Weakly Aligned Molecules: From Molecular Detectors to Room-Temperature Tunable Masers

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We study weakly aligned molecules in dc and ac electric fields. We demonstrate the new sensing mechanism based on an adiabatically changing electric field interacting with the rotational structure of the molecules with dipole moments. We have theoretically demonstrated a single low-frequency gas detector that can be used for sensing gas mixtures with high selectivity, accuracy, and sensitivity. The enhancement of the population difference between corresponding molecular levels and reached the theoretical maximum of absorption have been shown. It would be of great importance to have a sensor that can efficiently analyze the multi-gas mixtures with high selectivity. Such a gas sensor can be used for a huge range of applications – stretching from technology, sciences, control of the environment, biology and medicine. One can choose a resonant frequency to detect a gas mixture of molecules. Another application of the efficient population control of rotational levels is creating the population inversion and the possibility of the creation of a maser that works at room temperature.