



Weekly Seminar

Light-induced Band Engineering in 2D Materials and Topological Materials

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Venue: Room w563, Physics building, Peking University

地点: 北京大学物理楼, 西563会议室

Abstract

Interactions between light and matter allow the realization of out-of-equilibrium states in quantum solids and lead to the emergence of new complex correlated states. In the first part of this talk, we systemically demonstrate an unconventional excitonic state and its bound phonon sideband in layered silicon diphosphide (SiP_2), in which the bound electron-hole pair is composed of electrons confined within one-dimensional phosphorus-phosphorus chains and holes extended in two-dimensional SiP_2 layers [1]. Furthermore, in the heterostructure of SiP_2 with other TMDC materials even without twisting, the moiré pattern can be observed, which strongly renormalizes the electronic structures of TMDC and contributes to a giant anisotropic conductance [2]. In the second part, we report the observation of the Floquet engineering and the light-induced band renormalization in black phosphorus [3,4]. We will discuss the birth and death for the Floquet states in the experimental conditions. In the last part, we report the long-lived light-driven quasi-stationary geometry could stabilize the topological nature in the material family of HgTe compounds. We show that coherent excitation of the infrared-active phonon mode results in a distortion of the atomic geometry with a lifetime of several picoseconds. [5]

[1] Ling Zhou, et. al., Nat. Mater. 21, 773–778 (2022).

[2] Zeya Li, et. al., Nat. Commun. 14, 5568 (2023).

[3] Shaohua Zhou, et. al., Nature 614, 75–80 (2023).

[4] Shaohua Zhou, et. al., Phy. Rev. Lett. 131, 116401 (2023).

[5] Dongbin Shin, et. al., Phy. Rev. Lett. 132, 016603 (2024).

About the speaker

Peizhe Tang got the Ph.D degree from the Department of Physics in Tsinghua University in 2015. After that, he worked as a post-doctor researcher in Stanford University until 2017. From 2017 to 2020, he worked as a post-doctor in Max-Planck Institute for Structure and Dynamic of Matter (MPSD) in Hamburg, Germany. Since 2020, he is the Professor in the School of Material Science and Engineering in Beihang University. His current research focuses on the electronic properties of topological materials and light-matter interaction in quantum materials by using *ab initio* methods. He was awarded the Marie-Curie Fellowship (2018) and the Oversea High-level Talent Program for Young Researchers (2019).