Day 1 (Poster B)

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Title:Are neural quantum states good at solving non-stoquastic spin Hamiltonians?

Abstract:
Inspired by the huge success of machine learning technology, Carleo and Troyer introduced a complex-valued restricted Boltzmann machine (RBM) for solving quantum many-body problems under the variational Monte Carlo framework. However, even for earlier claims that this method is insensitive to the sign problem, it has been found that the RBM still suffers several difficulties in solving highly frustrated systems, similar to conventional quantum Monte Carlo methods.
In this work, we clarify the relation between the sign structure of the Hamiltonian and failure cases of the complex RBMs. Most importantly, we find that complex RBMs can express ground states of a Hamiltonian phase connected to a stoquastic one. On the other hand, we also identify several new phases challenging for the RBM Ansatz, including non-topological robust non-stoquastic phases and stoquastic phases where complex RBMs do not learn ground states efficiently due to a sampling problem. These classification results suggest a type of Hamiltonians that noisy intermediate-scale quantum devices provide advantages over classical variational methods.