



center for nanophysics
and advanced materials

Condensed Matter Colloquium

Thursday, February 13, 2014

2 pm, Room 1201



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The Anisotropic Nonlinear Meissner Effect – A New Superconducting Gap Node Spectroscopy

One of the first questions asked when a new superconductor is discovered is whether it has a non-trivial superconducting gap function on the Fermi surface. One signature of unconventional pairing is the presence of nodes in the gap function, giving rise to anisotropic electrodynamic properties, among other things. We have directly imaged the anisotropic nonlinear Meissner effect in an unconventional superconductor through the nonlinear electrodynamic response of both (bulk) gap nodes and (surface) Andreev bound states. A superconducting thin film is patterned into a compact self-resonant spiral structure, excited near resonance in the radio-frequency range, and scanned with a focused laser beam perturbation. At low temperatures, direction-dependent nonlinearities in the reactive and resistive properties of the resonator create photoresponse that maps out the directions of nodes, or of bound states associated with these nodes, on the Fermi surface of the superconductor. The method is demonstrated on the nodal superconductor $\text{YBa}_2\text{Cu}_3\text{O}_{7-d}$ and the results are consistent with theoretical predictions for the bulk and surface contributions. Further tests of the dc magnetic field dependence of the photoresponse are underway. The experiment is being re-designed to investigate new bulk superconductors where the pairing symmetry and existence of nodes in the energy gap are not yet known.

Refreshments at 1:30 pm in **Room 1305F**

