



**Seminar Topic:
Enhancing Properties of Two-Dimensional Perovskites with High
Pressure**

Professor Shen Zexiang

Abstract

Two-dimensional (2D) perovskites are a new class of functional materials with potential applications in various technologically important areas, such as solar cells, LED, and lasing. Compared with their 3D counterparts, 2D perovskites exhibit special properties, e.g., their natural quantum-well structure yields stable excitons, able to interact more strongly with phonons, spins, and defects. Layered perovskites are also more structurally stable.

High pressure induces a rich variety of phenomena in the electronic and optical properties in the hybrid Perovskite materials, including enhancement of photoluminescence (PL) by at least two orders of magnitude, narrow to white light emission, rich PL energy and lifetime changes. The optical properties of 2D perovskites are mainly governed by excitons, and the investigation of intrinsic and extrinsic, radiative and nonradiative exciton recombination pathways is essential. The intrinsic pathways are related to exciton-phonon interactions. Lattice vibrations create spatial and temporal potential fluctuations, where the first one causes scattering of excitons and broadening of excitonic peaks in optical spectroscopy, while the second leads to the fine structure of the spectra, known as Frank-Condon shape. Besides, a moving exciton can create vibrations around it, inducing lattice distortions.

Biography

Professor Shen Zexiang is Professor of Physics, at School of Physical & Mathematical Sciences in Nanyang Technological University (NTU). He also holds a joint appointment at School of Materials Science and Engineering. He is Associate Dean of Interdisciplinary Programme at Graduate College and the Co-Director of Centre for Disruptive Photonics Technologies in NTU. 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 and Global Highly Cited Researcher.

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.

Wednesday, 17 March 2021 || Time: 2:00 pm - 3:00 pm ||
Live Streaming Link (Zoom Meeting): <https://ntu-sg.zoom.us/j/92604286617>
Meeting ID: 926 0428 6617 Passcode: 170321
Hosted by: Associate Professor Li Shuzhou