Abstract for an Invited Paper
for the MAR09 Meeting of
The American Physical Society

Competing order, Fermi surface reconstruction, and quantum oscillations in high temperature superconductors[1]

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Recent quantum oscillation measurements in underdoped high temperature superconductors in high magnetic fields and low temperatures have ushered in a new era. These experiments appear to explore the normal state from which superconductivity arises and provide evidence of a reconstructed Fermi surface consisting of electron and hole pockets in a regime in which such a possibility was previously considered to be remote. Here we explain the observations with the theory that the alleged normal state exhibits a hidden order, the d-density wave. The success of our analysis underscores the importance of spontaneous breaking of symmetries, Fermi surface reconstruction, and quasiparticles. We primarily focus on the version of the order that is commensurate with the underlying crystalline lattice, but also touch upon the consequence of incommensuration. In addition, the effect of possible bilayer splitting and the nature of quantum oscillations in the mixed state are addressed.

[1]Supported by NSF DMR-0705092