ASU Department of Physics
Arizona State University

COLLOQUIUM

Thursday, September 19, 2024

Refreshments at 3:15pm outside PSF 101
Colloquium from 3:30pm - 4:30pm in PSF 101

Designer States in Van der Waals Heterostructures

Professor Brian LeRoy

University of Arizona

Abstract:

The ability to create arbitrary stacking configurations of layered two-dimensional materials has opened the way to the creation of designer band structures. Twisted bilayer graphene and graphene on hexagonal boron nitride are two of the simplest examples of such a van der Waals heterostructure where the electronic properties of the composite material can be fundamentally different from either individual material. These van der Waals heterostructures can be formed using a wide variety of layered materials including transition metal dichalcogenides, graphene and topological insulators. The lattice mismatch and twist angle between layers in the heterostructure produces a moiré pattern which affects its electronic and optical properties. This talk will mostly focus on creating novel states by picking the layers, controlling the twist angle and breaking inversion symmetry. In small twist angle bilayer graphene or transition metal dichalcogenides, the long-wavelength moiré pattern leads to the creation of flat bands and a wide range of correlated electronic states. In this talk, I will discuss on our fabrication of van der Waals heterostructures and measurements using scanning probe microscopy and optical spectroscopy.

Biography:

Brian LeRoy is a Professor and the Associate Department Head in the Physics department at the University of Arizona. He joined the UA faculty in 2006 after completing a post-doctoral research position at the Delft University of Technology, working on scanning tunneling spectroscopy of carbon nanotubes. He received his PhD from Harvard University, studying electron flow through semiconductor heterostructures. His current research interests are in the electrical and optical properties of low dimensional materials and van der Waals heterostructures. These measurements are performed using a combination of scanning probe microscopy and optical spectroscopy techniques. He has published extensively on the local electronic properties of van der Waals heterostructures, including the first observations of moiré patterns in graphene/boron nitride heterostructures and the modification of the band structure. He received an NSF CAREER award for his research into local electronic properties of materials. He is also an APS Fellow and is on the editorial advisory board for the journal APL Materials.

Host: Prof. Onur Erten
View our Fall 2024 Physics Colloquium schedule at https://physics.asu.edu/colloquia