北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Weekly Seminar

Recent Progresses on 2D Charge-Transferonics

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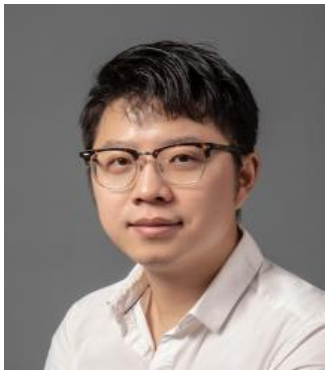

Time: 3:00 pm, Nov. 20, 2024 (Wednesday)

时间：2024年11月20日 （周三）下午3:00

Venue: Room w563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

In this talk, we will introduce a model system: synergetic interplay between two layers of 2D interacting interacted electronic system, and the emerging phenomena. Taking the van der Waal hybrid system of graphene/CrOCl for example, due to *e-e* interactions, the electrons filled (charge transferred from graphene with the help of vertical electrical field) in the surface state (mainly in the Cr-3d orbital in CrOCl, which is about 0.7 nm below graphene) of CrOCl can spontaneously form a long wavelength order, *i.e.*, a Wigner crystal. Such a charge order act as a quantum superlattice, which exerts a moiré-like super potential to the graphene placed on top of it, leading to a series of exotic interaction-driven phenomena [1-4], including unusually robust quantum Hall phase, exciton-enhanced correlated insulator, and interfacial coupling induced p-doping in 2D semiconductors. Our findings suggest that the paradigm of charge transfer can play key roles in the engineering of quantum electronic states, when the *e-e* interactions are taking effects. According to theory, such a charge-transferred interfacial quantum superlattice and the exotic electronic phases induced therein may be a universal effect, which we define as 'charge-transferonics', and enriched physical phenomena are yet to be discovered.

[1] Y. Wang, et al., Nature Nanotechnology,**17**, 1272–1279 (2022).
[2] K. Yang, et al, Nature Communications, **14**, 2136, (2023).
[3] X. Lu, et al., Nature Communications, **14**, 5550, (2023).
[4] Y. Guo, et al., Nature, **630**, 346 (2024).

About the speaker

Zheng Vitto Han is a research professor at the Institute of Optoelectronics, Shanxi University. His studies mainly focus on the emerging physical properties of functional materials in mesoscopic sizes, and on further implementing these interesting properties in future applications of nano-assemblies and nanoelectronics. In the past few years, he has revealed a series of exotic physical properties of such systems, with the related works published in journals including Science, Nature Nanotechnology, Nature Communications.