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Electrons in 2D moiré superlattices

Abstract: When two van der Waals materials of slightly different orientations or lattice constants are overlaid, a moiré pattern emerges. The moiré pattern introduces a new length scale, many times the lattice constant of the original materials, for Bragg scattering of Bloch electrons in each layer. This gives rise to moiré minibands and rich emergent quantum phenomena. In this talk, I will discuss recent experiments on angle-aligned semiconductor heterobilayers, which exhibit remarkable correlated insulating states [1,2,3]. I will also discuss the prospect of using moiré superlattices as a quantum simulator.

References:
1. Y. Tang et al., Nature 579, 353-358 (2020).
2. Y. Xu et al., Nature 587, 214–218 (2020).
3. C. Jin et al., Nat. Mater. 20, 940-944 (2021).

Bio: Jie Shan is a professor of applied & engineering physics and physics at Cornell University. She received her diploma in mathematics and physics from Moscow State University, Russia, and Ph.D. in physics from Columbia University. Before joining Cornell in 2018, she has been on the physics faculty at Case Western Reserve University and Penn State University. Research in her group is focused on experimental studies of the electronic and optical properties of nanoscale materials. Current activities have involved the investigation of two-dimensional atomic crystals and heterostructures, such as graphene and transition metal dichalcogenides.