Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

On the question of cooling without spontaneous emission via the bichromatic force[1] LELAND ALDRIDGE, DAVID DEMILLE, Yale University — The optical bichromatic force (BCF) has been experimentally shown to produce forces that exceed the saturated radiative force on both atoms and, recently, molecules. Cooling of atoms with BCF also has been observed, even on time scales shorter than the average time for spontaneous decay. This has been claimed as evidence for cooling without spontaneous emission. A mechanism for such cooling has been proposed, based on entropy exchange between atoms and laser photons. We present results that bear on this claim, from simulations of BCF on an ensemble of two-level atoms with no spontaneous decay. Our approach uses classical fields and is fully reversible; hence, by construction, atom-photon entropy exchange is absent in our simulations. We show that on sufficiently short time scales, a bounded degree of cooling (position-momentum phase space compression by a factor of less than two) can occur, due to transfer of entropy into the internal states of the ensemble. On longer time scales, all evidence for cooling disappears unless spontaneous emission is restored in the system.

[1]This work was supported by the US Army Research Office

Leland Aldridge
Yale University

Date submitted: 26 Jan 2018 Electronic form version 1.4