Correlations and topology in twisted bilayer graphene/WSe2 heterostructures.

U. Chandni *

Department of Instrumentation and Applied Physics, Indian Institute of Science, Bangalore 560012, India
*Email: chandniu@iisc.ac.in

Periodic potentials lay the foundation for solid state systems and their electronic band structures. When a secondary periodic potential is introduced in the form of a moiré superlattice with a long wavelength, the electronic band structure is heavily modified by the formation of minibands. In recent years, graphene and related layered materials have garnered considerable attention since they provide easy access to the moiré physics via tunability of the interlayer twist angles. The formation of extremely flat bands at certain 'magic' angles in twisted bilayers of graphene (tBLG), has led to the observation of correlated insulating states and superconductivity and other exotic states such as Chern insulators, orbital ferromagnets, and nematic phases. The dielectric environment of tBLG can play an important role in controlling electronic correlations within the flat bands. In this talk, I shall highlight various facets of many-body correlations that we have explored using a combination of magneto-transport and thermoelectric measurements in tBLG coupled to tungsten diselenide (WSe_2), which introduces a finite spin-orbit coupling. The primary findings are symmetry-broken phases at half-integer band fillings, orbital ferromagnetism, and tunable reconstructions of the Fermi surface below half-filling of the moiré band. Overall, our results suggest that proximity with transition metal dichalcogenide dielectrics is a promising pathway to further understand and explore the nature of correlated phases away from the commensurate fillings.

References

[1] S. Bhowmik *et al.*, Nature Physics, 18, 639-643 (2022).
[2] S. Bhowmik *et al.*, Nature Communications, 14, 4055 (2023)