

Cooperatively Coupled Motion with Superradiant and Subradiant Atoms

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We investigate the coupled motion of two cooperative atoms in the Doppler cooling setup. The dipole-dipole interaction introduces mutual decay channel and splits the super-radiant and sub-radiant states. The Doppler force is thus modified due to the collective emission and coupled recoil. Such a cooperative effect is more evident when the inter-atom separation is less than or comparable to a wavelength. In an optical molasses, we find that, along the axis of two atoms, there present mechanically stable and unstable regions alternatively as the separation increases. We also investigate the classical trajectories and map out the stability diagram.

Keywords: Doppler Cooling, Cooperative Effect, Optical Molasses, Dipole-Dipole Interaction