

Excitonic Chern insulator and heavy fermion liquid in $MoTe_2/WSe_2$ moire bilayer

Since the observation of the quantum anomalous Hall (QAH) effect in the AB-stacked $MoTe_2/WSe_2$ system, various explanations have been proposed. However, these all point to a valley-aligned order, which contradicts the latest experiment using the technique of magnetic circular dichroism. In this talk, I will review the experiments and discuss a new mechanism for the QAH effect, which gives a valley order consistent with the experimental observations. In particular, based on the observation that the inter-layer tunneling is suppressed in the AB stacking, we consider a model with two layers coupled through the Coulomb interaction. Through mean field theory, a $p \pm ip$ exciton condensation is found, leading to a Chern insulator with Chern number $C = \pm 1$. The valleys are polarized due to the kinetic energy instead of interaction. But the polarization in the two layers can be either the same or opposite depending on small perturbations away from a symmetric point. As a result, both valley polarized and inter-valley coherent (IVC) Chern insulator phases are possible. The latter has the same spin S_z in the two layers. Apart from this, I will briefly discuss the heavy fermion physics in this setup.