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The electronic state of underdoped YBCO at high magnetic fields and low temperatures: evidence from quantum oscillatory phenomena[1]

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Quantum oscillations in bulk and transport properties have been observed in underdoped $YBa_2Cu_3O_{6+x}$ via a range of techniques and by independent researchers in applied magnetic fields above 20T and temperatures below 10K. The consensus is that the oscillations are periodic in the reciprocal of the magnetic field and consist of a number of components with frequencies (fundamental or otherwise) of below 2kT, nearly an order of magnitude lower than that observed in the overdoped state of $Tl_2Ba_2CuO_{6+x}$. Moreover, the temperature dependence of the amplitude of the strongest oscillatory components that can be measured accurately follows closely that expected for elementary excitations of fermionic character. I will discuss a model of the Fermi surface that can potentially account for each of the periodic components observed, and that appears to be consistent with a number of other known properties in the high-field low-temperature state.

[1]Work performed in collaboration with S. E. Sebastian, N. Harrison, R. Liang, D. A. Bonn, and W. N. Hardy.