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Multidimensional laser cooing on broad and narrow line transitions HAN PU, DANIEL PHALEN, SU YI, Rice University — We investigate theoretically the properties of multidimensional laser cooling of a $J_g = 0 \leftrightarrow J_e = 1$ dipole transition. When the transition linewidth is broad (i.e., much larger than the single photon recoil frequency), we can use the semi-classical method to calculate both analytically and numerically the light pressure forces in a two-dimension (2D) σ^+-σ^- laser configuration. From the results, we identify unique multidimensional features that cannot be captured by a 1D theory. For the narrow line transition, we have to adopt a full quantum theory in which the atomic center-of-mass motion is also quantized. For the same 2D laser field, we use a Monte Carlo Wavefunction simulation to obtain the atomic momentum distribution. We expect that these calculations can provide guidance and motivation for current experimental efforts on laser cooling of alkaline earth atoms such as ^{88}Sr, which possesses both broad and narrow line $J_g = 0 \leftrightarrow J_e = 1$ transitions.

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