Approximating the frequency dependence of the effective interaction in the functional renormalization group for many-fermion systems

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Abstract

The functional renormalization group has become a widely used tool for the analysis of the leading low-temperature correlations in weakly to moderately coupled many-fermion lattice systems. A bottleneck for quantitatively more precise results is that the treatment of the frequency dependence of the flowing interactions is numerically quite demanding. Yet the frequency dependence is needed to compute relevant selfenergies and hence for controlled results on the energy scales for ordering or for the quasiparticle properties. Here we explore an approximate parametrization of the frequency dependence of the interaction vertex that is inspired by established simplifications in the theory of superconductivity and that keeps the numerical effort bounded. We demonstrate the validity of the approximation for Cooper pairing problems and apply it to the two-dimensional Hubbard model.

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