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Progress towards a 3D MOT of CaOH DEBAYAN MITRA, LOUIS BAUM, NATHANIAL VILAS, CHRISTIAN HALLAS, SHIVAM RAVAL, JOHN DOYLE, Harvard University — Laser cooling and evaporative cooling are the workhorse techniques that have revolutionized the control of atomic systems. In recent years the magneto-optical trap (MOT) has been successfully adapted to several diatomic molecules. We now seek to broaden these successes by extending the MOT to polyatomic molecules. The vibrational and rotational structure of polyatomic molecules generically gives rise to complexities in optical cycling, but also to useful closely spaced opposite parity levels in low lying excited states with orbital angular momentum along the internuclear axis. These parity doublets allow full polarization at low electric fields, a significant advantage for a range of applications such as precision measurement [1], quantum computation [2] and quantum simulation [3]. With calcium monohydroxide molecules (CaOH) we have very recently demonstrated an optical cycling scheme efficient enough for optical cooling and a one-dimensional MOT. Data from that work allowed us to quantitatively predict for CaOH the capture velocity v_{CaOH} ~7 m/s for a 3D MOT [4]. Here we present our progress with CaOH towards achieving v_{CaOH} in a cryogenic buffer-gas beam [5] and the loading of a 3D MOT. [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] Baum et. al, arXiv 2001.10525 [5] Hutzler et. al. Chem. Rev. 112, **9** 4803 (2012)

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