TcSUH Bi-Weekly Seminar

Photoirradiation in Quantum Many-Body Systems

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In Person – Room 102, Houston Science Center, 12:00 p.m. – 1:00 p.m
Sandwiches will be provided on a first-come, first-served basis.

ABSTRACT: Almost four decades after discovering cuprate superconductors, an overarching explanation of the microscopy mechanism that allows otherwise repulsive electrons to pair still eludes us. Many effects, including charge density wave formation (stripes) and local antiferromagnetic order with an anti-phase across a stripe, seem challenging to disentangle from the observed pairing with a nodal symmetry (d-wave), ultimately asserting whether they cooperate or compete with superconductivity. Recent experiments, however, have approached this investigation from another angle: By temporally disturbing the system, one can potentially suppress some of these effects, allowing tipping the balance to understand in which way the interplay goes. Experimentally, this is accomplished by introducing an ultrafast optical pulse, typically at a terahertz frequency, which disturbs the system in a very short time. After a brief review of existing experiments, I will introduce results we have obtained in my group that point to the change of character of the ground-state of a system upon fine-tuned time-dependent perturbation in various settings, using minimal quantum many-body models that are dynamically solved utilizing numerically unbiased techniques.

BIO: Rubem Mondaini is an Assistant Professor at the University of Houston focusing on studying quantum many-body systems; he previously held a position as an Assistant Professor at the Beijing Computational Science Research Center, China. His group employs large-scale computing methods to understand the behavior of quantum-correlated matter within regimes of in- and out-of-equilibrium conditions. His specific interests are the interplay of charge ordering, magnetism, and pairing in high-Tc's and applications of quantum computing to solve exponentially intractable problems in classical computers. In particular, he has contributed to the 'sign problem' that inherently appears in quantum Monte Carlo simulations and its relations with either quantum or thermal phase transitions. Additionally, he focuses on the emergent behavior of isolated quantum systems and how they exhibit thermalization or lack thereof. Lastly, collaborating with experimentalists utilizing quantum emulators allows one to understand fundamentally and test protocols based on simulations that successfully perform quantum communication of entangled states across an actual quantum device and probe fundamental properties of quantum mechanical systems, such as the quantum speed limit.