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Dual fermion dynamical cluster approach for strongly correlated systems SHUXIANG YANG, Department of Physics & Astronomy, Louisiana State University, HERBERT FOTSO, Department of Physics, Georgetown University, HARTMUT HAFERMANN, Centre de Physique Theorique, Ecole Polytechnique, CNRS, France, KA MING TAM, JUANA MORENO, Department of Physics & Astronomy, Louisiana State University, THOMAS PRUSCHKE, Department of Physics, University of Goettingen, Germany, MARK JARRELL, Department of Physics & Astronomy, Louisiana State University — A multi-scale many-body approach is developed for strongly-correlated electron systems by combining the dynamical cluster approximation (DCA) and the recently introduced dual fermion formalism. This approach systematically incorporates non-local corrections to the DCA by employing an exact mapping from a real lattice to a DCA cluster of linear size Lc embedded in a dual fermion lattice. The Green function in the dual space serves as a small parameter enabling the use of a diagrammatic perturbation calculation on the dual fermion lattice. For example, the dual fermion self-energy calculated with simple second-order perturbation theory scales as $\mathcal{O}(1/L_c^3)$. We demonstrate the effectiveness of the approach by applying it to the 2D Hubbard model.

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