS_2 and $MoSe_2$. These materials exhibit strong light emission properties when exfoliated into an atomically-thin monolayer. Furthermore, due to inherent crystal symmetries, they obey chiral optical selection rules, where illumination with right- or left-handed circularly polarized laser light can result in right- or left-handed circularly polarized fluorescence light emission, respectively. This intrinsic property is called valley polarization (VP) and enables observation of remarkable physical phenomena such as light-induced valley coherence and valley-Hall effects, though mostly at very low temperatures. However, for realizing practical next-generation valley-based optoelectronic devices, it is crucial to achieve room temperature valley polarization, which requires full control of the depolarization mechanisms. Here, I will introduce some of these (scattering) processes and discuss a preliminary set of experiments where the dynamics of valley excitons (coupled electron-hole pairs) is investigated.