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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

## Celebrating the 40th Anniversary of the University of Macau:
## Emergent optical properties of 2D materials


Prof. Xiaolong ZOU

*Tsinghua Shenzhen International Graduate School*


Date: 17/12/2021; Time: 10:00 - 11:30; Venue: N23-4018


Two-dimensional (2D) materials as ideal platforms for exploring emerging optical behaviors, at unprecedentedly high temperature and feasible control. Here, we report our systematic study on the effects of different band topologies and moiré superlattices on the optical properties of 2D systems. Different 2D materials with characteristic band topologies can be adopted to achieve various long-sought high-temperature excitonic quantum behaviors, including electron-hole liquid in a new-phase (γ-phase) group IV monochalcogenides (This new phase has been synthesized recently.), excitonic Bose-Einstein Condensation in $TiS_3$, and saddle excitons in β-phase group IV monochalcogenides. By introducing twist in trilayer black phosphorous (TTbP) with strong interlayer coupling and deep 1D moiré potential, we observed remarkably strong moiré optical resonances even at a large twist angle of 19°. Combining twisting, pressure, and electric field, controllable tuning of bandgap, bandwidth, and dimension of moiré bands can be achieved, thus establishing TTbP as an attractive platform to explore strongly correlated moiré electronic and excited states in different dimensions, as well as tunable opto-electronic applications.


**Introduction of speaker**

Prof. Xiaolong ZOU received his Ph.D. in physics from Tsinghua University, China, in 2011. After working as a research associate at Rice University, Houston, TX, USA, he joined Tsinghua-Berkeley Shenzhen Institute (TBSI), part of Tsinghua Shenzhen International Graduate School, Tsinghua University, as an Assistant Professor in 2016 and promoted to Associate Professor in 2019. Prof. Zou's current research focuses on the theoretical description of magnetic and optical properties of 2D materials and their coupling, as well as the growth mechanism of 2D materials. He has published over 90 papers in peer-refereed journals, including 1 Nature, 2 Nature Materials, 6 Nature Communications, 3 Materials Today, 1 Accounts of Chemical Research, 5 Advanced Materials, 8 Nano Letters, 11 ACS Nano. These papers receive total citations over 10,000 and an H-index of 40. He has been invited to write book/chapter by several prestigious publishers, including Science Press, and Cambridge University Press.


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