Unifying Fermi arcs and protected nodes in cuprate superconductors

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We show how, within a preformed pair scenario for the cuprate pseudogap, the nodal and antinodal responses in angle-resolved photoemission spectroscopy (ARPES) necessarily have very different temperature T dependences, which lead to Fermi arcs above T_c which collapses into nodal points upon phase coherence below T_c. We examine the behavior and the contrasting T dependences for a range of temperatures both below and above T_c. Our calculations are based on a fully microscopic T-matrix approach for addressing pairing correlations in a regime where the attraction is stronger than BCS and the coherence length is anomalously short. Instead of the "two-gap scenario" of the cuprates in which the pseudogap competes with superconductivity, our theory supports a unified picture in which the pseudogap derives from pairing correlations, identifying the two gap components with non-condensed and condensed pairs. It leads to reasonably good agreement with a range of different experiments without explicit curve fitting.
References: Q.J. Chen and K. Levin, Phys. Rev. B 78, 020513(R) (2008); C.C. Chien, Y. He, Q.J. Chen and K. Levin, Phys. Rev. B 79, 214527 (2009); Q.J. Chen, K. Levin and I. Kosztin, Phys. Rev. B 63, 184519 (2001).