LASER COOLING THE DIATOMIC MOLECULE CaH

JOE VELASQUEZ, III, MICHAEL DI ROSA, *Physical Chemistry and Applied Spectroscopy, Los Alamos National Laboratory, Los Alamos, NM, USA*.

To laser-cool a species, a closed (or nearly closed) cycle is required to dissipate translational energy through many directed laser-photon absorption and subsequent randomly-directed spontaneous emission events. Many atoms lend themselves to such a closed-loop cooling cycle. Attaining laser-cooled molecular species is challenging because of their inherently complex internal structure, yet laser-cooling molecules could lead to studies in interesting chemical dynamics among other applications. Typically, laser-cooled atoms are assembled into molecules through photoassociation or Feschbach resonance. CaH is one of a few molecules whose internal structure is quite atom-like, allowing a nearly closed cycle without the need for many repumping lasers. We will also present our work-to-date on laser cooling this molecule. We employ traditional pulsed atomic/molecular beam techniques with a laser vaporization source to generate species with well-defined translational energies over a narrow range of velocity. In this way, we can apply laser-cooling to most species in the beam along a single dimension (the beam's axis). This project is funded by the LDRD program of the Los Alamos National Laboratory.