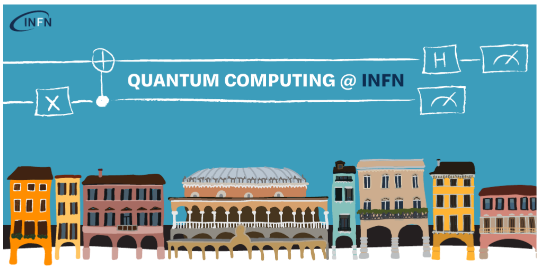

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Neural quantum Monte Carlo algorithms for quantum simulators

Wednesday, 30 October 2024 17:45 (20 minutes)

Simulating the low-temperature properties of frustrated quantum Ising models is a paradigmatic problem in condensed matter physics. It has recently gained strong interest in the context of quantum-enhanced optimization performed via quantum annealers and of quantum simulation in Rydberg-atom experiments.
We use a recently-developed self-learning projection quantum Monte Carlo algorithm driven by neural-network states to simulate both short-range and long-range disordered quantum Ising models at zero-temperature.
Our results show that, if the neural ansatz is big enough, this technique provides unbiased estimates of ground-state properties, accessing regimes not easily accessible so far.
In particular, we investigate the spin-glass phase of the 2D quantum Edwards-Anderson model and analyze the quantum critical point. Furthermore, we obtain results consistent with replica symmetry breaking.
Lastly, we study the properties of geometrically-frustrated quantum magnets with either nearest-neighbour or power-law type interactions, relevant to describe Rydberg atoms in optical tweezers. Our preliminary results confirm the existence of the so called "order-by-disorder"phenomenon in which the ordered clock-phase arises from quantum fluctuations. Future findings in these systems could be relevant for comparison with experiments on quantum simulators based on trapped atoms, where the interaction is highly controllable.

Sessione

Simulazione

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