Center for Artificial Low D Electronic Systems

2022 IBS-CALDES Seminar

- ✓ **Date & Time** **5:00PM, May 16th (Mon), 2022**
- ✓ **Zoom ID: 896 7585 7723 / PW: 807323**
- ✓ **Speaker & Title**

05:00PM~ Prof. Vic K.T. Law (HKUST)

Interaction Driven Quantum Anomalous Hall Phases in Moiré Materials

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- **05:00PM~**

Interaction Driven Quantum Anomalous Hall Phases in Moiré Materials

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Two-dimensional moiré superlattices have emerged as an ideal system to study the many-body interactions and correlated states. Recently, the quantum anomalous Hall phase was observed in MoTe2/WSe2 heterobilayers at half-filling (one hole per moiré unit cell) [Nature 600, 641 (2021)]. However, the mechanism behind the emergence of the topological phase is not known. In this work, we propose that the topologically nontrivial phase can be induced by the pseudo-magnetic fields caused by lattice relaxation.

We point out that a periodically modulated pseudo-magnetic field breaks the intra-valley time-reversal symmetry and induce non-zero Chern numbers at each valley. At half-filling, the strong Coulomb interactions lift the valley degeneracy and induce a valley-polarized state, where the quantum anomalous Hall effect can be observed. Our theory identifies a new mechanism to achieve topologically nontrivial states and provides a basis for the study of other strongly correlated phases [1].

With new experimental data available concerning the quantum anomalous Hall states in MoTe2/WSe2, we point out that the observed state can also be a topological valley coherent state which is a new state of matter which had not been discovered before.

In this talk, we will also discuss related interaction driven, time-reversal breaking phases observed in gate-defined Josephson junction in twisted bilayer graphene [2,3].

References:

1. Phys. Rev. Lett. 128, 026402 (2022).
2. arXiv:2110.01067
3. arXiv:2202.05663