Understanding the Protected Nodes and the Fermi Arcs in the Cuprate Superconductors

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We address a recent analysis of photoemission data which elucidates the superconducting phase of the underdoped cuprates. We first present a simple phenomenological approach to the spectral function which shows how the $d$-wave order parameter symmetry results in protected nodes, which, above $T_c$ broaden into Fermi arcs; this “protection” is associated with superconducting coherence rather than reduced thermal broadening. A microscopic theory, consistent with this phenomenology, is presented. It reconciles the observations that the excitation gap below $T_c$ is temperature independent while the superfluid density necessarily vanishes at $T_c$.


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