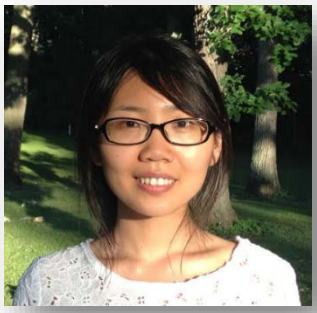
UCLA College | Physical Sciences Physics & Astronomy

# Physics and Astrophysics Special Seminar

Monday, March 22, 2021
2:00 p.m.

# Probing quantum matters in flatlands




## Qianhui Shi
Columbia University


Interactions between electrons in quantum many-body systems can lead to new phases of matter. The two-dimensional van der Waals materials host versatile individual properties and also facilitates tunability and integration, and, therefore, could serve as ideal building blocks. The effects of correlations are the most prominent when the electron kinetic energy is suppressed, e.g., in Landau levels formed under a perpendicular magnetic field, or flat bands formed in Moiré superlattices resulting from two slightly misaligned layers. In this talk, I will discuss our recent work exploiting high-resolution thermodynamic and transport measurements to explore quantum phases in the Landau level platforms. I will show that a bilayer $WSe_2$ makes a natural platform for interlayer exciton condensate in the strong coupling limit; in addition, a graphene double-layer heterostructure with boron nitride spacer provides a playground for several classes of two-component fractional quantum Hall states, some of which likely host exotic exchange statistics. Finally, I will discuss how these findings pave the way for further exploration of new phases of matter, especially in the Moiré superlattice platforms.

Qianhui Shi is a postdoc researcher at the physics department at Columbia University, before which she obtained her PhD in physics at University of Minnesota in Oct 2017. Her research efforts have focused on electronic properties in low dimension systems, with her PhD studies on conventional 2D systems realized in quantum wells, and postdoc work on van der Waals 2D materials. Examples of her past research subjects includes exotic quantum Hall states, exciton condensates, stripe phases, and non-equilibrium transport phenomena. Qianhui is interested in realizing and probing exotic quantum phases of matter exploiting van der Waals material as building blocks.