复旦大学物理系 Colloquium

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Correlated Electronic States in Moire Superlattices of Monolayer Semiconductors

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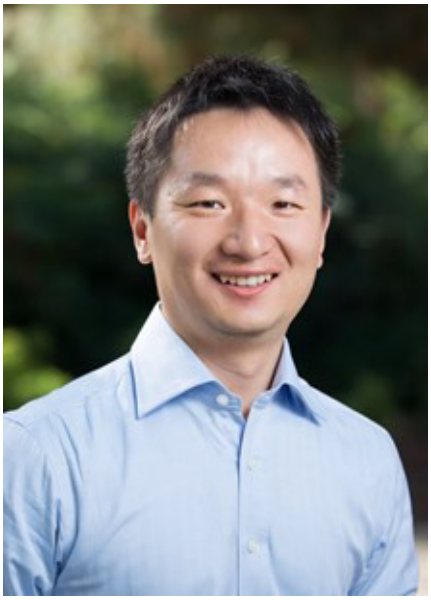
Abstract: Atomic layered materials provide a rich platform to discover and explore new electronic phases in two dimensions. Recent advances in fabrication techniques provide new capabilities to create angle-aligned multilayer stacks of 2D materials with similar structures, forming moire superlattices with a periodicity much larger than atomic lattices. Novel electronic states, such as superconductivity, correlated insulators, magnetism, have been experimentally discovered in moire superlattices based on graphene and transition metal dichacolgenides (TMD), which has been attributed to the formation of flat mini bands that enhances the electronic correlation. In this talk, I will talk about our recent work on the study of correlated states in TMD moire superlattices. We employ scanning microwave impedance microscopy to probe the local conductivity of these moire superlattices. We find that insulating states can appear when the moire superlattice is partially filled, unexpected from the conventional band theory, hence correlated in nature. The filling percentage is a series of simple fractions, which can be understood as charge orderings in the moire superlattice as a result of strong and long range electron interactions. We further study various methods to characterize and manipulate these correlated states.



Bibliography: Yongtao Cui is an Assistant Professor in the Department of Physics and Astronomy at the University of California, Riverside. He obtained his BS in Physics from Peking University in 2005, and his PhD degree in Applied Physics from Cornell University in 2011. He then moved to Stanford University for postdoc research on the development and application of Microwave Impedance Microscopy. He joined UC Riverside in the summer of 2016. His research mainly focuses on the study of electronic states in 2D quantum materials with scanning probe microscopy and development of new characterization capabilities.