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The optimal inhomogeneity for superconductivity - finite size studies WEI-FENG TSAI, Department of Physics and Astronomy, UCLA, HONG YAO, STEVEN KIVELSON, Department of Physics, Stanford University, ANDREAS LAUCHLI, IRRMA, EPF Lausanne, Switzerland — We report the results of exact diagonalization studies of Hubbard models on a 4×4 square lattice with periodic boundary conditions and various degrees and patterns of inhomogeneity. Inhomogeneities are represented by different patterns of inequivalent hopping integrals (t and t'), such that for $t' = t$, the model is "homogeneous", while for $t' << t$, the model consists of weakly coupled smaller Hubbard clusters. We focus primarily on two inhomogeneous patterns, the checkerboard and the striped cases, for a wide range of values of the on-site repulsion U and doped hole concentration. Starting in the homogeneous limit, $t' = t$, we show that in both cases at fixed, intermediate U, the pair binding energy and the pair-field pair-field correlation functions initially grow as t' decreases, and then decrease as the system approaches the highly inhomogeneous limit, $t' \to 0$. (Finite size effects are estimated by comparing these results to those with open boundary conditions.) This behavior reflects the competition between the pairing scale and the phase coherence of the system, and hence constitutes evidence for the existence of an "optimal inhomogeneity"' for superconductivity.

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