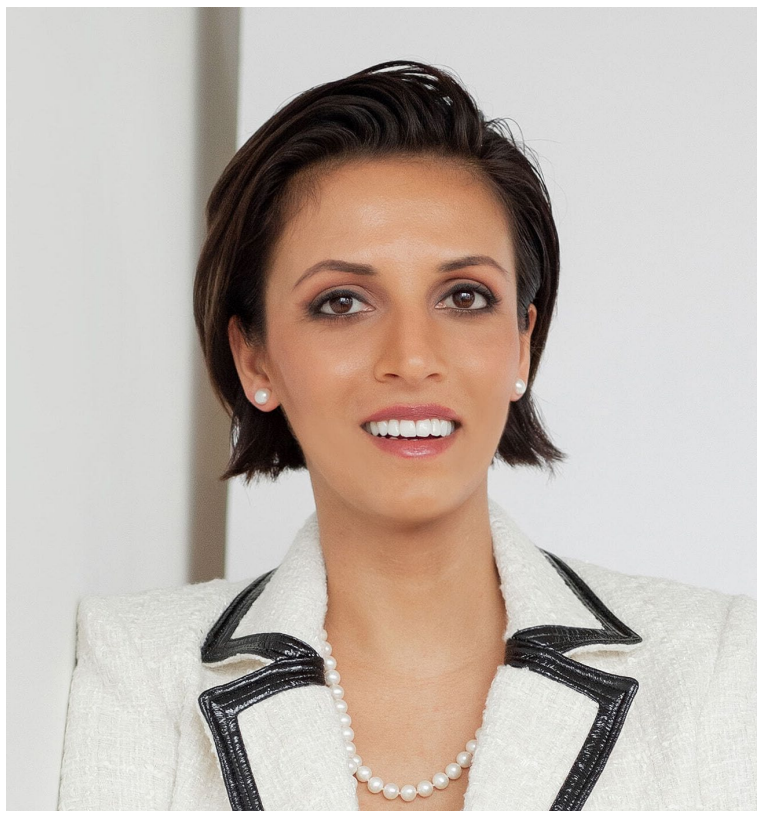
UCLA College | Physical Sciences Chemistry & Biochemistry

PHYSICAL CHEMISTRY SEMINAR



Prof. Prineha Narang

Department of Chemistry and Biochemistry
University of California, Los Angeles

Monday, April 17, 2023

4:00 PM | YH 4222

Mani L. Bhaumik Collaboratory -

Dongwon Yoo Seminar & Conference Hall

Predicting Electron Hydrodynamics and Signatures of Unconventional Transport

Abstract: The re-invigorated field of electron hydrodynamics in quantum matter has recently garnered considerable scientific interest, both due to its technological promise of designing near dissipation-less nanoelectronics, as well as its fundamental importance as an experimental probe of strong electron-electron interactions. Investigating the capacity to which observations of electron hydrodynamic flows can inform the nature of electron-electron interactions is particularly important and timely with the advent of spatially-resolved transport measurements which, having demonstrated the hallmark spatial signature of electron hydrodynamic channel flow, must now turn their attention to studying more spatially-complex geometries, enabling the observation of intricate fluid phenomena such as vortices. Recently we have explored the effects of crystal symmetry on electron fluid behaviors starting from the most general viscosity tensors in two and three dimensions, constrained only by crystal symmetry and thermodynamics. In our work we demonstrate the anomalous landscape for electron hydrodynamics in systems beyond graphene, highlighting that previously-thought exotic fluid phenomena can exist in both two-dimensional and anisotropic three-dimensional materials with or without breaking time-reversal symmetry. In this context, the first part of my talk will discuss our recent predictions of hydrodynamics beyond graphene, especially the role of phonons in hydrodynamics in Weyl semimetals. We identify phonon-mediated electron-electron interactions, computed with techniques developed in the group that I will discuss in this talk, as critical in a microscopic understanding of hydrodynamics. The second part of my talk will introduce a new theoretical and computational transport framework from our group, the SpaRTaNS (Spatially Resolved Transport of Nonequilibrium Species) framework. I will discuss applications of this method in nonequilibrium electron and phonon transport in quantum matter. Time permitting, building on our recent work in magnetic Weyl semimetals, I will discuss possible approaches to understand and realize axion physics in condensed-matter systems.

Please contact isaiahgtz@chem.ucla.edu for additional information.