PRINEHA NARANG

June 28, 2022
12:00 to 13:30
UOC Auditorium

"PREDICTING AND PROBING CARRIER INTERACTIONS IN QUANTUM MATTER USING ELECTRON HYDRODYNAMICS"

By Prineha Narang (Harvard University, Massachusetts, USA)

BIOGRAPHY:

Prineha Narang is an Assistant Professor of Computational Materials Science at Harvard University where she leads an interdisciplinary group working on topics at the vibrant intersection of computational science, dynamics in quantum matter, and quantum information science. Tenured and promoted, starting July 1st 2022, she will be on the UCLA faculty in physical sciences as the Howard Reiss Chair. Prior to starting on the Harvard faculty in 2017, Dr. Narang was an Environmental Fellow at HUCE, and worked as a research scholar in condensed matter theory in the Department of Physics at MIT. She received an M.S. and Ph.D. in Applied Physics from Caltech. Narang's work has been recognized by many awards and special designations, including the 2022 Outstanding Early Career Investigator Award from the Materials Research Society, Mildred Dresselhaus Prize, Bessel Research Award from the Alexander von Humboldt Foundation, a Max Planck Award from the Max Planck Society, and the IUPAP Young Scientist Prize in Computational Physics all in 2021, an NSF CAREER Award in 2020, being named a Moore Inventor Fellow by the Gordon and Betty Moore Foundation for pioneering innovations in quantum science, CIFAR Azrieli Global Scholar by the Canadian Institute for Advanced Research, a Top Innovator by MIT Tech Review (MIT TR35), and a leading young scientist by the World Economic Forum in 2018. Narang has organized several symposia and workshops relevant to the proposed work, most recently at the APS March Meeting on ï¿½Materials for Quantum Information Scienceï¿½. Her conti ued service to the community includes chairing the Materials Research Society (MRS) Sp ing Meeting (2022) and the MRS-Kavli Foundation Future of Materials Workshop: Computati nal Materials Science (2021), as an Associate Editor at ACS Nano, organizing APS, Optica (O A), and SPIE symposia, and a leadership role in APS' Division of Materials Phys

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[1-4], especially the role of phonons in hydrodynamics [5-10]. 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[11], with an outlook on extending it to magnon

transport in quantum matter.

REFERENCE(S):

SpaRTaNS: Link to Github https://narang-lab.github.io/spartans/

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