Physical Sciences Seminar

Quantum Seminars: Quantum chemistry calculations on a superconducting qubit quantum processor

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In recent years quantum technologies have rapidly developed towards first realizations 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 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, a good starting point for near-term applications with scientific and commercial relevance.

Tuesday, October 8, 2019 11:00am - 12:00pm
Heinzel Seminar Room / Office Bldg West (I21.EG.101)

This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station. Please find a schedule of the ISTA Shuttle on our webpage: https://ista.ac.at/en/campus/how-to-get-here/ The ISTA Shuttle bus is marked ISTA Shuttle (#142) and has the Institute Logo printed on the side.