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Fermi orbits versus Fermi arcs[1]

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We consider the effect of a short antiferromagnetic correlation length ξ on the electronic bandstructure of the underdoped cuprates. Starting with a Fermi-surface topology thought to be consistent with that detected in magnetic-quantum-oscillation experiments, we show that a reduced ξ gives an asymmetric broadening of the quasiparticle dispersion, resulting in simulated ARPES data very similar to those observed in experiment. Predicted features include the presence of 'Fermi arcs' close to $a\mathbf{k} = (\pi/2, \pi/2)$, where a is the in-plane lattice parameter, without the need to invoke a d-wave pseudogap order parameter. The statistical variation in the k-space areas of the reconstructed Fermi-surface pockets causes the quantum oscillations to be strongly damped, even in very strong magnetic fields, in agreement with experiment. (I would like to extend special thanks to the coauthors John Singleton and Ross McDonald and to E. Yelland and L. Taillefer for useful discussions).

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