

Chez Pierre

Presents ...

Monday, September 21, 2020

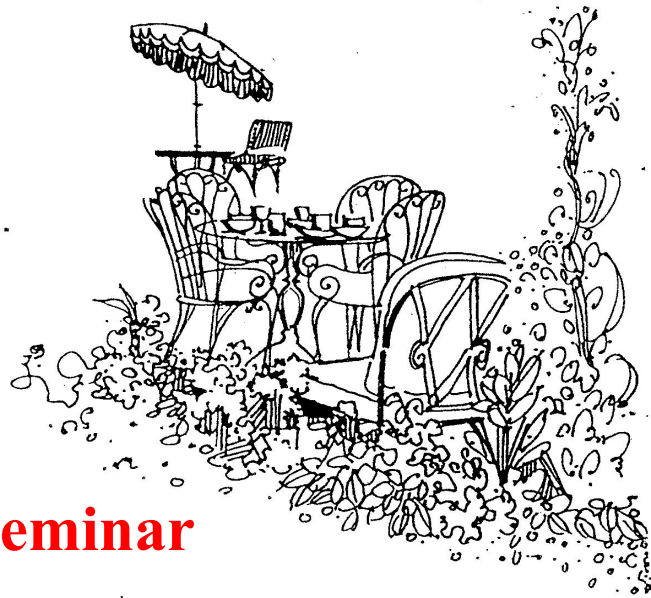
12:00pm Noon

MIT virtual seminar

Chez Pierre Seminar

James Valles – Brown University

“Bosonics”



The electronic devices that enable us to check in regularly with family and friends rely on particles that are inherently anti-social. Electrons, as fermions, refuse to co-occupy the same quantum state. Swap two fermions between two states and they answer with a “negative” sign. Now imagine bosonic devices in which the charged particles are bosons. Communal, they are willing to join coherently into a single quantum state.

I will describe investigations that have uncovered bosonic insulating and metallic phases in which Cooper pairs, as the bosons, dominate the transport. The Cooper pair insulator state forms in thin s-wave superconducting films near a 2D Superconductor-Insulator Quantum Phase Transition (SIT). Our latest magnetic impurity doping studies reveal strong evidence that it is a Mott insulator, rather than an Anderson insulator, with interactions screened by virtual quasi-particle excitations. The Cooper pair metal state appears as an intermediate finite resistance state between superconductor and insulator in a SIT in patterned cuprate films. The appearance of quantum oscillations with a period set by the superconducting flux quantum concomitant with the vanishing of the Hall coefficient strongly suggest that the transport involves incoherent Cooper pair transport. The talk will include brief speculation on why the bose metal phase does not appear in the s-wave films and how the local phase coherence inherent in these bosonic states provides a novel knob for tuning their properties.