Superconductivity in the repulsive Hubbard model: an asymptotically exact weak-coupling solution

STEVEN KIVELSON, SRINIVAS RAGHU, Stanford University, DOUGLAS SCALAPINO, University of California, Santa Barbara — We study the superconducting instability of the Hubbard model in the limit where $U$, the onsite repulsive interaction, is much smaller than the electron hopping. We present an asymptotically exact expression for $T_c$, the superconducting transition temperature, in terms of the correlation functions of the non-interacting system which remains valid for arbitrary densities so long as the interactions are sufficiently small. Our strategy for computing $T_c$ involves first integrating out all degrees of freedom having energy higher than an arbitrarily chosen initial cutoff. The renormalization group (RG) flows of the resulting effective action are computed and $T_c$ is obtained by determining the scale below which the RG flows in the Cooper channel break down. Using this method, we present results of $T_c$ and pairing symmetries as a function of electron concentrations for a wide variety of lattice systems in two and three dimensions.

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Date submitted: 20 Nov 2009

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