Nanooptics and nanophotonics

Cooling of molecules and nanoparticles by the pulsed laser radiation

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We discuss a possible one-dimensional trapping and cooling of atoms and molecules due to their nonresonant interaction with counterpropagating light pulse trains. The counterpropagating pulses form a one-dimensional trap for atoms and molecules and a properly chosen carrier frequency detuning from the transition frequency of the atoms or molecules keeps the temperature of the atomic or molecular ensemble close to the Doppler cooling limit. The calculation by the Monte Carlo wave-function method [1] is carried out for the two-level and three-level schemes of the atom's and the molecule's interaction with the field, respectively. The models discussed are applicable to atoms and molecules with almost diagonal Frank-Condon factor arrays. Illustrative calculations are carried out for ensemble-averaged characteristics for sodium atoms and SrF molecules in the trap.

We discuss also the possibility of the pulsed laser cooling without spontaneous emission demonstrated recently for the case of bichromatic field [2].

1. *C. Mølmer, Y. Castin, J. Dalibard.* Monte-Carlo wave function method in quantum optics // J. Opt. Soc. Am. -1993.- B **10** P. 524-538.

2. *C. Corder, B. Arnold, and H. Metcalf.* Laser cooling without spontaneous emission// Phys. Rev. Lett. -2015 - **114**, 043002.