

Challenges in Path Integral Monte Carlo

David Ceperley, University of Illinois Urbana-Champaign

Markov Chain Monte Carlo methods can provide statistically exact solutions to some many-body quantum problems. Two examples are particles confined to one dimension and bosonic particles. However, for most "important" problems, it is not known whether Monte Carlo methods can be used to provide exact solutions. In addition to the well known fermion sign problem, an important problem is how to transform MC estimates of imaginary time correlation to real time, or equivalently performing an inverse Laplace transform on noisy data. There are also many challenges in finding more efficient moving rules and lower variance estimators for properties.