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Towards chirped optical Stark deceleration of molecules NICHOLAS COPPENDALE, PETER DOUGLAS, LEI WANG, PETER BARKER, University College London — Optical Stark deceleration can be used to create cold stationary molecules. This scheme uses deep potentials, created by the interaction of the optical field with the induced dipole moment, to trap molecules within a cold molecular beam and transport them to zero velocity. This can be accomplished using the periodic potential of a constant velocity optical lattice created by the interference of strong laser fields $(10^{10} - 10^{12} \text{ W cm}^{-2})$ [1]. We describe the experimental realisation of chirped optical Stark deceleration which uses a rapidly decelerating optical lattice to slow molecules with a narrower energy spread. The lattice beams are created by a unique laser system that produces two, high energy, laser pulses whose frequency and intensity can be well controlled over durations of greater than 100 ns. The beams are created by amplifying a single rapidly tuneable Nd:YVO4 microchip laser at 1064 nm. Linear frequency chirps of up to 1 GHz have been demonstrated over 150 ns which are suitable for deceleration of most molecular species contained within a molecular of beam of xenon. We will describe this laser system and initial deceleration experiments of molecular hydrogen, as well as trapping and sympathetic cooling experiments with ultra-cold atoms.

 R. Fulton, A. I. Bishop, M. N. Shneider, and P. F. Barker, Nature, Physics, 2006, 2, 465.

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