The T_CSUH Distinguished Lecture Series

Texas Center for Superconductivity at the University Houston

Professor N. P. Ong

Eugene Higgins Professor of Physics
Department of Physics
Princeton University

“The Role of Vortices in Limiting T_c in Cuprate Superconductors”

Date Changed to Friday, April 18, 2008

~~Thursday, April 17, 2008~~

Houston Science Center, Room 102
4–5 p.m. Distinguished Lecture
5–6 p.m. Wine and Cheese Reception

RSVP by Tuesday, April 15, 2008, to 713-743-8213

Abstract

Superconductivity in the copper oxides occurs at temperatures much higher than in all other metals. There is growing evidence that the Cooper pairs actually survive to even higher temperatures. I will discuss Nernst and torque magnetometry experiments which suggest the scenario that, above Tc in the cuprates, long-range phase stiffness is destroyed, rather than the gap order parameter. In the Nernst experiment, the vortex current produced by a temperature gradient generates a Josephson E-field perpendicular to the applied field H. A large Nernst signal eN persisting to a high onset temperature ~130 K is observed in nearly all cuprate families. Extensive Nernst experiments in the cuprates LSCO, Bi 2201, and 2212 yield a 3D phase diagram (x, T, H) in fields up to 45 T. This picture has been confirmed by recent torque magnetometry experiments. In a tilted H, local planar supercurrents associated with vortices above Tc produce a torque that deflects a cantilever. The inferred diamagnetism provides thermodynamic evidence for the vortex liquid picture suggested by the Nernst effect. Recent high-temperature STM experiments providing direct test of these ideas will also be described.

Persons with disabilities who require special accommodations in attending this lecture should contact Jacqui Boulavsky at 713-743-8213 as soon as possible.

Professor N. Phuan Ong is Eugene Higgins Professor of Physics at Princeton University. His current research focuses on the mechanism of high-temperature superconductivity in the cuprates. Superconductivity may have important applications in curbing global warming through greater energy efficiency and bolstering national security by increasing the stability of the national power grid. Prof. Ong joined the Princeton faculty in 1985 after teaching for nine years at the University of Southern California. He was an undergraduate at Columbia University, where Prof. William Happer introduced him to quantum mechanics. Ong earned his Ph.D. in 1976 from the University of California, Berkeley. Prof. Ong has received numerous honors and awards for his scientific accomplishments. In 2006 he was elected to the 226th Class of Fellows of the American Academy of Arts and Sciences. The citation recognized his role in discovering sliding charge density waves while at the University of Southern California, as well as new findings in the field of high-temperature superconductivity at Princeton. His work in both fields, which challenged widely-held assumptions about electrical conduction and the behavior of superconductors, was initially met with skepticism, but was subsequently verified by other research groups. He also shared the 2006 Kamerlingh Onnes Prize, awarded for outstanding experiments that illuminate the nature of superconductivity, and for pioneering and seminal transport experiments that illuminate the unconventional nature of the metallic state of superconducting cuprates. He is a fellow of the American Physical Society (1989), and co-authored patent #4,996,186, “Flux Method for Producing Crystals of $YBa_2Cu_3O_7$” in 1991 with Z. Z. Wang. He held an Alfred P. Sloan Fellowship from 1982 to 1984. His biography is listed in Who’s Who in America (2007) and Who’s Who in Science and Engineering (2006-2007 ed.). Professor Ong’s research interests are in the behavior of electrons in strongly-correlated materials, exemplified by the cuprates, cobaltates, manganites and ruthenates. Experiments over the past two decades have shown that charge transport in these systems is anomalous because of dominant electron-electron interaction. The key transport quantities resistivity, Hall effect and thermopower do not follow the usual textbook prescriptions based on simple metals. His group has been active in exploring experimentally the new patterns seen in these materials. A second interest is in the behavior of how charge transport is affected by spin ordering in all its guises (ferromagnetism, antiferromagnetism, spiral states). The research extends to diverse areas of condensed matter physics, ranging from superconductivity and magnetism to enhanced thermopower, spin currents and the Berry phase in ferromagnets.

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