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Title:	Effective Hamiltonian based Monte Carlo for the BCS to BEC crossover in the attractive Hubbard model
Authors:	Pasrija, K. (/jspui/browse?type=author&value=Pasrija%2C+K.) Kumar, Sanjeev (/jspui/browse?type=author&value=Kumar%2C+Sanjeev)
Keywords:	Temperatures Effective Hubbard model Hamiltonian
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Abstract:	We present an effective Hamiltonian based real-space approach for studying the weak-coupling BCS to the strong-coupling Bose-Einstein condensate crossover in the two-dimensional attractive Hubbard model at finite temperatures. We introduce and justify an effective classical Hamiltonian to describe the thermal fluctuations of the relevant auxiliary fields. Our results for T_c and phase diagrams compare very well with those obtained from more sophisticated and CPU-intensive numerical methods. We demonstrate that the method works in the presence of disorder and can be a powerful tool for a real-space description of the effect of disorder on superconductivity. From a combined analysis of the superconducting order parameter, the distribution of auxiliary fields, and the quasiparticle density of states, we identify the regions of metallic, insulating, superconducting, and pseudogapped behavior. Our finding of the importance of phase fluctuations for the pseudogap behavior is consistent with the conclusions drawn from recent experiments on NbN superconductors. The method can be generalized to study superconductors with nontrivial order-parameter symmetries by identifying the relevant auxiliary variables.
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