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Quantum variational methods for supersymmetric quantum mechanics

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Supersymmetric models propose a symmetry linking bosons and fermions, but the infamous sign problem obstructs lattice studies of non-perturbative aspects like spontaneous supersymmetry breaking and real-time evolution, a limitation absent in quantum computing.

The lattice supersymmetric quantum mechanics model provides a valuable testbed for exploring key challenges in quantum computing, such as state preparation, ground state search, and time evolution. In this talk, we discuss the challenges of encoding fermionic and bosonic degrees of freedom on a gate-based quantum computer. We then explore quantum variational methods to directly measure supersymmetry breaking or preservation, with a focus on the Variational Quantum Eigensolver and Variational Quantum Deflation, while examining the intricate interplay between quantum ansätze and classical optimizers.

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