t-J model with random coupling: Numerical solution in infinite dimensions

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To explore the nature of the metallic state near the transition to a Mott insulator, the t-J model with random hopping and exchange interaction is considered. This model at half-filling has been discussed in the context of the spin-glass transition. In $d = \infty$, the model is mapped to an Anderson impurity model, where the local spin is coupled to a bosonic field[1]. A numerically exact solution is obtained by an extension of the continuous-time quantum Monte Carlo (CT-QMC) method.

It is shown that the paramagnetic solution near the Mott insulator is an incoherent metal with a residual moment. The single-particle excitation in this regime shows an energy dispersion consisting of the Hubbard band and an extra band, which is qualitatively different from that of the Fermi-liquid regime. The Fermi volume of this dispersion is close to that of the ferromagnetic state in the noninteracting system. The appearance of the extra band is discussed in terms of a one-hole excitation in the Mott insulator.

[1] O. Parcollet and A. Georges, Phys. Rev. B **59**, 5341 (1999).