澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU

應用物理及材料工程研究院
INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

IAPME Seminar

Engineering few-layer 2D Materials and Perovskites and their Applications

26 June 2025

Prof. Zexiang SHEN
Nanyang Technological University
Venue: N23-4018
Time: 16:00 - 17:00
Hosted by: Prof. Handong SUN

Abstract

The optical and electronic structures of two-dimensional (2D) materials and perovskites often show very strong layer-dependent properties. The properties can also be tuned by stacking configuration, which allows us to build electro and optical devices with the same material and the same thickness. Detailed understanding of the inter-layer interaction will help greatly in tailoring the properties of 2D materials for applications, e.g. in pn junction, transistors, solar cells and LEDs. Raman/Photoluminescence (PL) spectroscopy and imaging have been extensively used in the study of nano-materials and nano-devices. They provide critical information for the characterization of the materials such as electronic structure, optical property, phonon structure, defects, doping and stacking sequence.

In this talk, we use Raman and PL techniques and electric measurements, as well as simulation to study 2- and 3-layer 2D samples and Perovskite materials. The Raman and PL spectra also show clear correlation with layer-thickness and stacking sequence. Electrical experiments and ab initio calculations reveal that difference in the electronic structures mainly arises from competition between spin-orbit coupling and interlayer coupling in different structural configurations.

Biography

Prof. Zexiang SHEN is Professor of Physics. He is Associate Dean for interdisciplinary research, Graduate College, Nanyang Technological University. He is also Co-Director, Centre for Disruptive Photonics Technologies. He also holds a joint appointment at School of Materials Science and Engineering.

His current research work involves spectroscopic and theoretical study of graphene, 2D materials and hybrid perovskites using ultra-low wavenumber Raman spectroscopy, photoluminescence and time resolved spectroscopy in combination with high pressure and low temperature. His other research direction is electric energy storage using graphene composite materials. He is winner of NTU Nanyang Award for Research and Innovation, Gold Medal for Research Excellence by Institute of Physics Singapore, Honorary Professor of Moscow State University. He is a Global Highly Cited Researcher.

Enquiry: iapme.enquiry@um.edu.mo