THE CHINESE UNIVERSITY OF HONG KONG
Department of Physics
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Investigating the Intricacy of the Spin-1/2 Square Lattice Beyond High-Temperature Superconductivity

by

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Time: 10:30 - 11:30 a.m.
Place: Rm G25, Science Centre North Block, CUHK

ALL INTERESTED ARE WELCOME
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Abstract

High-temperature superconducting cuprates (HTSC) are, after so many years from their discovery, still challenging our understanding of the physics of solids. The core of their complexity is a square lattice of spin-1/2 atoms, combined with strong correlations between the electrons and long-range interactions. Despite the apparent simplicity of the lattice, the entanglement between the electrons gives rise to a plethora of unconventional phenomena, of which superconductivity is just the tip of the iceberg.

In this talk, I will first show how the strength of long-range interactions can be tuned by structural means in infinite-layer undoped cuprates. By using Resonant Inelastic X-ray Scattering, I will demonstrate how these tuning leads to the emergence of novel magnetic [1] and orbital excitations [2], previously unreported in two-dimensional systems. Then, I will move to one of the current hot topics of HTSC: the physics of charge density fluctuations, which seem intrinsically linked to the emergence of the strange metal phase [3]. I will show how the combination of uniaxial strain with RIXS can shed light on the nature of quantum fluctuations of the charge order parameter.

[1] L. Martinelli, et al., Fractional spin excitations in the infinite-layer cuprate CaCuO2, Physical Review X 12 (2022): 021041.
[2] L. Martinelli, et al., Collective nature of orbital excitations in layered cuprates in the absence of apical oxygens, Physical Review Letters 132 (2024): 066004.
[3] R. Arpaia, L. Martinelli et al.,Signature of quantum criticality in cuprates by charge density fluctuations, Nature Communications 14 (2023): 7198.

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