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Nature of the transition in cuprates: evidence from vortex Nernst and magnetization experiments

N. P. Ong
Princeton University, Ne Jersey, USA

he nature of the pseudogap state which appears at T^* and the nature of the transition to d-wave superconductivity (dSC) at T_c are two related, important issues in the phase diagram of cuprates. I will review recent high-field Nernst-effect results as well as torque magnetometry results that support the following scenario. In the hole-doped cuprates there exists an extended region above the T_c dome in which a large vortex Nernst signal is observed. This is accompanied by a large diamagnetic signal that is robust up to fields above 33 T. The existence of vortex excitations implies that phase coherence is lost at T_c by spontaneous creation of vortices, but the pair condensate amplitude survives for a large interval of T until a temperature T_{onset} which lies about halfway between T_c and T^*. The anomalous behavior of the upper critical field H_{c2} also supports the phase-disordering scenario. The existence of the Nernst region implies that the pseudogap state differs in a subtle way from dSC. On cooling, charge-pairing becomes increasingly evident but long-range phase coherence only develops at T_c. The contrasting case of NdCeCuO where none of these features is apparent, will also be discussed.

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