

Chez Pierre

Presents ...

Monday, April 29, 2024

12:00 pm -1:00 pm

Duboc Room – 4-331



Chez Pierre Seminar

Rui- Rui Du, Peking University

“Towards Bosonic Fractional Quantum Hall Effect in a Moat Band”.

Correlation and frustration play essential roles in many-body physics, giving rise to novel quantum phases. A typical frustrated system is correlated bosons on moat bands, which could host topological orders with long-range quantum entanglement. However, the realization of moat-band physics in cold atom experiments is still challenging. Here, we explore moat-band phenomena in shallowly-inverted InAs/GaSb quantum wells, which can be tuned by potential gates. We observe an unconventional time-reversal-symmetry breaking excitonic ground state under imbalanced electron and hole densities, where electron-hole pair possesses finite momentum. Theoretically, we show that strong frustration from density imbalance leads to a moat band for excitons, resulting in a time-reversal-symmetry breaking excitonic topological order, which explains all our experimental observations. More recently, by new experiments we have explored the moat-band physics in strongly spin-orbit coupled InAs/GaSb quantum wells. These developments open a new direction for realizing bosonic fractional quantum Hall effects in the presence of zero magnetic field.

Reference:

1. Lingjie Du, Ivan Knez, Gerard Sullivan, and Rui-Rui Du, Robust Helical Edge Transport in Gated InAs/GaSb Bilayers, *Phys. Rev. Lett.* 114, 096802 (2015).
2. R. Wang, T. A. Sedrakyan, B. G. Wang, L. J. Du, R. R. Du, Excitonic topological order in imbalanced the electron hole- bilayer. *Nature* 619, 57-62 (2023).