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Phase separation instabilities in two-dimensional Betts clusters: exact results ARMEN N. KOCHARIAN, California State University, Los Angeles, GAYANATH W. FERNANDO, KUN FANG, University of Connecticut, Storrs — The energy eigenvalues and eigenstates of the Hubbard model with nearest and next nearest neighbor hopping are calculated by exact diagonalization technique and Lanczos algorithm by exploiting the square symmetry of isotropic Betts square (cells) - clusters with periodic boundary conditions. The electron pairing instabilities, order parameters and quantum critical points (at one hole away from half filling) are evaluated by monitoring the charge and spin pairing gaps in a wide range of interaction strengths which show level crossings in the ground state and corresponding crossovers at finite temperatures. The calculated critical behavior of the energy gap in optimized 8-site square symmetry lattice structures display universal features consistent with the exact results obtained for elementary bipartite square geometry [A. N. Kocharian et al., Phys. Rev. B 78, 075431 (2008)]. The effects of the next nearest neighbor hopping and temperature on these electron instabilities are also considered. Behavior of electrons in contrasting bipartite and non-bipartite two- and three-dimensional topologies display a number of inhomogeneous, paired and non-paired nanoscale phases seen in high T_c cuprates, manganites.

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