Chez Pierre

Presents ...

Monday, September 18, 2023

12:00 pm -1:00 pm

Duboc Room – 4-331

Chez Pierre Seminar

Trithep Devakul, Stanford University

“Graphene trilayer with a helical twist.”

The moiré patterns generated by twisting van der Waals materials has given rise to a new regime of physics in which electronic interactions and quantum geometry are at the forefront. The unprecedented degree of tunability in these devices has led to the experimental realization of a remarkably diverse set of physical phenomena, including the recent first-ever observations of the fractional quantum anomalous Hall effect. While the majority of studies have focused on two-layer materials, going to three or more layers vastly increases the space of possibilities, which is just beginning to be explored.

I will discuss helical trilayer graphene (HTG), a deceptively simple structure consisting of three graphene layers with identical twist angles relative to one another. This structure results in a super-moiré pattern, emerging from the misalignment of the individual moiré patterns between layers 1-2 and layers 2-3, which becomes apparent at very large lengthscales. Despite this seeming complexity, I will show how a confluence of super-moiré lattice relaxation, topological flat bands, and strong interactions saves the day, making HTG a uniquely rich platform for realizing strongly correlated topological states such as integer and fractional Chern insulators and for exploring their phase transitions.

References:

TD, P. J. Ledwith, L. Xia, A. Uri, S. de la Barrera, P. Jarillo-Herrero, and L. Fu, “Magic-angle helical trilayer graphene”, Science Advances (to appear).

Y. H. Kwan, P. J. Ledwith, C. F. B. Lo, and TD, “Strong-coupling topological states and phase transitions in helical trilayer graphene”, arXiv:2308.09706.