

Abstract Submitted  
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**Cold Molecule Experiments and Production** ERIC R. HUDSON, BRIAN C. SAWYER, BENJAMIN L. LEV, JUN YE — Cold molecules promise to revolutionarily impact atomic physics with studies of cold molecular collisions and quantum chemistry, implementation of quantum information processing, and possibilities for ferro-electric phase transitions. Our research efforts have focused on providing cold, trapped molecules through Stark deceleration of supersonic beams of hydroxyl radicals (OH) and, recently, formaldehyde molecules (H<sub>2</sub>CO). Specifically, our work has been used to uncover the dynamics governing the evolution of the molecules within the decelerator, as well as to efficiently produce molecules for subsequent study. In our current experiments, we accelerate/decelerate a supersonic beam of molecules to a mean speed adjustable between 500 m/s to rest, with a translational temperature tunable from 1mK to 1K. Recently, we performed high resolution microwave spectroscopy of the lowest  $\lambda$ -doublet lines of OH, which along with astronomical observation of OH mega-masers can be used to constrain the time variation of the fine structure constant. We will present our latest results on deceleration and trapping, high resolution microwave spectroscopy of OH, and discuss our work on the study of cold molecular collisions/reactions as well as techniques that should allow extension to the ultra-cold regime.

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