Specific Heat of High-Temperature Superconducting Cuprates to 45T: Nodal Quasiparticle Density of States and Quantum Oscillations

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Introduction

Specific heat measurements in magnetic fields provide a thermodynamic measurement of the electronic and vortex density of states in high-temperature superconductors [1]. Performing these measurements in a magnetic field as large as 45T allows one to compare the superconducting state with the normal state at low temperatures [2]. We report the temperature and magnetic field dependence of specific heat in YBCO, as well as quantum oscillations in the specific heat. These measurements provide a direct measurement of the density of states of the nodal quasiparticles in the d-wave superconducting cuprates.

Experimental

Experiments were done in both the 33T resistive and 45T hybrid magnets.

![Figure 1: Quantum oscillations plotted on top of magnetization data [3] using a tunnel diode oscillator (TDO). All data were taken on the same sample and magnetization data are phase-shifted by 90 degrees to facilitate direct comparison. FFT reveals a frequency of 540T, consistent with magnetization data.](image)

References

[1] Yuxing Wang et al, PRB 63 094508