Old Dominion University
Department of Physics

Colloquium

Thursday, April 20, 2023

"Progress towards laser cooling of AlCl"

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Abstract:
Novel applications for ultracold polar molecules include studies of many-body physics of quantum degenerate gases, quantum computing, precision measurements and tests of fundamental symmetries. Confining molecules in a magneto-optical trap is an ideal first step to apply subsequent cooling and trapping schemes to create an ultracold sample of molecules. While this approach has been used extensively with atoms, applying the same to molecules is challenging due to the presence of dark states which interrupt the photon cycle process.
At present, a number of molecules have been identified to be suitable for laser cooling with AlCl being an excellent candidate. Starting with a cryogenic buffer-gas beam source, we used pulsed-laser ablation to produce AlCl in the gas phase and carried out precise spectroscopy that showed that AlCl has highly diagonal Franck-Condon factors of ~99.88%. To maximize the yield of AlCl, we have systematically studied and compared various precursor targets, including mixtures of KCl:Al, NaCl:Al, CaCl2:Al, MgCl2:Al, and AlCl3. We will discuss our target studies and discuss our plan towards slowing and cooling AlCl, including a theoretical model of the expected magneto-optical trap forces of AlCl. Furthermore, we will give an update on our setup to deposit and study thin films of AlCl, which could provide high-yield ablation precursors.

Presentation: OCNPS Scale-Up 142@ 3:00 pm
Refreshments: OCNPS Atrium @ 2:30 pm
All interested persons are cordially invited to attend.