New developments in dynamical cluster quantum Monte Carlo theory

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The dynamical cluster approximation (DCA) is a systematic extension beyond the single-site approximation in dynamical mean-field theory, to include spatially non-local correlations in quantum many-body simulations of correlated electron systems. It has been used effectively to understand the physics of the 2D Hubbard model, in particular with respect to unconventional superconductivity. This talk will review recent developments in this method including the DCA^+ extension and a new form of interlaced coarse graining. These advances improve the cluster size convergence of the method and, most importantly, significantly reduce the fermion sign problem of the underlying quantum Monte Carlo (QMC) solver. As will be demonstrated, this enables the determination of the exact infinite cluster size result in certain cases.