Abstract Submitted
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Laser cooling with three-level cascade transitions: calculations for group I and II atoms[1] CRUZ FLAVIO[2], Universidade Estadual de Campinas (UNICAMP), MICHAEL SUNDHEIMER[3], WICTOR MAGNO[4], Universidade Federal Rural de Pernambuco — From an interest in investigating laser cooling techniques suited for alkaline-Earth atoms, we analyze two-color laser cooling with three-level cascade transitions. In particular, for the most abundant even isotopes of light elements such as magnesium and calcium, usual sub-Doppler techniques or narrow-line cooling either cannot be applied or are too difficult to implement. For cascade transitions in which the upper level has longer lifetime than the intermediate one, and for cooling in a "EIT fashion," e.g. using "strong" and "weak" lasers, we found that temperatures below the Doppler limits associated with each one of the individual transitions are expected. Here we present estimations of temperatures as function of detunings and laser intensities for alkaline-Earth (Mg, Ca, Sr, Yb, Zn, Cd) and metal-alkaline atoms (Rb, Cs, Na), which can be used to stimulate further experimental and theoretical work. We study the influence of coherences on the final temperatures, and the effect of phase fluctuations between the lasers. We also discuss an analysis of temperatures limits in terms of dressed states, which reveal a general and simpler method to estimate temperature limits in three-level cooling.

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