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Mott physics and spin fluctuations: a unified framework THOMAS AYRAL, Department of Physics and Astronomy, Rutgers University, Piscataway, NJ 08854, JAKSA VUIEVI, OLIVIER PARCOLLET, Institut de Physique Thorique (IPhT), CEA, CNRS, UMR 3681, 91191 Gif-sur-Yvette, France — We present a formalism for strongly correlated electron systems which consists in a local approximation of the three-leg interaction vertex [1]. The vertex is self-consistently computed with a quantum impurity model with dynamical interactions in the charge and spin channels, similar to dynamical mean field theory (DMFT) approaches. The electronic self-energy and the polarization are both frequency and momentum dependent. The method interpolates between the spin-fluctuation or GW approximations at weak coupling and the atomic limit at strong coupling. We first apply the formalism to the two-dimensional Hubbard model on a square lattice. We show that as interactions are increased, the local vertex acquires a strong frequency dependence, driving the system to a Mott transition, while at low enough temperatures the momentum-dependence of the self-energy is enhanced due to large spin fluctuations. Upon doping, we find, already at the single-site impurity level, a Fermi arc in the one-particle spectral function, a signature of the pseudo-gap state. Second, we present an extension of the method to cluster impurity models. We reach close agreement with large-cluster DMFT results already with a four-site impurity cluster.
[1] Phys. Rev. B 92, 115109 and Phys. Rev. B 93, 235124

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