Optica Applicata, Vol. XIV, No. 3, 1984

Book review

Nonlinear laser chemistry

Multiple-photon excitation

V. S. LETOKHOV

Springer Series in Chemical Physics, Vol. 22

Springer-Verlag, Berlin, Heidelberg, New York, 1983
[pp. i–xiv + 417, with 152 Figs.]

This book has been edited in the well known Springer-Verlag series *Chemical Physics*. This series is devoted to monographs written by distinguished specialists from the fields of physics and physical chemistry. The newest scientific problems being actually in the stage of development are usually dealt with there. The author of the book reviewed, V. S. LETOKHOV, has worked for many years in the physics of lasers and their applications in physical chemistry. A significant part of the book is devoted to his own achievements as well as to those of his group in the Institute of Spectroscopy of the USSR Academy od Sciences in Troitsk (near Moskow). Below is a review of the more important problems presented in this book.

In Chapter 1 the general concepts connected with the nonlinear interaction of laser with the ensemble of atoms or molecules are discussed. In particular the concept of internal and external molecular selectivity (in excitation process) has been defined and multi-step and multi-photon molecular photoexcitation processes classified.

In Chapter 2 the selective photo-excitation of atoms and molecules is presented. The role of the isotopic shift, the problems of spectral lines overlapping, the role of spin in the molecules and also the overlapping of oscillation-rotational absorption bands are discussed.

Chapter 3 deals with the problems of multi-step selective photoionization of atoms. In particular the following topics are considered: the cross-section of the process, the effects of coherent interactions, ionization of highly excited atoms (Rydberg states), collisional processes, resonance exchange of energy, electron capture, associative ionization, electron escape and resonance transfer of energy.

Chapter 4 is devoted to the selective monomolecular photoprocesses in nonlinear excitation of electron states. Here the methods of multi-step electron excitation for molecule states, photodissociation of molecules in two-step excitation (via the oscillation states), monomolecular photoprocesses with oscillational multi-photon excitation and photoionization of molecules via the nonlinear excitation of electron states are successively discussed.

Chapter 5 deals with the problems of multi-photon processes in monomolecular molecules in ground state. In Chapter 6 the photoseparation at the level of atomic and molecular states is described. Selective detection of atoms and molecules is presented in Chapter 7. Here, among others, an important problem of single atom detection and also the visualization of molecules by application of laser photoionizing processes are considered.

The last Chapter 8 is devoted to both photochemistry and photobiochemistry. The photochemistry in infrared beams is here described and also the application of photochemistry

to examination of biomolecules in solutions discussed. The last part of this chapter describes the newest problems in photodecomposition and photochemical synthesis of nucleic acid by application of picosecond light pulses.

The book by V. S. LETOKHOV offers an extensive original scientific material. The reader will find here first of all the achievements of the Institute of Spectroscopy, USSR Academy of Sciences, also the most important results of the other research centres are presented. A valuable feature of the book is the high precision with which the definitions of many photochemical processes are formulated. This facilitates the study of the problems presented. The typography of the book is good though it is produced by the small offset printing technique and the figures are very carefully drawn. Therefore, I believe that this is a very good book which may be recommended to a wide circle of both physicists and chemists.

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