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Coherent Bichromatic Force Deflection of SrOH[1] IVAN KOZYRYEV, LOUIS BAUM, Harvard University, LELAND ALDRIDGE, Yale University, PHELAN YU, Harvard University, EDWARD EYLER, University of Connecticut, JOHN DOYLE, Harvard University — While beam deceleration employing the spontaneous radiation pressure force has been a standard for atomic experiments, it is not as effective in slowing molecular beams. The myriad of internal molecular states inhibits photon cycling, lowering the scattering rate. An alternative approach is to employ coherent optical processes to enable rapid momentum exchange between the light field and molecules before spontaneous emission occurs. With the stimulated bichromatic force (BCF), we demonstrate deflection of polyatomic molecules using a cryogenic buffer-gas beam of the polar free radical strontium monohydroxide (SrOH) [1]. Dual-frequency high-power standing light waves are used to achieve significant force enhancement compared to radiative deflection. The coherent nature of the directional momentum transfer allows multiple $\hbar k$ of momentum change per single spontaneous emission cycle. We perform theoretical calculations of BCF in complex multilevel systems and compare to our data. Our results open the door to coherent manipulation of molecular motion, including efficient optical deceleration of diatomic and polyatomic molecules with complex level structures. [1] Kozyryev et al., arXiv:1710.08525 (2017).

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