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Fermi surface reconstruction in high- T_c superconductors

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The recent observation of quantum oscillations in underdoped high- T_c superconductors (1), combined with their negative Hall coefficient at low temperature (2), reveals that the Fermi surface of hole-doped cuprates includes a small electron pocket. This strongly suggests that the large hole Fermi surface characteristic of the overdoped regime undergoes a reconstruction caused by the onset of some order which breaks translational symmetry. Here we consider the possibility that this order is “stripe” order, a form of combined charge / spin modulation observed most clearly in materials like Eu-doped and Nd-doped LSCO. In these materials, the onset of stripe order coincides with major changes in transport properties (3), providing strong evidence that stripe order is indeed the cause of Fermi-surface reconstruction. We identify the critical doping where this reconstruction occurs and show that the temperature dependence of transport coefficients at that doping is typical of metals at a quantum critical point (4). We discuss an interpretation of the pseudogap as a fluctuating precursor of the stripe-ordered phase.

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(1) N. Doiron-Leyraud *et al.*, Nature **447**, 565 (2007).

(2) D. LeBoeuf *et al.*, Nature **450**, 533 (2007).

(3) R. Daou *et al.*, Nature Physics, in press (DOI 10.1038/nphys1109); <http://arXiv.org/abs/0806.2881>.

(4) R. Daou *et al.*, to be published; <http://arXiv.org/abs/0810.4280>.