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## A setup for co-trapping an atom and a molecule

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Traditionally, molecules were considered too complicated for coherent quantum control. Recent molecular-ion-trapping developments enabled trapping, ground-state cooling, high-fidelity state detection, precision spectroscopy, coherent manipulation, and atom-molecule entanglement. Nowadays, molecule diversity and the variety of molecular degrees of freedom open new research directions that are impossible with atoms. Investigating the quantum properties of molecular ions and manipulating their unique characteristics may lead to new quantum-information applications. Here, we present our work toward building a quantum-logic apparatus for co-trapping  $N_2^+$  and  $Ca^+$  to create qubits encoded in the molecule's nuclear-spin-isomer degree of freedom.

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