

Cooperative motion and cooling with superradiant and subradiant atoms

Guin-Dar Lin

Department of Physics, National Taiwan University, Taiwan

Cooperativity such as super- and sub-radiance originates from exchange interaction in quantum many-body systems. Such coherence can be built up through the dipole-dipole interaction in an ensemble of atomic emitters, resulting in modification of absorption and emission behavior. In this work, we deal with cooperative responses of atoms and investigate the associated mechanical effect, emphasizing on the change of dissipative radiation pressure and the Doppler cooling. We find novel and interesting behavior in their coupled dynamics and spatial arrangement in the subwavelength scale. In order to observe such effects, we propose an implementation using an ion trap. We find that without invoking resolved side-band cooling, sub-Doppler cooling for some specific modes is possible due to atoms' cooperative motion.