TRAPPED POLAR MOLECULES AS QUBITS

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Trapped polar molecules have recently identified as promising physical systems for quantum information storage and processing. The rotational states of diatomic molecules and their associated electric dipole moments provide a natural basis for long-lived qubits that can couple with reasonable strength to each other and/or to microwave photons. We have proposed two schemes for large-scale quantum information processing with molecular qubits—one based on molecules in an optical lattice, and a second with molecules trapped above the surface of a chip containing superconducting stripline resonators. In both cases, the primary technological hurdle appears to be creating molecules at sufficiently low temperature and high phase space density, in order to reliably load the traps. This talk will discuss our recent experimental progress towards this goal.