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Radiation Pressure Force from Optical Cycling on a Polyatomic Molecule SrOH IVAN KOZYRYEV, LOUIS BAUM, KYLE MATSUDA, ALEX SEDLACK, BOERGE HEMMERLING, JOHN DOYLE, Harvard-MIT Center for Ultracold Atoms and Department of Physics, Harvard University — Polyatomic molecules hold promise for many applications in physics and chemistry due to their rotational and vibrational degrees of freedom. The starting point for our approach to the production of ultracold strontium monohydroxide (SrOH) is buffer-gas cooling [1] followed by laser manipulation. Linear geometry, diagonal Franck-Condon factors, short radiative lifetimes and unresolved hyperfine splittings make SrOH a particularly attractive candidate for direct laser cooling. We report deflection of the SrOH beam through radiative force from optical cycling on the $\tilde{X}^2\Sigma^+ \leftrightarrow \tilde{A}^2\Pi_{1/2}$ transition. We observe $\times 12$ fluorescence enhancement with closed spin-rotation splitting and demonstrate cycling between different vibrational levels with the Sr $\leftrightarrow$ O mode repumping laser. Observed deflection and detection signals correspond to the scattering of $\sim$ 100 photons. Additional repumping laser for the bending mode would lead to scattering of $\sim 1,000$ photons allowing for transverse laser cooling of the SrOH beam. We will also describe our experimental efforts towards laser slowing and trapping of SrOH. [1] I. Kozyryev, L. Baum, K. Matsuda, P. Olson, B. Hemmerling and J. M. Doyle, New J. Phys. 17 (2015) 045003.

Ivan Kozyryev
Harvard Univ

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