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Magneto-optical forces applied to polyatomic molecules LOUIS BAUM, NATHANIAL VILAS, CHRISTIAN HALLAS, SHIVAM RAVAL, BENJAMIN AUGENBRAUN, DEBAYAN MITRA, JOHN DOYLE, Harvard University
— In recent years, laser cooling has been successfully applied to diatomic molecular systems, resulting in robust magneto optical traps (MOTs) and grey molasses cooling to the μKelvin temperature regime. Polyatomic molecules have additional (controllable) degrees of freedom, compared to their diatomic counterparts, that provide further advantages for a myriad of applications in quantum science [1-3]. Here we present the one-dimensional magneto-optical cooling and compression (1D MOT) of a cryogenic buffer-gas beam [4] of calcium monohydroxide (CaOH) molecules [5]. We establish a quasi-closed cycling transition and scatter 10^3 photons per molecule, with this number limited predominantly by interaction time. The resulting cooling and compression lead to an increase in on-axis molecular beam brightness and a reduction of temperature from 8.4 mK to 1.4 mK. This demonstration realizes a significant milestone on the route towards a 3D MOT of CaOH and the laser cooling of polyatomic molecules into the μKelvin regime . [1] Kozyryev and Hutzler, PRL 119, 133002 (2017). [2] Yu et. al., New J. Phys. 21 093049 (2019) [3] Wall et. al., New J. Phys. 17, 025001 (2015). [4] Hutzler et. al., Chem. Rev. 112, 9 4803 (2012) [5] Baum et. al., arXiv 2001.10525

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