Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

" Symmetry breaking and skyrmionic transport in magic angle twisted bilayer graphene on h-BN"

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Abstract: In magic angle twisted bilayer graphene (TBG), alignment of h-BN substrate with one or both graphene monolayers can lead to nearly flat Chern bands labeled by valley and spin indices. At odd-fillings, we discuss, within an effective Landau Level model, how interaction effects can lead to a ferromagnetic Chern insulator with an anomalous Hall effect that has been recently observed [1]. Next, we study the system at half-filling of the conduction bands, and discuss possible symmetry broken states, taking into account both inter and intra-valley interactions mediated by Coulomb forces and phonons. We argue that an intervalley coherent state is at odds with the behavior of resistivity in a perpendicular magnetic field [1]. However, either the ferromagnet or the antiferromagnet, where we find skyrmions to be the lowest energy charged excitations, affords a natural explanation of the magnetoresistance. We discuss different possible scenarios that can arise from skyrmion pairing, including a superconducting transition via a deconfined quantum critical point. Finally, we comment on experimental probes that can be used to test our picture.

[1] Aaron L. Sharpe, Eli J. Fox et al; arXiv:1901.03520

12:00pm noon
Thursday, June 13, 2019
Duboc Room (4-331)

Host: Debanjan Chowdhury