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Laser cooling and slowing of CaF molecules STEFAN TRUPPE, HANNAH WILLIAMS, MORITZ HAMBACH, BEN SAUER, ED HINDS, MIKE TARBUTT, Imperial College London — We have developed a cold and bright source for CaF molecules and use laser radiation pressure to slow the molecules to within the capture velocity of a magneto-optical trap (MOT). Using laser ablation of Ca into a continuous flow of cryogenic Helium buffer gas mixed with SF_6 we produce up to 10^{11} molecules per steradian per pulse in a single rotational state. The molecules move with a mean forward velocity of 160m/s and have a velocity spread of 80m/s. We then apply laser radiation pressure to the molecular beam to slow and cool the molecules. We form a quasi-closed laser-cooling cycle by using a main cooling laser to drive the $B^2\Sigma^+(v'=0)$ - $X^2\Sigma^+(v''=0)$ transition and a single repump laser to address the $A^2\Pi_{1/2}(v'=0)$-$X^2\Sigma^+(v''=1)$ transition. Radio-frequency sidebands applied to both lasers address the hyperfine structure. By chirping the frequencies of both lasers to keep the decelerating molecules resonant with the light, we scatter more than 10000 photons and reduce the speed to below 50 m/s. We achieve a similar effect by broadening the linewidth of the laser to several hundred MHz. This "white-light" slowing is compared to the chirped slowing technique. We also present progress towards a MOT of CaF molecules.

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