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Critical Number of Fermions in Anisotropic QED_3; Application to the Pseudogap State of High-T_c Cuprates[1] ANDRES CONCHA, VALENTIN STANEV, ZLATKO TESANOVIC, Johns Hopkins University — The low-energy physics of d-wave superconductors is marked by the presence of four nodal points where the gap function vanishes. This nodal structure can be used as the basis of an effective theory for fermionic quasiparticles, which turns out to be an incarnation of a two-dimensional quantum electrodynamics (QED_3), where the gauge field encodes quantum fluctuations in the phase of the gap function. The theory predicts the Fermi surface of the pseudogap state which is confined to the four nodal points and contains an intrinsic anisotropy reflecting the difference between the gap and Fermi velocities. In this context, the emergence of an antiferromagnetic order can be described as the dynamical generation of mass due to the phenomenon of spontaneous chiral symmetry breaking. Mass generation occurs when the number of fermionic species in the theory is less than some critical number N_c, the actual value of which is still much debated. Based on simple physical arguments we find that N_c does depend on anisotropy and, more surprisingly, different regimes emerge depending on the ratio between the Fermi and gauge field velocities.

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