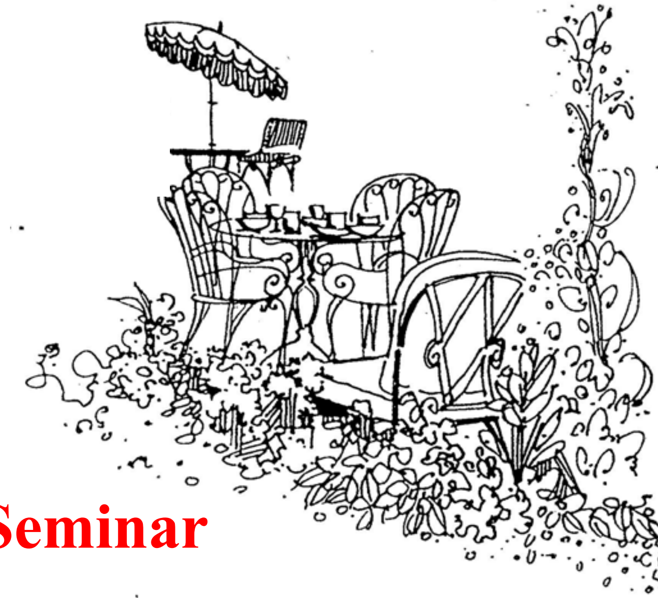
Chez Pierre

Presents ...

Monday, December 14, 2020

12:00pm Noon

Broadcast via Zoom



Chez Pierre Seminar

Edoardo Baldini - Massachusetts Institute of Technology

"Nonequilibrium terahertz probing of exotic phases in correlated insulators”

Ultrafast laser science has recently emerged as a powerful means to investigate and manipulate the properties of complex phases in quantum materials. On the one hand, weak laser pump pulses can gently perturb the ground state of solids with many intertwined order parameters, exposing in the time domain specific elementary excitations that would otherwise be buried in congested equilibrium spectra. On the other hand, increasing the laser pump intensity can lead to the creation of transient phases of matter that do not exist in thermodynamic equilibrium. In both cases, the development of advanced probing schemes plays a crucial role in revealing the details of the nonequilibrium dynamics. In this respect, here I will discuss novel opportunities in using broadband terahertz (THz) probes as a sensitive tool to detect the low-energy (meV) single-particle and collective response of strongly correlated insulators. In particular, I will first illustrate the ability of ultrafast THz light to advance the understanding of the famous Verwey transition in magnetite, unveiling the low-lying collective modes that govern electronic ferroelectricity within the material’s charge-orbitally ordered state [1]. Afterwards, I will describe how THz probes also allow for the direct visualization of a transient antiferromagnetic metallic phase driven by spin-orbit-coupled excitons in a van der Waals correlated insulator [2]. These results highlight the strength of combining tailored light excitation protocols of quantum materials with selective probing of their rich low-energy electrodynamics.

[1] E. Baldini*, C. A. Belvin*, et al., Nature Physics 16, 541-545 (2020)
[2] C. A. Belvin*, E. Baldini*, et al., submitted.