



“Probing correlated states with excitons in van der Waals heterostructures”

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Physics and Astronomy

University of California, Riverside

Friday, June 05, 2026, 11:00am – 12:00pm

Venue: Elliott Hall – Room 130C

147 South Bedford St, Burlington, MA

The seminar is both in person and [Online](#)

Abstract:

Since the isolation of atomically thin van der Waals (vdW) materials, vdW heterostructures have been used to engineer new quantum phenomena at the two-dimensional (2D) limit. Semiconducting transition metal dichalcogenide (TMD) monolayers are of particular interest because they serve as a highly tunable platform hosting both 2D electron gases and light-induced electron-hole bound pairs, known as excitons. In this talk, I will demonstrate how we utilize excitons as highly sensitive optical probes to explore correlated electronic behavior in these systems. First, I will highlight their use in studying correlated electron-hole fluids, revealing the formation of interlayer excitons and perfect Coulomb drag. I will then present recent work from my group exploring correlated insulating phases in TMD moiré heterostructures. By performing optical spectroscopy, we identify moiré-induced exciton species that can detect charge localization between different moiré sites and layers. Together, these findings establish excitons as a versatile optical probe for mapping the complex landscape of correlated electron phenomena in van der Waals systems.



Bio: Andrew Joe is an Assistant Professor in the Department of Physics and Astronomy at the University of California, Riverside. Prior to joining UC Riverside, he was a postdoctoral fellow at UC Berkeley and the Lawrence Berkeley National Laboratory (LBNL), where his research focused on electrostatically created interlayer excitons. He received his Ph.D. in Physics from Harvard University, working with Philip Kim and earned his B.A. in Physics from Cornell University. As an experimental condensed matter physicist, his research centers on discovering novel quantum phenomena in low-dimensional materials. By combining advanced electrostatic control and nanoscale device engineering, his group investigates moiré superlattices in van der Waals heterostructures, strongly correlated electron-hole fluids, and emerging electronic and optoelectronic properties in novel quantum materials.