Abstract Submitted
for the CAL11 Meeting of
The American Physical Society

Electron and magnetic instabilities in Betts lattices with next nearest neighbors: exact results ARMEN KOCHARIAN, California State University Los Angeles, GAYANATH FERNANDO, KUN FANG, University of Connecticut, CINT TEAM — The spontaneous phase transitions and quantum critical points in the repulsive (U >0) Hubbard model with nearest and next nearest neighbor coupling (t_{nnn}), accompanied by (local) charge and spin density inhomogeneities, are studied by exact diagonalization of isotropic Betts cells (8- and 10-site squares) with periodic boundary conditions. The first order phase separation instabilities are found by monitoring charge and spin gaps under the variation of electron density (doping) and magnetic field in a wide range of interaction strength U and t_{nnn}. The coupled opposite spins and paired charge of electrons (holes), complied with Bose-Einstein statistics at zero temperature and moderate U, suggests full Bose condensation and coherent pairing of electrons in real space with equal gaps (similar to the unique BCS quasiparticle gap). However, a separate pairing of charge and spin degrees at distinct condensation temperatures offers a new route to superconductivity different from the BCS scenario. The conditions for spin liquid, unsaturated and saturated Nagaoka-like ferromagnetism due to spin-charge separation at large U values are also established. The criteria for enhanced coherent electron pairing and saturated ferromagnetism driven by t_{nnn} are considered.

Armen Kocharian
California State University Los Angeles

Date submitted: 01 Oct 2011 Electronic form version 1.4