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INSIGHT SEMINAR: Strong interactions and isospin symmetry breaking in a supermoire lattice

AMIR YACOBY

May 09, 2024
15:00 to 16:00
Elements Room

In multilayer moire heterostructures, the interference of multiple twist angles ubiquitously leads to tunable ultra-long-wavelength patterns known as supermoire lattices. However, their impact on the system's many-body electronic phase diagram remains largely unexplored. We present local compressibility measurements revealing numerous incompressible states resulting from supermoire-lattice-scale isospin symmetry breaking driven by strong interactions. By using the supermoire lattice occupancy as a probe of isospin symmetry, we observe an unexpected doubling of the miniband filling near ?=?2, possibly indicating a hidden phase transition or normal-state pairing proximal to the superconducting phase. Our work establishes supermoire lattices as a tunable parameter for designing novel quantum phases and an effective tool for unraveling correlated phenomena in moire materials.

BIO:

Amir Yacoby is a Professor of Physics and Applied Physics at Harvard University. He received his bachelor's degree in the field of Aerospace engineering and then transitioned into Physics. Following a Master's degree in theoretical Physics, Yacoby received his PhD in experimental condensed matter physics in 1994 from the Weizmann Institute of Science. Professor Yacoby is a member of the National Academy of Science, a member of the American Academy of Arts and Sciences, Fellow of the American Physical Society, member of the American Academy for Advancement of Science and an external member of the Max Planck Society.

Professor Yacoby works to develop new experimental techniques to explore quantum matter and uses these techniques to obtain new insights into their underlying quantum mechanical properties.

ABSTRACT:

In multilayer moire heterostructures, the interference of multiple twist angles ubiquitously leads to tunable ultra-long-wavelength patterns known as supermoire lattices. However, their impact on the system's many-body electronic phase diagram remains largely unexplored. We present local compressibility measurements revealing numerous incompressible states resulting from supermoire-lattice-scale isospin symmetry breaking driven by strong interactions. By using the supermoire lattice occupancy as a probe of isospin symmetry, we observe an unexpected doubling of the miniband filling near ?=?2, possibly indicating a hidden phase transition or normal-state pairing proximal to the superconducting phase. Our work establishes supermoire lattices as a tunable parameter for designing novel quantum phases and an effective tool for unraveling correlated phenomena in moire materials.

Hosted by: Prof. Dr. Adrian Bachtold