PRODUCTION OF ULTRACOLD POLAR MOLECULES FROM ATOMS

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There is a growing interest in producing gases of ultracold molecules, particularly polar species. Such samples have novel potential applications in a broad range of fields including quantum chemistry, astrophysics, condensed matter, quantum information, and particle physics. This talk will focus on the "assembly" of ultracold polar molecules from laser-cooled atoms. Our group has recently demonstrated a multi-step technique for production of RbCs molecules in their vibronic ground state, at a translational temperature of $\sim 100\ \mu$K. Understanding and control of each step in the process (photoassociation; radiative stabilization into metastable vibrational levels; and stimulated emission pumping into the ground state) required spectroscopic investigations across the wide range of electronic and vibrational states involved in the process. I will discuss the techniques and results of our experiments, as well as specific ideas for applications using the resulting ultracold molecules.

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