On selective collisionless excitation and dissociation of molecules by intense infrared light (with reference to review articles in Usp. Fiz. Nauk).

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In connection with the appearance in "Uspekhi Fizicheskikh Nauk" of two review articles (Usp. Fiz. Nauk **118**, 583 (1976); 121, 427 (1977); [Sov. Phys. Usp. **19**, 285 (1976); 20, 209 (1977)]) on separation of isotopes with the aid of lasers, I would like to note the unsatisfactory treatment in them of the question of selective multistep collisionless excitation and dissociation of molecules by intense infrared light.

The possibility of such an effect on molecules by tuning for vibrational resonance and "driving" up the levels to high excitation and dissociation was first examined in our papers[1,2] already in 1964–65, with a *general treatment* (and not only for diatomic molecules) being given in Ref. 1 where also different methods of overcoming anharmonism were noted (field broadening, rotation, possibility of a smooth decrease of frequency, broadening of the spectrum, excitation by several frequencies, etc.) and an estimate was given of the time for quasiharmonic strong excitation $t \sim M\Omega a/eE$ where M and Ω are the mass and the frequency of oscillation of an atom or of a group of atoms in a molecule, a is the dimension of the molecule, e is the charge of the part being set in oscillation, E is the intensity of the field of the light wave. Substitution of experimental values $E \gtrsim 20$ CGSE ($\gtrsim 100$ kW/cm^2) $M \approx 5\times10^{-23}$ g and $\Omega = 2\times10^{14}$ rad/sec yields $t \lesssim 10$ nsec, which is compatible with the experimentally obtained values of 3–8. This shows that for a number of reasons (that have not yet been finally elucidated) overcoming of anharmonism occurs and rates of passage are compatible with quasiresonance ones. In Refs. 1, 2 new types of resonance excitation were also examined—based on frequency doubling in homopolar molecules, with jumping over a number of levels, by means of mixing of two frequencies, etc.

The first experiments on the detection of selective excitation and dissociation of molecules by intense infrared light were carried out by Isenor[3–6] and his collaborators, where the choice of the type of molecules guaranteed the resonant build-up of vibrations by radiation from CO_2 lasers. In Ref. 4 the isotopic selectivity and the difference in the excitation of different isotopes was also noted. One should bring to the attention of the authors of the review articles the usefulness of a more complete citation of articles.

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