Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Solving fermion sign problem in quantum Monte Carlo by Majorana representation HONG YAO, ZI-XIANG LI, YI-FAN JIANG, Institute for Advanced Study, Tsinghua University — We discover a new quantum Monte Carlo (QMC) method to solve the fermion sign problem in interacting fermion models by employing Majorana representation of complex fermions. We call it Majorana QMC (MQMC). Especially, MQMC is fermion sign free in simulating a class of spinless fermion models on bipartite lattices at half filling and with arbitrary range of (unfrustrated) interactions. To the best of our knowledge, MQMC is the first auxiliary field QMC method to solve fermion sign problem in spinless (more generally, odd number of species) fermion models. MQMC simulations can be performed efficiently both at finite and zero temperatures. We believe that MQMC could pave a new avenue to solve fermion sign problem in more generic fermionic models. (Zi-Xiang Li, Yi-Fan Jiang, and Hong Yao, arXiv:1408.2269).

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Date submitted: 14 Nov 2014 Electronic form version 1.4