Chiral Bound States in Flat Bands

Daniel Kaplan[1]

[1]University Of Central Florida, Orlando, United States

"Flatland" is an emergent sandbox of competing strongly interacting phases of electrons in low dimensions. I will present an interesting consequences of flatness: the spontaneous breaking of time-reversal and inversion symmetries by interactions through a condensation phase transition.

Unlike standard Fermionic Stoner symmetry breaking, here the symmetry is broken through condensation of bosons, and without a classical, thermodynamic order parameter. I will present detailed analytical and numerical results which highlight that even in "flatland", interactions can be strongly modulated by the presence of topology – momentum space texturing of electronic states.

I will discuss these ideas in the context of rhombohedral multilayer graphene, twisted transition-metal dichalcogenides and Landau levels as paradigmatic systems where topology, intertwined with strong interactions, drive exotic phase transitions, especially when the kinetic energy is quenched.