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【522】Gate-efficient simulation of molecular eigenstates on a quantum computer

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In order to perform simulations of quantum systems on current quantum processors, quantum algorithms with short circuit depth have to be designed. Here, we experimentally demonstrate that exchange-type gates, tunable in amplitude and phase, are ideally suited for calculations in quantum chemistry [1]. We optimize and characterize these exchange-type gates, which yield an average gate fidelity of 95% obtained via randomized benchmarking. Finally, we determine the energy eigenstates of molecular hydrogen with an accuracy of 50 mHa using a variational quantum eigensolver algorithm based on exchange-type gates in combination with a method from computational chemistry to compute the excited states.

[1] M. Ganzhorn et al., Phys. Rev. Applied 11, 044092

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