“The Physics Department Spring Seminar Series”
Smith College

Exotic Superconductivity, a pulsed magnetic field, and a tunnel diode oscillator: a match made in... a cryostat

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Date:  Friday, February 26, 2016
Time:  4:15 pm
(refreshments at 4:00 pm)
Place:  McConnell 103

Exotic Superconductivity occurs when it becomes energetically favorable to form Cooper pairs consisting of two electrons with opposite momenta and oppositely aligned spins (magnetic moments). One would expect that due to its spin an electron can orient in a magnetic field in a manner analogous to a compass needle, and destroy the superconducting state when the spin magnetic energy exceeds the binding energy of the Cooper pairs. However in most cases, superconductivity is destroyed in an external magnetic field by vortices -- non-superconducting regions containing a magnetic field line shielded by circulating electrons -- which increase in density as the magnetic field is increased and ultimately displace the superconducting phase. We will show evidence for an exotic superconducting state that exists above the magnetic field limit as determined by vortices. We will also describe the rf penetration depth system and pulsed magnetic field apparatus developed in our laboratory that allows us to see phase transitions in the superconducting state at fields up to 50 tesla and temperatures as low as 0.4 K. Finally we will show how recent calorimetric experiments done in collaboration with Prof. Fortune and his group have richly added to our understanding of the exotic superconducting state.