Chez Pierre

Presents ...

Monday, May 11, 2015
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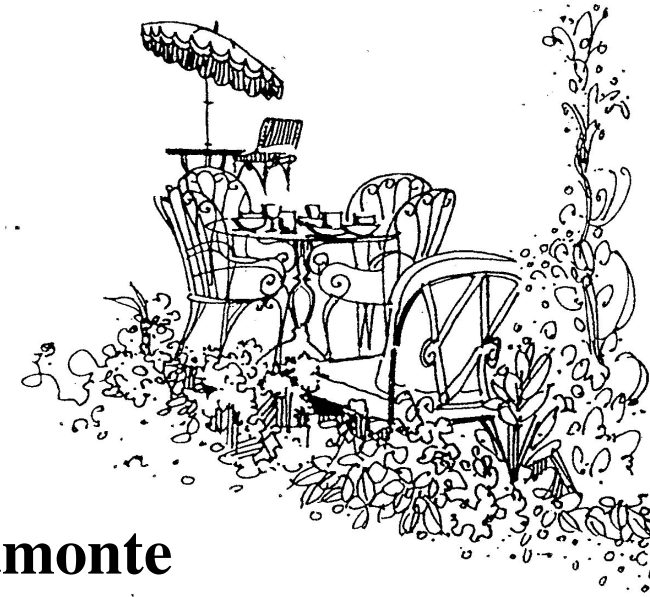
MIT Room 4-331



Peter Abbamonte

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"Low-energy properties of the bosonic spectral function of $Bi_2Sr_2CaCu_2O_{8+x}$ measured with momentum-resolved electron energy-loss spectroscopy"*

The charged collective modes of a material determine many of its fundamental properties, including its ability to screen charge, its susceptibility to external fields, its tendency to form density wave instabilities, corrections to the quasiparticle self-energy, the strength of renormalized interactions, etc. Unfortunately, it has never been possible to measure the momentum dependence of the charged bosonic modes directly at least not at the energy scales relevant to socalled "quantum" materials of modern interest.

In this talk I will describe our use of momentum-resolved electron energy loss spectroscopy (EELS) to measure the meV bosonic spectral function of the high temperature superconductor Bi_2 Sr_2 $CaCu_2$ O_{8+x} (BSCCO). I will show that the "kink" structure observed in this system with angle-resolved photoemission (ARPES) many years ago arises from the combined action of as many as ten distinct, *c*-axis polarized phonons involving oxygen vibrations in the CuO_2 , BiO, and SrO layers, some of which arise from locally broken inversion symmetry due to the structural supermodulation. Using techniques developed for x-ray scattering, I will also demonstrate a full, two-dimensional reconstruction of the charge propagator, allowing real-time observation of the charge dynamics of the system with femtosecond time resolution. I will also present evidence for short-ranged charge order in BSCCO that are reminiscent of the glassy order observed with scanning tunneling microscopy (STM) ten years ago. This study illustrates a new approach to studying the momentum dependence of low-energy collective charge dynamics that is applicable to quantum materials more broadly.

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