Tata Institute of Fundamental Research
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Seminar

Non-equilibrium dynamics of charge and spin in a photo-excited Mott insulator

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Pump-probe experiments on the spin-orbit coupled Mott insulator Sr_2IrO_4 reveal a striking separation of timescales: low-energy optical weight emerges almost instantly after photoexcitation, while the collapse and subsequent recovery of three-dimensional magnetic order occur much more slowly. This disparity has often been attributed to weak interlayer coupling in Sr_2IrO_4.

In this talk, I will show that the effect originates more fundamentally from the distinct nature of charge and spin dynamics in correlated systems. Using a combination of spatio-temporal mean-field dynamics and Langevin dynamics in a photo-excited Mott-Hubbard model, we find that charge relaxation proceeds on a short, nearly fluence-independent timescale, while magnetic recovery involves domain growth and shows a strong fluence dependence, even in purely two-dimensional systems.

Beyond clarifying the iridate case, this framework provides a general approach to study phase competition and spatial ordering in out-of-equilibrium superconductors and charge-ordered systems.

Friday, Oct 17th 2025

16:00 Hrs (Tea / Coffee 15:45 Hrs)

Seminar Hall, TIFRH