

Topics in Applied Physics

Volume 2

Laser Spectroscopy of Atoms and Molecules

Editor: H. Walther

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with Lasers

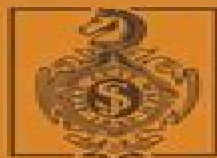
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The impact of lasers on spectroscopy can hardly be overestimated. Lasers represent intense light sources with spectral energy densities which may exceed those of incoherent sources by several orders of magnitude. Furthermore, because of their extremely small bandwidth, single mode lasers allow a spectral resolution which far exceeds that of conventional spectrometers. Many experiments which could not be done before the application of lasers because of lack of intensity or insufficient resolution are readily performed with lasers. Now several thousands of laser lines are known which span the whole spectral range from the vacuum ultraviolet to the far infrared region. Of particular interest are the continuously tunable lasers which may in many cases replace wavelength selecting elements such as spectrometers or interferometers. In combination with optical frequency mixing techniques such continuously tunable monochromatic coherent light sources are available at nearly any desired wavelength above 100 nm.

High-Power Lasers and Applications K.-L. Kompa, H. Walther, 2013-04-17 The High Power Lasers and Applications Conference was held in Munich June 20-22 1977. The conference took place simultaneously with the Laser 77 International Congress and Trade Fair at the Munich Fair Ground. The meeting was a continuation of a series of colloquia on electronic transition lasers previously held in the United States. The main topics of the conference were high power VUV, UV, visible and IR lasers including an analysis of laser systems technology and laser concepts. Also some applications to nonlinear optics, chemical kinetics and spectroscopy particularly with respect to isotope separation were discussed. The conference was attended by 95 scientists representing Austria, Canada, England, Finland, Germany, FRG, Germany, GDR, France, Israel, Italy, The Netherlands and the U.S.A. The organizers acknowledge financial support from the Deutsche Forschungsgemeinschaft, the U.S. Air Force Office of Scientific Research, the U.S. Air Force European Office of Aerospace Research and Development (EOARD) and the U.S. Army European Research Office as well as from the companies Coherent Radiation, Spectra Physics and Cryophysics. Furthermore, we thank our colleagues Dr. Steven N. Suchard and Professor Jeffrey I. Steinfeld for coordinating the U.S. contribution to the conference. We are grateful to Frau Maischberger for administrative assistance.

High Resolution Spectroscopy J. Michael Hollas, 2013-10-22 High Resolution Spectroscopy discusses the underlying concepts in the different branches of spectroscopy, especially in high resolution spectroscopy. The coverage of the book includes basic principles such as the quantization of energy as well as the interaction of electromagnetic radiation with atoms and molecules, general experimental methods and features of instrumentation and microwave, millimeter wave and Lamb dip spectroscopy. Also covered in the book are subjects such as the principles behind rotational spectroscopy, diatomic and polyatomic molecules in vibrational spectroscopy and the electronic spectroscopy of atoms as well as diatomic and polyatomic molecules. The text is recommended for engineers and

physicists who would like to know more about the concepts theories methods and instrumentation related to spectroscopy particularly in the field of high resolution spectroscopy *Methods of Laser Spectroscopy* Yehiam Prior, Abraham Ben-Reuven, Michael Rosenbluh, 2012-12-06 The Fritz Haber Symposium on Methods of Laser Spectroscopy was held in Ein Bokek Israel on the shores of the Dead Sea on December 16 20 1985 The location is the lowest place on earth 392 meters below sea level It was hoped that 120 active laser scientists so lowly trapped in such a place with the nearest entertainment 100 km away will have no choice but to discuss laser spectroscopy On the average the Dead Sea area receives 3 4 days of rain each year and this year these days all occurred during the conference This did not mean the cancellation of the hikes although the trip to Massada was conducted in the rain The unexpected rains also caused flash floods in the area and Ein Bokek was completely cut off on Thursday night The archeologist scheduled to speak after dinner and the belly dancer scheduled to appear afterwards could not arrive resulting in the only serious deviation from the original plan The scientific program consisted of invited talks and contributed posters The emphasis in selection of invited speakers and topics was on the methods rather than specific molecular systems and an attempt was made to allow ample time for discussion after each lecture The same philosophy guided us in editing this book and authors were requested to write manuscripts longer than usual for standard conference proceedings **Lasers in Atomic, Molecular, and Nuclear Physics** V. S. Letokhov, 1986

Laser-Induced Processes in Molecules K. L. Kompa, S. D. Smith, 2012-12-06 This conference on both the physics and chemistry of laser induced processes in molecules was organized by the Quantum Electronics Divisional Board of the European Physical Society whose membership is given on p 367 The conference aim to mix physicists and chemists interested in this exciting field both from Europe and further afield was well fulfilled by the attendance of around 250 participants and the submission of about 100 papers which were presented here Numerous people at both the Physics Department Heriot Watt University Edinburgh and at the Projektgruppe für Laserforschung MPI Garching contributed hard work to the organization in addition to Dr Bob Harrison who bore the biggest burden with conspicuous success we particularly thank Hugh MacKenzie Richard Dennis and last but not least Miss Joanne Askham and the secretaries in Edinburgh together with Frau Doris Maischberger and the secretaries in Garching December 1978 K L Kompa S D Smith *Conren Part I Study of Lasers and Related Techniques Suitable for Applications in Chemistry and Spectroscopy* Rare Gas Halogen Lasers and Photochemical Applications By S D Rockwood 3 Group VI Molecular Photolytic Dissociation Studies Using Rare Gas Halide Lasers By M C Gower A J Kearsley and C E Webb 8 Broadly Tunable UV Source Based on Stimulated Raman Scattering *Chemical and Biochemical Applications of Lasers* V5 C. Bradley Moore, 2012-12-02 Chemical and Biological Applications of Lasers Volume V focuses on the laser applications in photochemistry and spectroscopy This book examines the spectroscopic detection of single atoms and explores the purification of industrial chemicals Organized into seven chapters this volume starts with an overview of the methods developed for laser detection of single atoms including

fluorescence photoionization photodeflection and their combinations This text then discusses the methods of high resolution spectroscopy which provide detailed information on molecular structure and reaction kinetics studies Other chapters review several laser photodissociation studies which explain dissociation dynamics This book discusses as well the possibilities for selective photochemical reactions and examines the potential of lasers for practical application in chemical processing The final chapter considers the various metals that can undergo a photochemical change in oxidation state in ordinary solvents This book is a valuable resource for physicists chemists electrochemists photochemists electrical engineers and chemical engineers

Atomic, Molecular, and Optical Physics: Atoms and Molecules, 1996-05-16 Combined with the other two volumes this text is a comprehensive treatment of the key experimental methods of atomic molecular and optical physics as well as an excellent experimental handbook for the field The wide availability of tunable lasers in the past several years has revolutionized the field and led to the introduction of many new experimental methods that are covered in these volumes Traditional methods are also included to ensure that the volumes will be a complete reference source for the field

Tunable Lasers and Applications A. Mooradian, T. Jaeger, P. Stokseth, 2013-06-29 The Tunable Lasers and Applications Conference was held in Loen Norway on June 6-11 1976 This conference dealt with the technology of tunable lasers from the vacuum ultraviolet to the far infrared and their application in the areas of photochemistry chemical kinetics isotope separation atmospheric photochemistry and environmental studies photobiology and spectroscopy The need for such a conference grew out of the rapidly expanding use of tunable lasers in a broad range of disciplines The conference was attended by 130 scientists representing Japan Italy West Germany Canada Israel France England Norway Sweden Brazil Denmark Finland the Netherlands the Soviet Union and the United States The location of the conference in Loen Nordfjord was chosen because of the magnificent beauty of its aqua blue fjords surrounded by glacier capped mountains and lush green hillsides The Alexandra Hotel was a perfect host for such a conference with first class services superb smorgasbord and excellent audio visual facilities The atmosphere was free of distractions and provided for a relaxed interchange of ideas An afternoon hike was arranged to the Briksdal glacier while the highlight of the outdoor activities was a bus ship excursion to the majestically splendid Geiranger fjord A sumptuous banquet was followed by an interesting and entertaining illustrated talk on high speed and underwater photography by Professor Harold Edgerton from MIT Financial support from our sponsors is gratefully acknowledged in helping to make this conference a complete success

Progress in Atomic Spectroscopy W. Hanle, 2013-03-09 W. HANLE and H. KLEINPOPPE In 1919 in the first edition of *Atombau und Spektrallinien* Sommerfeld referred to the immense amount of information which had been accumulated during the first period of 60 years of spectroscopic practice Sommerfeld emphasized that the names of Planck and Bohr would be connected forever with the efforts that had been made to understand the physics and the theory of spectral lines Another period of almost 60 years has elapsed since the first edition of Sommerfeld's famous monograph As the editors of this monograph *Progress in Atomic*

Spectroscopy we feel that the present period is best characterized by the large variety of new spectroscopic methods that have been invented in the last decades Spectroscopy has always been involved in the field of research on atomic structure and the interaction of light and atoms The development of new spectroscopic methods i e new as compared to the traditional optical methods has led to many outstanding achievements which together with the increase of activity over the last decades appear as a kind of renaissance of atomic spectroscopy

Introduction to Nonlinear Laser Spectroscopy 2e Marc Levenson, 2012-12-02 Introduction to Nonlinear Laser Spectroscopy Revised Edition presents the most useful nonlinear spectroscopy techniques at a level accessible to spectroscopists and graduate students unfamiliar with nonlinear optics This book discusses the principles of nonlinear laser spectroscopy Organized into seven chapters this edition starts with an overview of the stimulated Raman effect and coherent anti Stokes Raman spectroscopy which can be used in a varied way to generate radiation in the ultraviolet and vacuum ultraviolet areas This text then explains the exciting possibilities started by saturated absorption and related techniques including improved spectroscopic precision studies of collisional dynamics and better measurements of fundamental constants and of basic units Other chapters examine Hamiltonian relaxation which describes all of the processes that return the ensemble to thermal equilibrium The final chapter deals with the method of infrared spectrophotography which combines efficient detection time resolution and coherent infrared Spectroscopists and graduate students will find this book extremely useful

Laser Spectroscopy, 1977 *Introduction to Nonlinear Laser Spectroscopy* Marc Levenson, 2012-12-02 Introduction to Nonlinear Laser Spectroscopy focuses on the principles of nonlinear laser spectroscopy This book discusses the experimental techniques of nonlinear optics and spectroscopy Comprised of seven chapters this book starts with an overview of the stimulated Raman effect and coherent anti Stokes Raman spectroscopy which can be used in a varied way to generate radiation in the ultraviolet and vacuum ultraviolet areas This text then explains the simplest quantum mechanical system consisting of an isolated entity with energy eigenstates

Advances in Atomic, Molecular, and Optical Physics, 1993-03-05 Advances in Atomic Molecular and Optical Physics *Principles of Magnetic Resonance* Charles P. Slichter, 2013-06-29 It is a source of great pleasure to help launch the new Springer Series in Solid State Sciences Some years ago I wrote my book Principles of Magnetic Resonance I have been eager to publish a new book concerned with spin temperature double resonance and spin flip line narrowing topics basic to important trends in present day magnetic resonance which were not treated in my earlier book Invitations to lecture in Osaka Japan in Leuven Belgium and Lausanne Switzerland had provided occasion to prepare first drafts of the new topics and to get student feedback My plans were changed however when I learned that Principles of Magnetic Resonance was no longer available Dr Lotsch Physics Editor of Springer Verlag and I decided it made sense to combine the new book with a modified old one thereby continuing to make available a complete text in basic magnetic resonance written with a philosophy of presenting a thorough treatment of a small number of concepts which are key to large areas of magnetic resonance In addition to adding

three new chapters I have added new material to the original chapters have added two new appendices one on the use of Bloch equations to describe rate processes the other on the effect of diffusion on spin echoes and have augmented the collection of homework problems

Progress in Atomic Spectroscopy H.J. Beyer, Hans Kleinpoppen, 2012-12-06 H J BEYER AND H KLEINPOPPEN We are pleased to present Part D of Progress in Atomic Spectroscopy to the scientific community active in this field of research When we invited authors to contribute articles to Part C to be dedicated to Wilhelm Hanle we received a sufficiently enthusiastic response that we could embark on two further volumes and thus approach the initial goal set when Parts A and B were in the planning stage of an almost comprehensive survey of the current state of atomic spectroscopy As mentioned in the introduction to Parts A and B new experimental methods have enriched and advanced the field of atomic spectroscopy to such a degree that it serves not only as a source of atomic structure data but also as a test ground for fundamental atomic theories based upon the framework of quantum mechanics and quantum electrodynamics However modern laser and photon correlation techniques have also been applied successfully to probe beyond the traditional quantum mechanical and quantum electrodynamical theories into nuclear structure theories electro weak theories and the growing field of local realistic theories versus quantum theories It is obvious from the contents of this volume and by no means surprising that applications of laser radiation again played a decisive role in the development of new and high precision spectroscopic techniques

Laser Applications in Physical Chemistry D.K. Evans, 2020-11-26 This book provides an introduction on applications of lasers in Chemistry It describes laser as a tool for chemistry the consideration involved in describing a laser beam and what happens to beam as it is propagated through a gas The book is useful for graduates and advanced undergraduates

Raman Spectroscopy of Gases and Liquids A. Weber, 2012-12-06 The Raman effect is a most useful tool for the study of molecular vibrations and molecular structure Information about the structure and symmetry of molecules as well as about their vibrational energies can be obtained to a reasonable degree of satisfaction from their infrared and Raman vibrational spectra The body of knowledge of the vibrational infrared and Raman spectra of molecules is immense and is now so well organized and understood that it is found to be represented in any standard upper level undergraduate curriculum in chemistry The rotational energies of a molecule and quantitative details about its structure can only be obtained through the techniques of microwave and high resolution infrared and Raman spectroscopy of low pressure gases and vapors The results of such investigations are of interest not only to the academic scientists but also to scientists and engineers who are active in applied fields of chemistry and physics as well as the atmospheric sciences This book deals with basic investigations of the Raman scattering of light by gases with some attention also being given to liquid substances After a brief introductory chapter that delineates the historical development of Raman spectroscopy of gases high resolution rotation vibrational and pure rotational Raman spectroscopy is described in Chapters 2 and 3 The all important intensity parameter the Raman scattering cross section is treated in Chapter 4 while the broadening of Raman lines due to the effects

of intermolecular forces is taken up in Chapter 5

Whispering the Secrets of Language: An Emotional Journey through **Laser Spectroscopy Of Atoms And Molecules Topics In Applied Physics**

In a digitally-driven world wherever screens reign great and quick connection drowns out the subtleties of language, the profound strategies and psychological nuances hidden within words often move unheard. Yet, set within the pages of **Laser Spectroscopy Of Atoms And Molecules Topics In Applied Physics** a charming literary value sporting with raw thoughts, lies an exceptional quest waiting to be undertaken. Penned by a skilled wordsmith, this marvelous opus invites viewers on an introspective journey, lightly unraveling the veiled truths and profound impact resonating within the material of each and every word. Within the emotional depths of this emotional review, we shall embark upon a honest exploration of the book is core subjects, dissect their captivating publishing model, and yield to the powerful resonance it evokes heavy within the recesses of readers hearts.

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