Low-energy effective interaction parameters for correlated electrons by constrained functional renormalization group calculations

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The estimation of interaction parameters for effective low-energy models is essential if one aims at a quantitatively sensible description of correlated electrons in solids. This question was already addressed in the 1960s by Anderson and Morel for superconductors and by Kanamori for magnetic ordering. In recent times, effective interactions play an important role in the attempts to understand the differences between various iron-based superconductors or the ground states of graphene systems.

Here we discuss the constrained functional renormalization group (cfRG) as an extension of the widely-used constrained random phase approximation (cRPA) for effective non-local and dynamical interactions in the 'target' bands near the Fermi level of multiband systems. We present examples, supported by other numerical studies, where the cRPA over-screens the effective repulsion, while the cfRG gives a more correct description.