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Quantum Oscillations in the Specific Heat of YBCO 6.55 SCOTT RIGGS, OSKAR VAFEK, JON KEMPER, GREG BOEBINGER, MagLab/FSU, JON BETTS, ALBERT MIGLIORI, LANL, ROSS MCDONALD, DOUG BONN, WALTER HARDY, RUIXING LIANG, UBC — We measure the specific heat of underdoped YBCO 6.55 in magnetic fields up to 45T in order to provide a first study of the thermodynamics of the normal state in the high temperature superconducting cuprates. Our experiments are motivated by quantum oscillation measurements of resistivity and magnetization over the past several years that have been interpreted in the context of the standard Lifshitz-Kosevich (LK) formalism for conventional metals. We find quantum oscillations in the specific heat of the cuprates for the first time ever and reveal that the normal state exhibits a seemingly-contradictory mixture of conventional and unconventional behavior. We find that LK theory can quantitatively describe the temperature-dependence of the specific heat as well as the temperature- and field-dependence of the quantum oscillations in specific heat. However, the magnetic field dependence of the specific heat follows the sqrt(B) behavior of the superconducting state over our entire magnetic field range. As the superconducting state is suppressed (Tc –> 0) at ∼30T in this sample, why does specific heat at 45T give evidence for a superconducting gap? Some ideas will be presented.

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