Reply to the letter of G. A. Askar'yan

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In connection with the letter of G. A. Askar'yan in Usp. Fiz. Nauk we would like to explain the reason for the lack of completeness in quoting the literature on selective collisionless excitation of molecules in a strong infrared field in our review of the new methods of isotope separation (Usp. Fiz. Nauk 121, 427 (1977) [Sov. Phys. Usp. 20, 209 (1977)]) which has been noted by the author of the letter.

It would appear that in order to throw light on the history of the problem of exciting higher vibrational levels of molecules by radiation in the infrared range and to discuss its present state one should include in the review the series of papers cited in the letter of G. A. Askar'yan. At the same time we would like to remark that in our review we have discussed the application of collisionless vibrational excitation of molecules only to the separation of isotopes, and in connection with this it included papers directed to the solution of this specific problem and mainly those in which experimental results were obtained or discussed. It is this circumstance which explains the absence in our review of references to articles concerning which G. A. Askar'yan has written in which the problem of the separation of isotopes is not explicitly posed. But in a whole series of our papers (among them those of a review nature) devoted to the excitation of molecules by laser radiation and to the selective stimulation of physical-chemical processes we have quoted in particular the papers of G. A. Askar'yan of 1964–1965 as being among the first investigations in this field.

If the author of the letter has no objections, then the papers quoted by him can be regarded as an additional compilation of references to our review article.

Translated by G. Volkoff

Concerning the letter of G. A. Askar'yan "On selective collisionless excitation and dissociation of molecules by intense infrared light"

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1. G. A. Askar'yan in 1964–1965 drew attention to the possibility of a strong radiative action of laser radiation on the vibrational degrees of freedom of molecules.

2. The effect discovered by N. Isenor in 1971 of collisionless dissociation of molecules by the intense field of the radiation from a CO_2 laser is observed only in the case of sufficiently polyatomic symmetric molecules.

3. The discussion given by G. A. Askar'yan is valid only for the description of excitation of diatomic molecules or nondegenerate vibrations of polyatomic molecules. It does not describe the excitation of molecules with degenerate vibrational modes, does not take into account the Fermi resonances, the complicated nature of the vibrational spectrum and the existence of a quasicontinuum of excited vibrations and of its structure. Taking all these circumstances into account fundamentally alters the description of the excitation and dissociation of molecules.

4. At the same time the papers of G. A. Askar'yan and also of F. B. Bunkin (Ref. 46 in the review article in Usp. Fiz. Nauk 118, 583 (1976) [Sov. Phys. Usp. 19, 285 (1976)]) are the first publications devoted to the radiative action of intense laser radiation on molecules and as such should be cited.

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