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Correlation Energy of the Mean-Field Fermi Gas as an Upper Bound

Interacting Fermi gases are of great technological importance. We consider a model of fermions with bounded compactly supported interaction in the mean-field scaling regime. We incorporate many-body correlations to obtain the first correction to the ground state energy beyond Hartree-Fock theory, as an upper bound. Our approach is to derive an effective quadratic Hamiltonian by bosonizing collective pair excitations. The result is a Gell-Mann–Brueckner–type formula.