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**Exact thermodynamics of phase separation and pairings in Hubbard nanoclusters.** ARMEN KOCHARIAN, Department of Physics and Astronomy, California State University Los Angeles, GAYANATH FERNANDO, TUN WANG, KALUM PALANDAGE, Department of Physics, University of Connecticut, JIM DAVENPORT, Computational Science Center, Brookhaven National Laboratory — The exact numerical diagonalization and thermodynamics in an ensemble of small Hubbard nanoclusters reveal intriguing insights into the phase separation, charge and spin pairings, Bose condensation and ferromagnetism in nanometer scale. The phase diagram off half filling strongly suggests the existence of electron pairing, superparamagnetism and saturated ferromagnetism in small nanoclusters driven by electron repulsion and doping. Rigorous criteria for the existence of charge and spin pairings in the ground state and corresponding crossovers at finite temperatures are formulated. The phase separation and electron pairing, monitored by a magnetic field and electron doping, surprisingly resemble phase diagrams in the family of doped high  $T_c$  cuprates. Exact theory provides incoherent electron charge pairing above  $T_c$  and pair coherency with spin condensation below  $T_c$ . These ideas may also be linked to recent atomic scale tunnelling experiments in La cuprates on nucleation of pairing pseudogaps and microscopic inhomogeneities in a real space.

Prefer Oral Session  
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