Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

The Ground State Phase Diagram of the Two-Dimensional Hubbard Model on Square Lattice BO-XIAO ZHENG, GARNET CHAN, Princeton University — We systematically study the 0K phase diagram of the two-dimensional Hubbard model on the square lattice using density matrix embedding theory (DMET) with broken spin and particle number symmetry. We explicitly treat clusters with up to 16 sites and extrapolate the energy and relevant order parameters to the thermodynamic limit. At half-filling, the energies from DMET are as accurate as results from the state-of-the-art auxiliary-field QMC and density matrix renormalisation group (DMRG), with similar error bars. When doped, however, these "exact" methods either suffer from the sign problem, or require too large systems to be tractable, while the DMET calculations remain accurate. We obtain a phase diagram similar to the generic phase diagram of the cuprates, and find very robust superconductivity in the ground-state. We also see inhomogeneous phases in the strong interaction regime. We find the negative next nearest neighbor hopping ($t'/t < 0$) enhances the spatially inhomogeneous phases while the positive t' stabilizes the antiferromagnetic order.

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Date submitted: 12 Nov 2014 Electronic form version 1.4