

Book review

Lasers, Spectroscopy and New Ideas

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[pp. i-xiv + 337 with 161 Figures]

The book is written by physicians connected with the Physics Department of Stanford University, co-workers and former students of Nobel Laureate ARTHUR SCHAWLOW. The volume originates on the occasion of honouring the 65th birthday of Prof. ARTHUR SCHAWLOW.

The papers contained in this book are divided into four parts. The first three are devoted to lasers, lasers spectroscopy, spectroscopy of atomic and molecular systems and spectroscopy in condensed phases. Prof. ARTHUR SCHAWLOW has had a significant influence in these areas of physics. The fourth part contains papers which are related to other areas of physics, to which the contribution of Prof. SCHAWLOW was indirect, consisting in training a cadre of scientists working in these areas.

The first part of the book comprises six papers which are concerned with lasers and lasers spectroscopy techniques. The first paper is a review of research works done at Schawlow's Laboratory by T. W. HANSCH and co-workers. We can find a lot of interesting information about the development of a highly monochromatic tunable dye laser, using a spectroscopy without Doppler broadening and cooling an atomic gas by resonant pressure. The next paper describes the development of powerful, efficient, multiwavelength lasers for scientific, energy, defence, industrial and medical applications. These research works are based on the work initiated by SCHAWLOW in the 1950s and on the series of his scientific achievements in the 1960s and 1970s.

The third article is a review of some aspects of the research connected with Cavity Quantum Electrodynamics, i.e., with the cavity which is either empty or unable to sustain a single photon emitted by the atomic medium. Experimental works, including the study of one or two-photon Rydberg atom masers and the study of inhibition of spontaneous emission in a microwave cavity, are an extension of the research of Rydberg atom radiative properties.

The fourth paper describes the glass of modern lasers, its parameters and applications to the powerful lasers. The paper can be treated as a source of information about various parameters of different kinds of laser glass, because of a detailed presentation of laser glass and very good bibliography. The predictions concerning the future possibilities in glass lasers are presented.

The fifth paper is a detailed discussion of theoretical and practical aspects of intra-cavity spectroscopy with multimode lasers. The described experiments are connected with the application of the high-sensitive inter-cavity spectroscopy to the detection of weak linear or nonlinear absorption of gain and of weak light.

The last paper of this part describes an FM dye laser capable of producing an FM oscillation over a region in the excess of 1 THz and its characteristics. The experiments on single frequency UV generation using the FM laser and Doppler-free two-photon spectroscopy using the FM laser are presented.

The second part of this volume consists of six papers and the main emphasis is laid on atomic and molecular spectroscopy. The first paper of this part is a review of the recent works with laser and Fourier transform techniques on the transition metals with open 3d, 4d and 5d shells. The combination of laser spectroscopy and Fourier transform spectroscopy makes possible a progress in determining atomic

transition probabilities for the elements in low stages of ionization. This method can improve the accuracy of atomic transition probabilities from 5% to 10%.

The second paper is a detailed discussion of the engineering of enormous size atoms, about a million times larger than a normal hydrogen atom. The production and detection of such large atoms involve the most advanced techniques of laser and atomic physics. The study of this kind of atoms is concerned with the old ideas of Niels Bohr concerning atomic structure.

The next paper of this part summarizes the research on sodium dimers. The authors combine various nonlinear laser spectroscopy techniques for the study of Na_2 .

The fourth paper is focused on the application of laser-driven ionization techniques to the study of atomic physics problems. The experimental results confirm that a collisional mechanism is responsible for the nearly complete ionization following the laser irradiation.

The third part of the book contains four papers on solid state spectroscopy.

The first of them discusses inhomogeneous and homogeneous broadening line profile for rare earth ion impurities in single crystals. These investigations are connected with a study of sharp line spectra in solid body.

The second paper is a review of research on spectroscopy of solid-state laser materials, which was made by the author and co-workers. The next paper is very closely connected with the mentioned ones, being devoted to spectroscopic study of the ruby spectrum.

The last paper describes the theoretical and experimental bases for studying the relaxation processes of defect metastable states in solid. The results show that this method provides the information about metastable states which can be quite different from that provided by direct fluorescence of phosphorescence measurements.

The last part of this book gives a miscellany of problems which are connected with lasers and laser spectroscopy. This part consists of three papers, namely: the study of highly ionized atoms physics by using a device which produces magnetically confined high-temperature plasma (Tokamak), problems related to the investigations of a noise state in vacuum, research on Raman spectroscopy applied to polypeptides and proteins.

Some anecdotes and other items found in this volume show that joy and humor normally prevail in association with Prof. ARTHUR SCHAWLOW.

At the end of the volume we get a short information about the authors of the papers.

The book is not very easy to study because the authors assume that their readers have a special background. This book should be very useful to any person working with lasers, i.e., to graduate students in physics, chemistry and engineering. The papers are well-written, explanations are clear provided with suitable figures, tables, etc. The book earns its place as a valuable collection of excellent and diverse articles on laser. This beautifully produced volume presents the same accuracy and clarity of presentation as in the earlier books of this series.

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