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Exact thermodynamics of pairing and charge-spin separation in Hubbard nanoclusters TUN WANG, Department of Physics, University of Connecticut, ARMEN KOCHARIAN, Department of Physics and Astronomy, California State University, GAYANATH FERNANDO, KALUM PALANDAGE, Department of Physics, University of Connecticut, JIM DAVENPORT, Computational Science Center, Brookhaven National Laboratory — An exact thermal studies of charge-spin separation, pairing fluctuations and pseudogaps are carried out by exact diagonalization of 4-site, frustrated (three dimensional) tetrahedral Hubbard and planar (2x4) clusters. Our exact results for 4-site cluster strongly suggest the existence of a quantum critical points in small Hubbard clusters for particle-particle/hole pair binding, antiferromagnetism, unsaturated and saturated ferromagnetism. Exact studies of larger planar and three dimensional Hubbard clusters yield more intriguing insight supporting the analytical results obtained for the 4-site clusters. Our microscopic theory reproduces electron pairing correlations, phase separation and magnetism in clusters, small nanoparticles, and, surprisingly, in transition metal oxides and high T_c doped cuprates. Theory describes also the effect of pressure on the superconducting transition temperature, the presence of a dormant magnetic state in a narrow region of doping and variation of spin pseudogap with doping level, etc.

Armen Kocharian

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