Slow beams of cold molecular radicals for precision spectroscopy

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Ultra-cold matter has a huge range of uses - from searches for new physics such as the measurement of the electron electric dipole moment (EDM) or variation of fundamental constants, to the exploration of exotic and degenerate phases of matter. Buffer gas cooling is a general method for cooling molecules to the 1 Kelvin level, and can produce molecular beams with speeds below 50m/s. Such beams are ideal for precision measurements where long interaction times are needed, or for further cooling (using laser cooling methods, for example).

We present a characterization of a buffer gas source of ytterbium monofluoride (YbF) molecules. Our source produces 5 billion ground state YbF radicals per steradian per pulse, with speeds in a range from $80 - 200\, ms^{-1}$ and translational and rotational temperatures of 4K. We consider how to load an optical molasses from this source, with the goal of producing ultracold YbF molecules for a vastly improved measurement of the electron EDM.