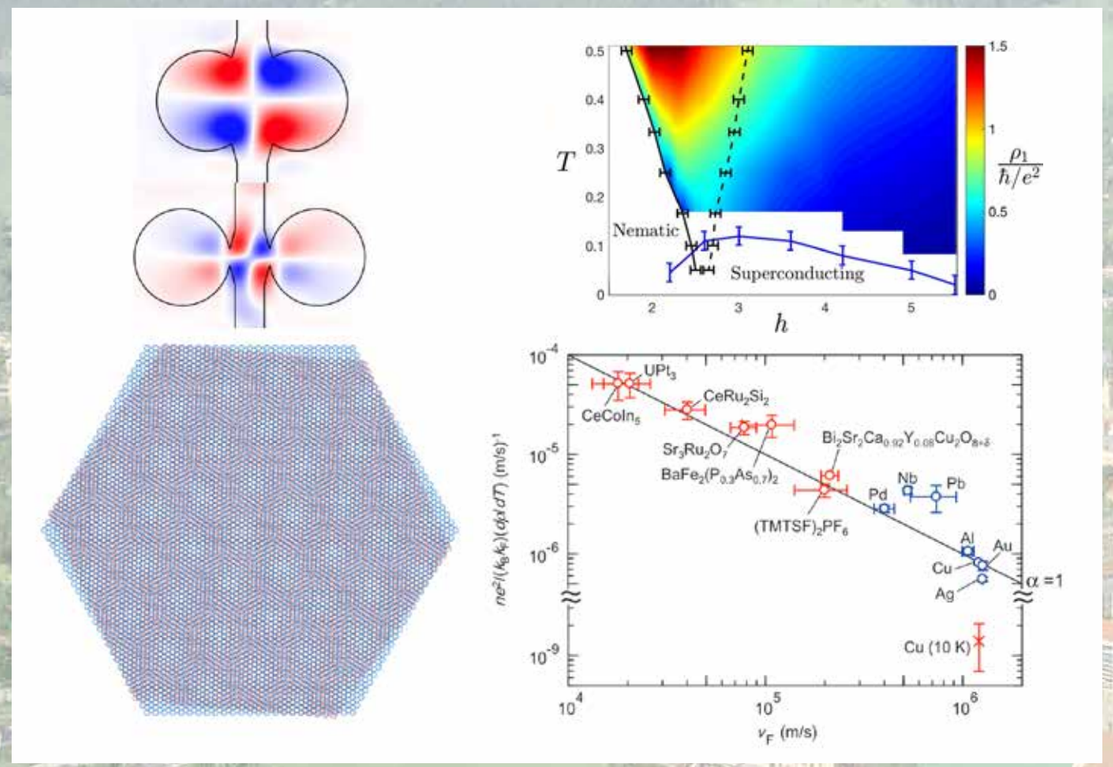
Boulder School for Condensed Matter and Materials Physics

Dynamics of Strongly Correlated Electrons

June 30-July 25, 2025

The past few decades have seen tremendous progress in the study of quantum materials with strongly correlated electrons, both in theory and in experiment. At the same time, many important challenges remain. We still lack a full theory of high-temperature superconductivity and the adjacent strange metal phase. New materials are being discovered, including twisted van der Waals heterostructures, which experimentally probe regimes requiring new theoretical frameworks. This school focuses on some of the profound and long-standing challenges and mysteries in the field of correlated quantum materials, and covers both theoretical and experimental advances. Experimental topics include the quantum chemistry of correlated electron systems, to novel platforms such as Moiré materials, to state-of-the-art techniques to detect quasiparticles (or the lack thereof) in material systems. Theoretical topics will include transport and hydrodynamic theory, quantum phase transitions and superconductivity, application of quantum field theory methods to correlated metals, and computational methods.

Peter Armitage (Johns Hopkins)
Andrey Chubukov (Minnesota)
Luca Delacretaz (Chicago)
Philip Kim (Harvard)
Steven Kivelson (Stanford)
Leonid Levitov (MIT)
Allan MacDonald (UT Austin)
Andrew Mackenzie (MPI-CPfS)
Dmitrii Maslov (Florida)
Margaret Murnane (JILA)
Frank Pollmann (TU Munich)
Subir Sachdev (Harvard)
Lucile Savary (ENS Lyon)
Leslie Schoop (Princeton)
T. Senthil (MIT)
Jie Shan (Cornell)



Top left: "Local current flow illustrating ohmic (top) vs. viscous (bottom) electronic transport regime" (arxiv/2202.02798); Top right: "Numerically obtained phase diagram with high-temperature superconductivity and non-Fermi liquid transport near a nematic quantum critical point in a metal" (Lederer et al., PNAS 2017); Bottom left: "A moiré superlattice, realized in a bilayer graphene, as a tunable correlated electron system with a rich phase diagram"; Bottom right: "A broad variety of quantum materials with linear-in-temperature resistivity consistent with a "Planckian" scattering time" (Science.339(6121) pp. 804-807).

Scientific Organizers:
Debanjan Chowdhury (Cornell)
Sean Hartnoll (Cambridge)
Minhyea Lee (CU Boulder)
Andrew Lucas (CU Boulder)
Director: Leo Radzihovsky (CU Boulder)

The school will pay for most local expenses, and there are travel grants available for participants from U.S. universities. Students and postdocs interested in participating should submit an electronic application by the January 15 deadline. The application form, and detailed information regarding housing, travel and financial support are available at

http://boulderschool.yale.edu/

The Boulder School in Condensed Matter and Materials Physics provides expert training, not usually available within the traditional system of graduate and post-graduate education, for advanced graduate students and postdoctoral researchers working in condensed matter physics, materials science and related fields. The School is supported by the National Science Foundation and meets annually during July in Boulder, Colorado.