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Cold, Trapped Molecules via Cryogenic Buffer Gas Methods

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We present a summary of recent results from our group on the cooling of molecules using cryogenic buffer-gas techniques. A variety of molecules are cooled, including NH, NH₃, O₂, ThO and Naphthalene. NH is magnetically trapped and studied for times longer than 10 seconds. Spin relaxation cross-sections (in-trap) are measured. NH is co-trapped with atomic nitrogen (N). Preliminary results for both theoretical and experimental N-NH collisional properties will be presented. Cold molecular beams of unprecedented flux are demonstrated with a wide variety of species, including ThO, as well as with atomic species. These sources can form the basis for new precision tests as well as for further work towards (co-)trapping and cooling of atoms and molecules. We also briefly describe our creation of BEC in the atomic species He* using buffer-gas methods, without laser cooling. A summary of possible future directions will be presented.