Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Global phase diagram of the checkerboard Hubbard model HONG YAO, Stanford, WEI-FENG TSAI, UCLA, STEVEN KIVELSON, Stanford — Local electronic structure (self-organized inhomogeneity) may play an essential role for the "mechanism" of high-T_c superconductivity. Moreover, in the limit of large inhomogeneity, well-controlled theoretical solutions of strongly interacting models can be obtained. We have computed the phase diagram of the checkerboard Hubbard model in the limit of small inter-cluster electron hopping, t', for all doping (x=hole density per site) and for all interaction strengths, 0<U/t. For O(t')<U<U_c =4.58t, and all 0≤ x ≤1/2, the existence of an effective pair attraction results in one of two d-wave superconducting ground states - either with nodal or without nodal quasiparticles. For U_c <U<U_t=18.6t, the ground state is a Fermi liquid of spin 1/2 fermions with two possible orbital flavors. Interestingly, around x=1/4 the ground state is a spin-1/2 antiferromagnet which also possesses alternating orbital currents on every other plaquette that spontaneously break time reversal symmetry. For U>U_t, the ground state is a Fermi liquid of fermions with spin-3/2, with a spin-3/2 antiferromagnet is favored near x=1/4. By including next nearest neighbor hopping, t_2, within clusters, we can study the physics of particle-hole asymmetry. Strikingly, we find that increasing t_2 increases the range of U for which hole doping leads to a superconducting state, but suppresses the range of U for electron doping. (For $t_2 \rightarrow -t_2$, the roles of electrons and holes are interchanged.)

Hong Yao
Stanford University

Date submitted: 20 Nov 2006 Electronic form version 1.4