Exploring quantum coherence and correlations in graphene van der Waals heterostructures

Dong-Keun Ki
Department of Physics and HK Institute of Quantum Science and Technology Organization, The University of Hong Kong, Pokfulam Road, Hong Kong, China
dkki@hku.hk

Abstract

Due to strong confinement, charge carriers in atomically thin graphene layers exhibit enhanced quantum effects that can be further engineered by van der Waals (vdW) interactions. Graphene vdW heterostructures, therefore, offer great opportunities to study various quantum transport phenomena that emerge in low dimensions. Here, we will discuss the past and on-going efforts in investigating and understanding the effects of the vdW interactions on various quantum coherence and correlations phenomena in graphene. We will begin with graphene on transition metal dichalcogenides (TMDCs) heterostructures where we have recently found pronounced ballistic transport effect that provides deeper understandings of the interface-induced spin-orbit coupling in the system [1]. We will also discuss how electrons in Dirac band and those in moiré mini-band interact with each other in graphene-hBN-graphene moiré heterostructures. Lastly, we will briefly discuss the impacts of these works and future directions. The work is financially supported by the National Key R&D Program of China (2020YFA0309600) and by the UGC/RGC of Hong Kong SAR under schemes of Area of Excellence (AoE/P-701/20).

References

[1] Qing Rao, Wun-Hao Kang, Hongxia Xue, Ziqing Ye, Xuemeng Feng, Kenji Watanabe, Takashi Taniguchi, Ning Wang, Ming-Hao Liu, and Dong-Keun Ki, Nat. Commun. 14 (2023) 6124.

Figures