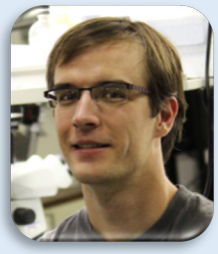
center for nanophysics and advanced materials

Condensed Matter Colloquium

Thursday, April 17, 2014

2 pm, Room 1201



Brad Ramshaw

Los Alamos National Laboratory

Fermi surface measurements approaching the quantum critical point at the heart of $YBa_2Cu_3O_{6+x}$ high-T_c superconductivity

There has been a lot of activity recently regarding broken symmetries in the underdoped cuprates, including the observation of charge order and a new interpretation of the onset of Kerr rotation. Still unresolved is whether these broken symmetries are associated with a quantum critical point near optimal doping, and further, whether such a quantum critical point enhances superconductivity. Previous quantum oscillation studies have shown that the quasiparticle g-factor is consistent with charge rather than spin-order reconstruction of the Fermi surface, but have been unable to access dopings above p~0.12. We show that, on applying magnetic fields in excess of 92 T, the metallic state of $YBa_2Cu_3O_{6+\delta}$ can be accessed almost up to optimal doping. We find that the quasiparticle effective mass diverges approaching a critical doping of p~0.18---direct evidence for a large region of fluctuations surrounding a ground-state change in symmetry. This quantum critical point is further found to lie within a small "island" of superconductivity that persists to magnetic fields above 80 T, thus linking the region of strongest quantum-critical fluctuations to the most robust high-temperature superconductivity.

Refreshments at 1:30 pm in Room 1305F

HOST: Johnpierre Paglione

physics University of Maryland