
Atomic and Molecular Beam Methods

VOLUME 1

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Atomic and Molecular Beams Cyril Bernard Lucas, 2013-12-13 Atomic and molecular beams are employed in physics and chemistry experiments and to a lesser extent in the biological sciences These beams enable atoms to be studied under collision free conditions and allow the study of their interaction with other atoms charged particles radiation and surfaces Atomic and Molecular Beams Production and Collimation explores the latest techniques for producing a beam from any substance as well as from the dissociation of hydrogen oxygen nitrogen and the halogens The book not only provides the basic expressions essential to beam design but also offers in depth coverage of Design of ovens and furnaces for atomic beam production Creation of atomic beams that require higher evaporation temperatures Theory of beam formation including the Clausing equation and the transmission probability Construction of collimating arrays in metals plastics glass and other materials Optimization of the design of atomic beam collimators While many review articles and books discuss the application of atomic beams few give technical details of their production Focusing on practical application in the laboratory the author critically reviews over 800 references to compare the atomic and molecular beam formation theories with actual experiments Atomic and Molecular Beams Production and Collimation is a comprehensive source of material for experimentalists facing the design of any atomic or molecular beam and theoreticians wishing to extend the theory *Atom, Molecule, and Cluster Beams I* Hans Pauly, 2012-12-06 A consistent up to date description of the extremely manifold and varied experimental techniques which nowadays enable work with neutral particles Th book lays the physical foundations of the various experimental techniques which utilize methods from most fields in physics **Nuclear Science Abstracts**, 1974-07 **The Chemical Dynamics and Kinetics of Small Radicals** Ketian Liu, Albert Wagner, 1996-01-19 This book highlights recent progress in the chemistry of radicals Developments include the growing use of lasers to generate radicals the application of lasers to provide state angular polarization energy and real time resolution in kinetics and dynamics experiments the development of theories for handling the reactions of radicals and the simulation of the reaction dynamics of increasingly larger systems for direct comparison to experimental results The book emphasizes the increasing interaction between experimental dynamics kinetics and theory It is appropriate for chemistry graduate students and researchers about to enter the field However the discussions of some topics progress to a more advanced level so that even an expert will find the book useful **Surface Science** Kurt W. Kolasinski, 2020-01-07 An updated fourth edition of the text that provides an understanding of chemical transformations and the formation of structures at surfaces The revised and enhanced fourth edition of Surface Science covers all the essential techniques and phenomena that are relevant to the field The text elucidates the structural dynamical thermodynamic and kinetic principles concentrating on gas solid and liquid solid interfaces These principles allow for an understanding of how and why chemical transformations occur at surfaces The author a noted expert on in the field combines the required chemistry physics and mathematics to create a text that is

accessible and comprehensive The fourth edition incorporates new end of chapter exercises the solutions to which are available on line to demonstrate how problem solving that is relevant to surface science should be performed Each chapter begins with simple principles and builds to more advanced ones The advanced topics provide material beyond the introductory level and highlight some frontier areas of study This updated new edition Contains an expanded treatment of STM and AFM as well as super resolution microscopy Reviews advances in the theoretical basis of catalysis and the use of activity descriptors for rational catalyst design Extends the discussion of two dimensional solids to reflect remarkable advances in their growth and characterization Delves deeper into the surface science of electrochemistry and charge transfer reactions Updates the Frontiers and Challenges sections at the end of each chapter as well as the list of references Written for students researchers and professionals the fourth edition of Surface Science offers a revitalized text that contains the tools and a set of principles for understanding the field Instructor support material solutions and PPTs of figures are available at <http://booksupport.wiley.com>

Atomic and Molecular Clusters Roy L. Johnston, 2002-04-25 Cluster physics is the foundation of the increasingly important field of nanotechnology Clusters ranging in size from a few to many millions of atoms constitute a fascinating field of research in physics chemistry and materials science They are formed by most of the elements of the Periodic Table and the types of bonding and the resultant clusters are equally as varied This book introduces atomic clusters ranging from weakly bonded clusters of argon to strongly bonded carbon clusters and metal nano particles It includes worked examples to enable lecturers and students to gauge their understanding and progress Atomic and Molecular Clusters describes the experimental generation detection and interrogation of clusters and theoretical approaches developed to aid understanding of their physical properties It classifies clusters according to their bonding types and gives examples of present and possible future applications of clusters in electronic optical and magnetic devices

High-Resolution Experiments on Strong-Field Ionization of Atoms and Molecules Lutz Fechner, 2016-04-26 In this thesis the ionization of atoms and small molecules in strong laser fields is experimentally studied using a reaction microscope The population of autoionizing doubly excited states in the laser fields is proven and a possible connection to the well known dielectronic recombination processes is discussed The fundamental process of tunnel ionization in strong laser fields is subject of investigation in a pump probe experiment with ultrashort laser pulses A coherent superposition of electronic states in singly charged argon ions is created within the first and subsequently tunnel ionized with the second pulse This gives access to state selective information about the tunneling process and allows to test common models Moreover the ionization of krypton and argon at different wavelengths is studied from the multiphoton to the tunneling regime The wavelength dependent investigations are furthermore extended to molecular hydrogen In addition to ionization this system might undergo different dissociative processes Channel selective electron momentum distributions are presented and compared to each other

Atom, Molecule, and Cluster Beams II Hans Pauly, 2013-04-17 This book completes the physical foundations and

experimental techniques described in volume 1 with an updated review of the accessory equipment indispensable in molecular beam experiments It extends the subject to cluster beams and beams of hyperthermal and subthermal energies

Laser Spectroscopy Wolfgang Demtröder, 2008-07-23 Keeping abreast of the latest techniques and applications this new edition of the standard reference and graduate text on laser spectroscopy has been completely revised and expanded While the general concept is unchanged the new edition features a broad array of new material This new edition has been completely revised especially the chapters on non linear spectroscopy ion trapping ultra short laser pulses and new developments Fifty new figures illustrate the newest developments and results The author is one of the most renowned experts in this area and no other book with this broad scope is available Modern Techniques of Surface Science D. P. Woodruff, T. A. Delchar, 1994-03-03 This is a fully revised and expanded edition of a very successful and widely used book It describes the physical basis of all the principal and most of the more specialised techniques currently employed in the study of well characterised solid surfaces The coverage of each technique illustrated with selected examples is underpinned by discussion of the relevant physical principles and the complementary aspects of the various methods are also described Throughout the emphasis is on understanding the concepts involved rather than on an exhaustive review of applications The book will be of great use to final year undergraduate and postgraduate students in physics chemistry and materials science It will also be valuable to established researchers in any area of surface science concerned with the acquisition and analysis of experimental data *Advanced Topics in Contemporary Physics for Engineering* Rui F. M. Lobo, Mário J. Pinheiro, 2022-12-21 This book highlights cutting edge topics in contemporary physics discussing exciting advances and new forms of thinking in evolving fields with emphases both on natural phenomena and applications to modern engineering It provides material for thought and practice in nanophysics plasma physics and electrodynamics Nanophysics and plasmas are synergic physical areas where the whole is more than the sum of the parts quantum atomic and molecular electrodynamics photonics condensed matter thermodynamics transport phenomena The authors emphasize both fundamentals and more complex concepts making the contents accessible as well challenging Nanoscale properties and physical phenomena are explained under the umbrella of quantum physics Advances made in the physical knowledge of the nanoworld and its metrology are addressed along with experimental achievements which have furthered studies of extreme weak forces present at nano or sub micron scales The book does not focus in detail on the diversity of applications in nanotechnology and instrumentation considering that the reader already has basic prior knowledge on that It also covers an introduction to plasma universe phenomenology the basics of advanced mathematics applied to the electromagnetic field longitudinal forces in the vacuum concepts of helicity and topological torsion SU 2 representation of Maxwell equations 2D representation of the electromagnetic field the use of the fractional derivative and ergotropic dynamics The chapters include theory applications bibliographic references and solved exercises The synergies of the book s topics demonstrate their potential in critical issues

such as relieving humans from barriers imposed by energetic and entropic dependencies and penetrating the realm of weak forces at the nanoscale The book will boost both post graduate students and mature scientists to implement new scientific and technological projects Springer Handbook of Atomic, Molecular, and Optical Physics Gordon W. F. Drake, 2023-02-09 Comprises a comprehensive reference source that unifies the entire fields of atomic molecular and optical AMO physics assembling the principal ideas techniques and results of the field 92 chapters written by about 120 authors present the principal ideas techniques and results of the field together with a guide to the primary research literature carefully edited to ensure a uniform coverage and style with extensive cross references Along with a summary of key ideas techniques and results many chapters offer diagrams of apparatus graphs and tables of data From atomic spectroscopy to applications in comets one finds contributions from over 100 authors all leaders in their respective disciplines Substantially updated and expanded since the original 1996 edition it now contains several entirely new chapters covering current areas of great research interest that barely existed in 1996 such as Bose Einstein condensation quantum information and cosmological variations of the fundamental constants A fully searchable CD ROM version of the contents accompanies the handbook

Chemical Dynamics And Kinetics Of Small Radicals, The (In 2 Parts) - Part 2 Kopin Liu, Albert Wagner, 1996-01-19 This book highlights recent progress in the chemistry of radicals Developments include the growing use of lasers to generate radicals the application of lasers to provide state angular polarization energy and real time resolution in kinetics and dynamics experiments the development of theories for handling the reactions of radicals and the simulation of the reaction dynamics of increasingly larger systems for direct comparison to experimental results The book emphasizes the increasing interaction between experimental dynamics kinetics and theory It is appropriate for chemistry graduate students and researchers about to enter the field However the discussions of some topics progress to a more advanced level so that even an expert will find the book useful **Advances in Atomic, Molecular, and Optical Physics** , 1994-07-26 The latest volume in the highly acclaimed series addresses atomic collisions assessing the status of the current knowledge identifying deficiencies and exploring ways to improve the quality of cross section data Eleven articles written by foremost experts focus on cross section determination by experiment or theory on needs in selected applications and on efforts toward the compilation and dissemination of data This is the first volume edited under the additional direction of Herbert Walther Presents absolute cross sections for atomic collisions Uses benchmark measurements and benchmark calculations Discusses needs for cross section data in applications Contains a guide to data resources bibliographies and compendia **Atomic Scale Dynamics at Surfaces** Giorgio Benedek, Jan Peter Toennies, 2018-12-28 Experimental advances in helium atom scattering spectroscopy over the last forty years have allowed the measurement of surface phonon dispersion curves of more than 200 different crystal surfaces and overlayers of insulators semiconductors and metals The first part of the book presents at a tutorial level the fundamental concepts and methods in surface lattice dynamics and the theory of atom surface

interaction and inelastic scattering in their various approximations up to the recent electron phonon theory of helium atom scattering from conducting surfaces The second part of the book after introducing the experimentalist to He atom spectrometers and the rich phenomenology of helium atom scattering from corrugated surfaces illustrates the most significant experimental results on the surface phonon dispersion curves of various classes of insulators semiconductors metals layered crystals topological insulators complex surfaces adsorbates ultra thin films and clusters The great potential of helium atom scattering for the study of atomic scale diffusion THz surface collective excitations including acoustic surface plasmons and the future prospects of helium atom scattering are presented in the concluding chapters The book will be valuable reading for all researchers and graduate students interested in dynamical processes at surfaces **The Chemical**

Dynamics and Kinetics of Small Radicals Kopin Liu, Albert Wagner, 1995 This book highlights recent progress in the chemistry of radicals Developments include the growing use of lasers to generate radicals the application of lasers to provide state angular polarization energy and real time resolution in kinetics and dynamics experiments the development of theories for handling the reactions of radicals and the simulation of the reaction dynamics of increasingly larger systems for direct comparison to experimental results The book emphasizes the increasing interaction between experimental dynamics kinetics and theory It is appropriate for chemistry graduate students and researchers about to enter the field However the discussions of some topics progress to a more advanced level so that even an expert will find the book useful Principles of

Vapor Deposition of Thin Films Professor K.S. K.S Sree Harsha, 2005-12-16 The goal of producing devices that are smaller faster more functional reproducible reliable and economical has given thin film processing a unique role in technology Principles of Vapor Deposition of Thin Films brings in to one place a diverse amount of scientific background that is considered essential to become knowledgeable in thin film deposition techniques Its ultimate goal as a reference is to provide the foundation upon which thin film science and technological innovation are possible Offers detailed derivation of important formulae Thoroughly covers the basic principles of materials science that are important to any thin film preparation Careful attention to terminologies concepts and definitions as well as abundance of illustrations offer clear support for the text *Atomic Collisions* Earl W. McDaniel, J. B. A. Mitchell, M. Eugene Rudd, 1993-05-10 Deals with elastic

inelastic and reactive collisions between heavy particles The impact energy range extends from sub thermal to energies at which nuclear forces become significant Although the focus is on experiment theory is integrated with experimental discussions Scattering resonances beam monochromators particle detectors coincidence measurements and laser photodetachment are among the topics covered Includes extensive references and problem sets **Handbook of Nanophysics** Klaus D. Sattler, 2010-09-17 Providing the framework for breakthroughs in nanotechnology this landmark publication is the first comprehensive reference to cover both fundamental and applied physics at the nanoscale After discussing the theoretical principles and measurements of nanoscale systems the organization of the set follows the historical

development of nanoscience Each peer reviewed chapter presents a didactic treatment of the physics underlying the nanoscale materials applications and detailed experimental results State of the art scientific content is enriched with fundamental equations and illustrations many in color *Dielectric Properties of Isolated Clusters* Sven Heiles,Rolf Schäfer,2013-11-26 A broad range of state of the art methods to determine properties of clusters are presented The experimental setup and underlying physical concepts of these experiments are described Furthermore existing theoretical models to explain the experimental observations are introduced and the possibility to deduce structural information from measurements of dielectric properties is discussed Additional case studies are presented in the book to emphasize the possibilities but also drawbacks of the methods

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