Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Slowing techniques for loading a magneto-optical trap of CaF molecules STEFAN TRUPPE, NOAH FITCH, HANNAH WILLIAMS, MORITZ HAMBACH, BEN SAUER, ED HINDS, MIKE TARBUTT, Imperial College London — Ultracold molecules in a magneto-optical trap (MOT) are useful for testing fundamental physics and studying strongly-interacting quantum systems. With experiments starting with a relatively fast (50-200 m/s) buffer-gas beam, a primary concern is decelerating molecules to below the MOT capture velocity, typically 10 m/s. Direct laser cooling, where the molecules are slowed via momentum transfer from a chirped counter-propagating narrowband laser, is a natural choice. However, chirping the cooling and repump lasers requires precise control of multiple laser frequencies simultaneously. Another approach, called white-light slowing uses a broadband laser such that all fast molecules in the beam are decelerated. By addressing numerous velocities no chirping is needed. Unfortunately, both techniques have significant losses as molecules are transversely heated during the optical cycling. Ideally, the slowing method would provide simultaneous deceleration and transverse guiding. A newly developed technique, called Zeeman-Sisyphus deceleration, is potentially capable of both. Using permanent magnets and optical pumping, the number of scattered photons is reduced, lessening transverse heating and relaxing the repump requirements. Here we compare all three options for CaF.

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Date submitted: 29 Jan 2016 Electronic form version 1.4