

凝縮系セミナー

日時： 2024 年 11 月 26 日（火） 14：00～

場所： 物性研究所本館 6 階 第 5 セミナー室（A615）

講師： Prof. Wang Yao

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Title: Quantum geometric properties and anomalous Hall effects
in twisted TMDs

Abstract:

This talk will discuss quantum geometric properties of electrons in homobilayer semiconductors arising from the layer pseudospin when twisting introduces its texture in real and momentum spaces. In small angle twisted transition metal dichalcogenides (TMDs), real-space Berry curvature from the moiré-patterned layer pseudospin texture realizes an effective magnetic field that underlies the emergence of quantum anomalous Hall (QAH) effects recently observed in t-MoTe_2 . We show an intrinsic dipole Hall effect in both the ferromagnetic and antiferromagnet QAH states at integer fillings of the moiré, which leads to a novel magnetoelectricity. This allows contact-free detection of the topological transitions to QAH states, signified by a sudden sign switch of the magnetoelectric susceptibility. I will also discuss a bipartite limit of the fluxed three-orbital tight-binding model we initially proposed for twisted TMDs, featuring a singular flatband with band touching, where DMRG and ED calculations surprisingly reveal fractional QAH phases at its fractional fillings. Gapping the touching point turns singular flat band into a Chern band, but counter-intuitively, the fractional QAH phase gets quenched, which may be attributed to the variation in Berry curvature distribution upon the gap opening. If time allows, I will also briefly cover linear and nonlinear responses of quantum geometric origins from momentum space layer texture.

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