Fermi Arcs in the Superconducting Clustered State for Underdoped Cuprates

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The Fermi surface of some underdoped cuprates is composed of disconnected segments ("Fermi arcs") centered at the nodal points. We study [1] the presence of Fermi arcs in the context of phenomenological models [2] that describe the competition between antiferromagnetism and d-wave superconductivity in the cuprates. The state above the critical temperature T_c is made of superconducting clusters, with a non-zero amplitude of the superconducting order parameter but random phase factors. This state disappears above a higher temperature scale T^*. Our main result is that the angle-resolved photoemission spectrum of this clustered state contains Fermi surface arcs in the region between T_c and T^*, very similar to those observed experimentally [3]. Low energy states created at the interface between clusters are responsible for the arcs. Moreover, the LDOS of this state is in good agreement with recent STM experiments [4].

[1] G. Alvarez and E. Dagotto, http://arxiv.org/abs/0802.3394
[2] G. Alvarez et al., Phys. Rev. B 71, 014514 (2005).
[3] A. Kanigel et al., cond-mat/0708.4099 (2007).
[4] K. K. Gomes et al., Nature 447, 569 (2007).