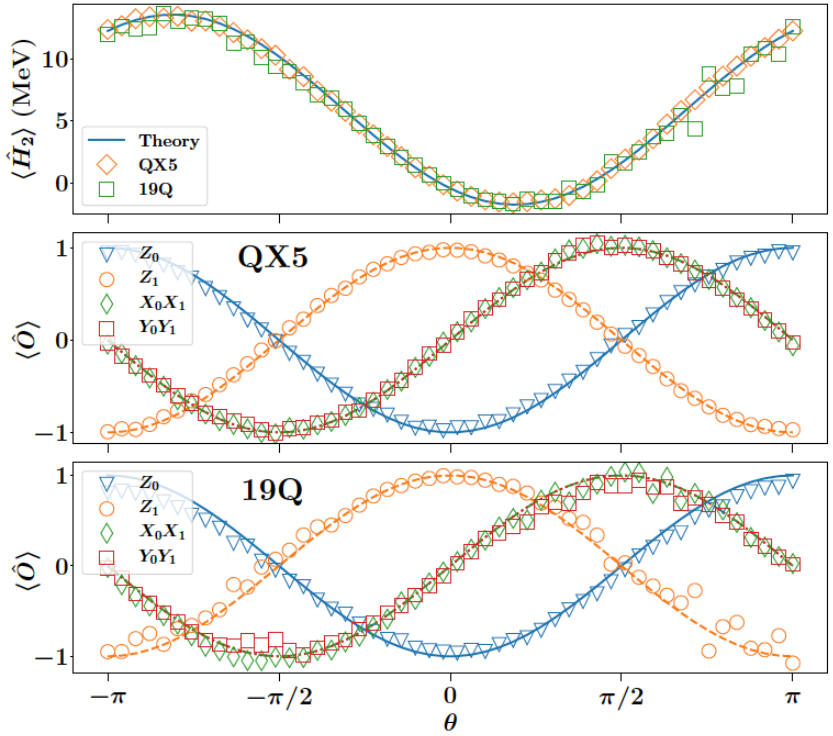
Quantum Computing of an Atomic Nucleus

Objectives

- Perform the first quantum computation of an atomic nucleus
- Learn how to map real-word physics problems onto existing quantum devices

Impact

- Demonstrated that the binding energy of an atomic nucleus can be computed on quantum chips
- Designed a low-depth circuit and used extrapolation techniques to mitigate noise



Accomplishments

- Using two and three qubits, and two different quantum chips, the binding energy of the lightest nucleus, the deuteron, was computed to within a few percent.
- Proof-of-principle computation that atomic nuclei can be computed on nascent quantum devices.

Caption: Experimentally determined energies for the deuteron (top) and expectation values of the Pauli terms that enter the two-qubit Hamiltonian as determined on the QX5 (center) and 19Q (bottom) quantum chips as a function of the angle that parameterizes the wave function. Experimental (theoretical) results are denoted by symbols (lines).

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NUCLEI Nuclear Computational Low-Energy Initiative

Reference: E. F. Dumitrescu *et al.*, Phys. Rev. Lett. accepted (2018); arXiv:1801.03897

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