Stuttgarter Physikalisches Kolloquium

Max-Planck-Institut für Intelligente Systeme
Max-Planck-Institut für Festkörperforschung
Fachbereich Physik, Universität Stuttgart

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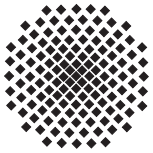

Dienstag, 12. November 2019 | **16.00 Uhr c.t.** | **Hörsaal 2D5**

Stuttgarter Max-Planck-Institute, Heisenbergstraße 1, 70569 Stuttgart-Büsnau

Gastgeber: Prof. Gisela Schütz, Max-Planck-Institut für Intelligente Systeme, Telefon: 0711 689-1950

Quantum chemistry algorithms using superconducting near-term quantum devices

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Abstract

In recent years we have observed a rapid development of quantum technologies for the realization of quantum computers that promise to outperform conventional computers in certain types of problems. This includes problems in optimization, machine learning, finite element calculations, but also in the computation of complex molecules. We utilize a fixed-frequency superconducting qubit system, an architecture characterized by its stability, relatively long coherence times and scalability. On this platform we use variational algorithms to compute the ground state of small molecules.
Such algorithms are well suited for near-term applications on non-error corrected quantum hardware because they only rely on a small number of quantum operations. To compute the energy spectra of molecular hydrogen we employ parametrically-driven flux-tunable couplers to realize exchange-type interactions that preserve the number of qubit excitations corresponding to the fixed number of electrons in the molecule. With this choice of gates we can make best use of the available hardware and realize short algorithms that finish within the coherence time of the system. With gate fidelities around 95% we compute the eigenstates within an accuracy of 50 mHartree on average, a good starting point for near-term applications with scientific and commercial relevance.