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Simulation of Bichromatic Force Cooling[1] XIANG HUA, CHRISTOPHER CORDER, HAROLD METCALF, Stony Brook University — Laser cooling without spontaneous emission as implemented by the bichromatic force (BF) remains a controversial topic. We have done a numerical simulation of the BF on He using the $2^3S \leftrightarrow 3^3P$ transition at $\lambda = 389$ nm in order to support the interpretation of previously reported measurements[2,3]. Our experiments and the simulation reported here use a time scale comparable to the excited state lifetime[2,3] so that spontaneous emission cannot contribute significantly. The average velocity change is 30 - 40 times larger than the recoil velocity but the measurements of both phase space and velocity space compression are limited by the longitudinal velocity spread of the atomic beam to ~ 2.[2,3] The simulation clearly shows this spreading. The code passed several preliminary tests using single-frequency traveling and standing waves, and then it was run with the appropriate bichromatic light fields. Its output agrees very well with the measurements and, most importantly, shows that significant laser cooling is indeed possible on a time scale comparable to that of a single absorption-spontaneous cycle.

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[2]C. Corder et al., Phys Rev. Lett. **114,** 043002 (2015).
[3]C. Corder et al., J. Opt. Soc. Am. B **32**, B75 (2015).

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