Correlated and topological electronic phases in narrow band moiré systems

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Understanding and taming correlated electronic phases is one of the central problems of modern condensed matter physics and an important milestone on the way towards new technologies such as topological quantum computation. Owing to recent advances in fabrication techniques, van der Waals (vdW) heterostructures have become one of the most active platforms for the experimental investigation of exotic electronic phases in 2D. My talk will focus on the physics of moiré superlattices, which arise from small rotational misalignment between layers in vdW structures. This interlayer twist parameter enables one to obtain narrow electronic bands that promote electronic correlations in a highly tunable setting where electron density can be tuned in situ over the entire electronic band. I will present recent studies of twisted bilayer graphene in which partial band filling leads to superconductivity and correlated insulating states with both trivial and non-trivial topology. I will also discuss a system composed of twisted monolayer and bilayer graphene which hosts novel gate-switchable quantum anomalous Hall states and helps us understand the relationships between the phases in moiré systems.

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