Phase diagram of a two dimensional electron glass

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Abstract

We investigate the phase transition in two dimensional electron glass, which is a system in which all the electron states are localised. We model the system by a square lattice of localised states which have random energies and interact via long-range Coulomb potential. Further a much discussed question is whether there is an equilibrium transition to glassy phase or a charge ordered phase as the temperature is lowered and disorder is increased. For a three dimensional Coulomb glass Martin Goethe have found a transition from charge ordered phase to paramagnetic phase for small disorders and no evidence of glass transition at higher disorders. We have used Monte Carlo annealing to study the system where only half the sites are occupied and the number of particles are conserved. We found a charge-ordered phase whose transition to fluid phase is of second-order type at very weak disorder strength, where the transition temperature was calculated using the finite size scaling. In the higher disorder regime the hysteresis studies show a transition from ordered phase characterized by large clusters (no long range order exists) to a paramagnetic phase. We did not find evidence of glassy phase at any finite temperature and disorder strength.

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