Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Controlling Thermal Collisions with Frequency-Chirped Light

MATTHEW WRIGHT, Adelphi University — We conduct semi-classical monte-carlo simulations of cold collisions utilizing frequency-chirped laser light on the nanosecond timescale. Previous work revealed partial control of light-assisted collisional mechanisms with relatively slow chirp rates (10 GHz/μs). Collisions induced with positive chirped light enhance the inelastic collisional loss rate of atoms from a magneto-optical trap whereas these trap loss collisions can be blocked when negative chirped light is used. Early quantum and classical simulations show that for negative chirps the laser's frequency continually interacts with the atom-pair during the collision. We investigate how this process depends on the chirp rate and show that by moderately speeding up the chirp ($>$ 50 GHz/μs), we can significantly enhance the difference in the collisional loss rate induced by the negative and positive chirps, gaining nearly full control of the collision. We also explore extending this model to probe collisions at temperatures exceeding 1 K.

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Date submitted: 15 Nov 2013 Electronic form version 1.4