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Supersymmetric Quantum Mechanics in Multiple Dimensions Applied to Variational Monte Carlo - A Proof of Principle Study[1]
THOMAS MARKOVICH, KAUSHIK MAJI, ERIC BITTNER, DON KOURI, University of Houston — We present a new approach to variational monte carlo using our N-Dimensional generalization of Supersymmetric Quantum Mechanics. We do this by introducing a *vector* superpotential in an orthogonal hyperspace. In the case of N distinguishable particles in three dimensions this results in a vector superpotential with $3N$ orthogonal components. The original scalar Schrödinger operator can be factored into vector "charge" operators: $\vec{Q}_1$ and $\vec{Q}_1^\dagger$. Using these operators, we can write the original (scalar) Hamiltonian as $H_1 = \vec{Q}_1^\dagger \cdot \vec{Q}_1 + E_0^{(1)}$. The second sector Hamiltonian is a tensor given by $H_2 = \vec{Q}_1 \vec{Q}_1^\dagger + E_0^{(1)}$ and is isospectral with H_1. The vector ground state of sector two, $\vec{\psi}_0^{(2)}$, can be used with the charge operator $\vec{Q}_1^\dagger$ to obtain the excited state wave functions of the first sector. We demonstrate the approach with examples of a pair of separable 1D harmonic oscillators and the example of a non-separable 2D anharmonic oscillator (or equivalently a pair of coupled 1D oscillators).

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