# POLAR MOLECULES IN THE QUANTUM REGIME

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Quantum gas of ground-state polar molecules opens the door to a wide range of scientific explorations. Novel molecular interactions, chemical reactions in the quantum regime, exotic quantum phase transitions, and strongly correlated states of matter are among a few prominent examples to be studied. We present recent experimental progresses at JILA, including the production of a high phase-space density gas of polar molecules in the absolute rovibrational ground state, coherent manipulation of the nuclear spin state, and the observation of barrier-less chemical reactions at ultralow temperatures. We control the reaction rate with the quantum mechanical wave functions of the molecules. Long-range and anisotropic dipolar interactions are observed in the thermodynamics of the molecular gas and we control inelastic and elastic collision rates by varying the molecular dipole moment in the laboratory frame and by confining molecules in two-dimensional optical traps.