

Room-temperature tunable masers based on the weakly aligned molecules

Yuri Rostovtsev

Department of Physics, University of North Texas, 1155 Union Circle, #311427, Denton, USA

We have developed and demonstrated a new mechanism of manipulation of population in molecular rotational levels in a weakly aligned molecules. The mechanism is based on an adiabatically changing electric field interacting with the molecules with dipole moments. Treating molecules as simple rotators, we have described their behavior using the density matrix taking into account the relaxation processes. We have considered the interaction of the weakly aligned molecules with a microwave field in a high finesse cavity. We have found that, on one hand, the population inversion can be reached in the ensemble of the weakly aligned molecules to be used for the maser operation at room temperature. On the another hand, we have found that the enhancement of the absorption can reach the theoretical limit and be used for gas sensing with high sensitivity and selectivity. Such sensors can efficiently analyze the multi-gas mixtures and be used for a huge range of applications – stretching from technology, sciences, control of environment, biology and medicine.