Abstract Submitted
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Advances in Bichromatic Force Slowing of Atoms and Molecules[1]

M.A. CHIEDA, E.E. EYLER, University of Connecticut — The optical bichromatic force (BCF) holds promise as an efficient, simple, and compact means to slow atoms and molecules to MOT capture velocities.[2,3] Metastable helium beams, with $v \sim 1000$ m/s, are especially worthwhile atomic candidates since they presently require Zeeman slowers with lengths of 2–3 m. We present a novel BCF decelerator in which the Doppler shifts are chirped to keep the force centered on the atoms as they slow. This is made possible by recent advances in high-power diode lasers and electronics, and avoids many of the problems of alternative designs using large detunings. Initial tests on He* atoms show encouraging results. Unlike atoms, direct laser slowing of molecules remains exceedingly difficult, although success with SrF has very recently been reported.[4] We calculate that for molecules with near-cycling transitions, rapid laser BCF slowing should be possible.[5] For the CaF molecule, we predict slowing by $\Delta v = 150$ m/s, enough to bring a buffer-gas cooled beam to rest. An experimental demonstration is in progress.

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[2]M. Cashen and H. Metcalf, JOSA B **20**, 915 (2003).
[3]M. A. Chieda and E. E. Eyler, PRA **84**, 063401 (2011).
[4]J. F. Barry, E. S. Shuman, E. B. Norrgard, and D. DeMille, to be published.
[5]Chieda, op. sit.

Edward Eyler
University of Connecticut

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