

Dynamical mean-field approach to non-local exchange interactions

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To explore the nature of the metallic state near the transition to a Mott insulator, we investigate the t-J model using the dynamical mean-field theory (DMFT). In this theory, the non-local exchange interaction is reduced to a local but dynamical exchange interaction, which may be described by a vector bosonic bath coupled to the local spin. A numerically exact solution is obtained by an extension of the continuous-time quantum Monte Carlo (CT-QMC) method to a model with the spin-boson coupling. It is shown that the paramagnetic solution near the Mott insulator describes an incoherent metal with a residual moment. We further present the spin excitation spectra in magnetically ordered states of the Heisenberg model, clarifying significance and limitation of the approximation.