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【433】Precision spectroscopy and coherent manipulation of single trapped nitrogen molecules

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Complex energy-level structure of molecules with rotational and vibrational degrees of freedom provides transitions with various properties but also presents challenges toward molecular state initialization, manipulation, and readout. We followed a quantum-logic protocol that uses a single co-trapped atomic ion as a probe for the molecular state, and demonstrated a quantum non-demolition state detection with fidelities >99%. Currently, we are implementing precision-spectroscopic measurements on a narrow infrared quadrupole transition referenced to the Swiss primary frequency standard at METAS in Berne. The present method paves the way for the implementation of molecular qubits, for establishing new frequency standards in the mid-IR regime, and for investigating state-to-state dynamics of chemical reactions.

Theoretical Work

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