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Title of the Presentation: Quantum Criticality in Twisted Transition Metal Dichalcogenides

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Short Biography:

Dr. Lei Wang is a professor in Physics department, Nanjing University. He received the B.S. (2005) in Electrical Engineering from National University of Singapore. In 2014, he earned a Ph.D. in Electrical Engineering at Columbia University, where he studied the electronic transport properties of the atomically thin two-dimensional (2D) materials. In particular, Dr. Wang developed the novel 'pick-up' transfer and edge-contacting technique to achieve 2D material devices in an ultra-clean limit in 2013. These methods also establish a platform to assemble the van der Waals heterostructures layer by layer for device applications in multiple research directions. Between 2015 and 2018, he won the Kavli postdoctoral fellowship at Cornell University, where he has been exploring 2D materials-based unconventional electronics tuned by their topological property changes.

Abstract:

In strongly correlated materials such as cuprates, pnictides and heavy Fermion systems, a plethora of ordered phases have been observed, including Mott insulators, superconductors and density waves. The most intriguing electronic properties of these materials are not found in these ordered phases, but instead in the metallic phases that are adjacent to them. Near criticality, these metallic phases exhibit anomalous transport properties that defy description by the Landau Fermi liquid paradigm. One striking manifestation of this is the temperature and magnetic field dependence of the resistance of the metallic phase, which deviates strongly from the expected T^2 or B^2 dependence predicted by Fermi liquid theory. Here, we use transport measurements to characterize the gate-driven metal-insulator transitions and the metallic phase in twisted WSe_2 near half-filling of the first moire subband. We find that the metal-insulator transition as a function of both density and displacement field is continuous. At the metal-insulator boundary, the resistivity displays strange metal behaviour at low temperature with dissipation comparable to the Planckian limit.

[1] A.Ghiotto…L.Wang✉ et al., ***Nature*** 597, 345-349, (2021).