Atoms In Intense Laser Fields

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Classical Trajectory Perspective of Atomic Ionization in Strong Laser Fields Springer Science & Business Media
This text presents the major advances in both intense laser fields phenomena and laser control of photochemical reactions - highlighting experimental and theoretical research on the interaction of simple molecules with intense laser fields. The book introduces new concepts such as above-threshold ionization (ATI), above-threshold dissociation (ATD), laser-induced avoided crossings, and coherent control.
Progress in Ultrafast Intense Laser Science XVI Springer Science & Business Media
The development of lasers capable of producing high-intensity pulses has opened a new area in the study of light-matter interactions. The corresponding laser fields are strong enough to compete with the Coulomb forces in controlling the dynamics of atomic systems and give rise to multiphoton processes. This book presents a unified account of this rapidly developing field of physics. The first part describes the fundamental phenomena occurring in intense laser-atom interactions and gives the basic theoretical framework to analyze them. The second part contains a detailed discussion of Floquet theory, the numerical integration of the wave equations and approximation methods for the low- and high-frequency regimes. In the third part, the main multiphoton processes are discussed: multiphoton ionization, high harmonic and attosecond pulse generation, and laser-assisted electron-atom collisions. Aimed at graduate students in atomic, molecular and optical physics, the book will also interest researchers working on laser interactions with matter.
Resonance Atomic Collisions in Intense Laser Fields Springer Science & Business Media
Multiphoton Ionization of Atoms ...
Atoms in Intense Laser Fields SIF Edizioni Scientifiche
Atoms in strong radiation fields are interesting objects for study, and the research field that concerns itself with this study is a comparatively young one. For a long period after the ~scovery of the photoelectric effect. it was not possible to generate electro magnetic fields that did more than perturb the atom only slightly, and (first-or~er) perturbation theory could perfectly explain what was going on at those low intensities. The development of the pulsed laser bas changed this state of affairs in a rather dramatic way, and fields can be applied that really have a large, or even dominant influence on atomic structure. In the latter case, w~ speak of super-intense fields. Since the interaction between atoms and electromagnetic waves is characterized by many parameters other than the light intensity, such as frequency, iQnization potential, orbit time, etc., it is actually quite difficult to define what is exactly meant by the term 'super-intense'. Obviously the term does not have an absolute meaning, and intensity should always be viewed in relation to other properties of the system. An atom in a radiation field can thus best be described in terms of various ratios of the quantities involved. The

nature of the system sometimes drastically changes if the value of one of these parameters exceeds a certain critical value, and the new regime could be called super-intense with respect to that parameter.
Molecules and Clusters in Intense Laser Fields Springer Science & Business Media
The recent evolution of lasers and other external field (e.g. Synchrotron radiation, strong electric and magnetic fields) sources is opening up new frontiers of science which cover explorations in broad areas ranging from atomic, molecular and optical physics (AMOP) to nuclear fusion and high energy particle physics; even further to astrophysics and cosmology. Atomic and molecular dynamics is being explored at the femto and near atto-second time scale. Ultra-intense laser and other external fields attracting vigorous attention and interest from the view point of their control. The topics covered in the book are: Applications of ultra-intense ultra-short pulse lasers; Atoms, molecules and clusters in strong laser and other external fields; high field chemistry; high harmonic generation (HHG), X-ray generation by laser matter interactions and their applications, collisions in laser fields, relativistic particle generation and acceleration by super-strong laser plasma interactions etc.
Multiphoton Processes in Atoms Springer
This book covers a diverse cross section of this interdisciplinary research field, with contributions grouped into four categories: laser-induced filamentation; atoms and molecules in a laser field; interaction of solid materials with a coherent light field; and ion acceleration and ionization of atoms in super intense laser fields. This book series presents up-to-date reviews of advances in this interdisciplinary research field, spanning atomic and molecular physics, as well as molecular and optical science, which have been stimulated by the recent developments in ultrafast laser technologies. Each book compiles peer-reviewed articles by researchers at the forefront of their particular subfields. All the chapters include an overview to allow graduate students and researchers unfamiliar with the subfield to grasp the importance and attractions of the topic covered, followed by reports of cutting-edge discoveries.
Atoms, Solids, and Plasmas in Super-Intense Laser Fields CRC Press
Multiphoton Processes in Atoms in intense laser-light fields is gaining ground as a spectroscopic diagnostic tool. The authors present descriptions of processes occurring in atoms under the action of strong electromagnetic radiation, in particular, the shift, broadening, and mixing of atomic states. The topics include tunneling ionization, above-threshold ionization, ionization of multiply charged ions, resonance-enhanced ionization, super-intense radiation fields, and properties of Rydberg states strongly perturbed by laser radiation.
Bound State Evolution in Atoms Exposed to Intense Laser Fields Springer
This book covers a broad range of interdisciplinary topics, focusing on atoms and molecules in intense laser fields, excitation processes in intense laser fields, photonics and materials, high-order harmonics generation, XFEL, high-power lasers

and their applications, and quantum computing. This seventeenth volume features contributions from world-renowned researchers on topics such as applications of attosecond and femtosecond laser pulses, coherence and dynamics in quantum systems, and applications of super-intense laser fields. The PUILS series delivers up-to-date reviews of progress in this emerging interdisciplinary research field, spanning atomic and molecular physics, molecular science, and optical science, which has been stimulated by the recent developments in ultrafast laser technologies. Each volume compiles peer-reviewed articles authored by researchers at the forefront of each of their own subfields of ultrafast intense laser science. Every chapter opens with an overview of the topics to be discussed, so that researchers unfamiliar with the subfield, especially graduate students, can grasp the importance and attractions of the research topic at hand; these are followed by reports of cutting-edge discoveries.

Progress in Ultrafast Intense Laser Science Springer Science & Business Media

It is a great pleasure that we are now publishing the fourth volume of the series on PUILS, through which we have been introducing the progress in ultrafast intense laser science, the frontiers of which are rapidly expanding, thanks to the progress in ultrashort and high-power laser technologies. The interdisciplinary nature of this research ?eld is attracting researchers with di?erent expertise and backgrounds. As in the previousvolumeson PUILS, each chapter in the presentvolume, which is in the range of 15–25 pages, begins with an introduction in which a clear and concise account of the signi?cance of the topic is given, followed by a description of the authors' most recent research results. All the chapters are peer-reviewed. The articles of this fourth volume cover a diverse range of the interdisciplinary research ?eld, and the topics may be grouped into four categories: strong ?eld ionization of atoms (Chaps. 1–2), excitation, ioni- tion and fragmentation of molecules (Chaps. 3–5), nonlinear intense optical phenomena and attosecond pulses (Chaps. 6–8), and laser solid interactions and photoemissions (Chaps. 9–11).

Progress in Ultrafast Intense Laser Science Cambridge University Press

For graduate students, laser scientists, atomic, molecular and optical physicists, topics include the effects of superintense laser fields on multiphoton ionization and harmonic generation; novel effects with ultrashort, subpicosecond laser pulses; and Rydberg atoms in intense microwave fields.

Multiphoton Processes in Atoms Springer Nature

This book provides a thorough and comprehensive introduction to the physics of molecules and clusters in intense laser fields. It covers both theoretical and experimental aspects of the subject, and presents new research in the area of clusters in intense laser fields. Topics covered include coherent control, diatomic and polyatomic molecules, and femtosecond pulse production and diagnostics. Written by leading researchers in the field, this book will be of

interest to graduate students and researchers in atomic, molecular and optical physics. It will also be suitable as a reference text for advanced physics courses.

Super-Intense Laser—Atom Physics Springer Science & Business Media

A unified account of the rapidly developing field of high-intensity laser-atom interactions, suitable for both graduate students and researchers.

Progress in Ultrafast Intense Laser Science XIII Alpha Science International, Limited

This thirteenth volume in the PUILS series covers a broad range of topics from this interdisciplinary research field, focusing on atoms, molecules, and clusters interacting in intense laser field and high-order harmonics generation and their applications. The series delivers up-to-date reviews of progress in ultrafast intense laser science, the interdisciplinary research field spanning atomic and molecular physics, molecular science, and optical science, which has been stimulated by the developments in ultrafast laser technologies. Each volume compiles peer-reviewed articles authored by researchers at the forefront of each their own subfields of UILS. Typically, each chapter opens with an overview of the topics to be discussed, so that researchers unfamiliar to the subfield, as well as graduate students, can grasp the importance and attractions of the research topic at hand; these are followed by reports of cutting-edge discoveries.

Progress in Ultrafast Intense Laser Science II Cambridge University Press

This book series addresses a newly emerging interdisciplinary research field, Ultrafast Intense Laser Science, spanning atomic and molecular physics, molecular science, and optical science. Highlights of this second volume include Coulomb explosion and fragmentation of molecules, control of chemical dynamics, high-order harmonic generation, propagation and filamentation, and laser-plasma interaction. All chapters are authored by foremost experts in their fields.

Electron Dynamics of One- and Two-electron Atoms in Intense Laser Fields Springer Science & Business Media

The rapid development of powerful pulsed lasers is at the origin of a conside rable interest in studying the response of an atom, a molecule (or a solid) to a strong electromagnetic field. It is now possible to produce at the laboratory scale, ultra-short 13 pulses with a duration of 100 femtoseconds (10-second) and a power of the order 12 of 1 terawatt (10 Watt). Under these conditions, very high peak intensities may be obtained and electric fields exceeding typical electron binding fields in atoms are generated. The interaction of an atom or a molecule with such electromagnetic fields has a highly non-linear character which leads to unexpected phenomena. Amongst them, - above-threshold ionization (ATI) i.e. the absorption of additional photons in excess of the minimal number necessary to overcome the ionization potential and its molecular counterpart, above-threshold dissociation (ATD); - generation of very high harmonics of the driving field; - stabilization of one-electron systems in strong fields. These processes were the main topics of two international meetings which were held

in 1989 and 1991 in the United States under the common name SILAP (Super-Intense Laser-Atom Physics).

Progress in Ultrafast Intense Laser Science XV Toronto ; New York : Academic Press

Scientific advances and several technical breakthroughs have led to a remarkable increase in available laser intensities over the past decades. In available ultra-intense laser fields, photon fluxes may become so high that free charge carriers interact coherently with several of the field's photons. In this thesis such nonlinear interactions are investigated for the prime example of radiation emission by electrons scattered from intense laser pulses of arbitrary temporal structure. To this end, nonlinear quantum field theory is employed taking the interaction with the laser into account exactly. After an in-depth introduction to classical particle dynamics as well as quantum field theory in nonlinearly intense laser fields the emission of one and two photons is explicitly analyzed. The results are then translated to viable technical applications, such as a scheme for the determination of the carrier-envelope phase of ultra-intense laser pulses and a proposal for detecting the strongly suppressed two-photon signal.

Atoms In Electromagnetic Fields (2nd Edition) Springer

This volume contains the lectures and communications presented at the NATO Advanced Research Workshop (NATO ARW 900857) which was held May 5-10, 1991 at McMaster University, Hamilton, Ontario, Canada. A scientific commitee made up of P.P. Lambropoulos (USC & Crete), P.8. Corkum (NRC, Ottawa), and H. B. vL. van den Heuvell (FOM, Amsterdam) guided the organizers, A.D. Bandrauk (Sherbrooke) and S.C. Wallace (Toronto) in preparing a programme which would cover the latest advances in the field of atom and molecule laser interactions. Since the last meeting held in July 1987 on "Atomic and Molecular Processes with Short Intense Laser Pulses", NATO ASI vol 1718 (Plenum Press 1988), considerable progress has been made in understanding high intensity effects on atoms and the concomitant coherence effects. After four years, the emphasis is now shifting more to molecules. The present volume represents therefore this trend with four sections covering the main interests of research endeavours in this area: i) Atoms in Intense Laser-Fields ii) Molecules in Intense Laser Fields iii) Atomic Coherences iv) Molecular Coherences The experience developed over the years in multiphoton atomic processes has been very useful and is the main source of our understanding of similar processes in molecules. Thus ATI (above threshold ionization) has been found to occur in molecules as well as a new phenomenon, ATD (above-threshold dissociation). Laser-induced avoided crossings of molecular electronic surfaces is also now entering the current language of high intensity molecular processes.

Progress in Ultrafast Intense Laser Science XIV Springer Science & Business Media

This 14th volume in the PUILS series presents up-to-date reviews of advances in Ultrafast Intense Laser Science, an

interdisciplinary research field spanning atomic and molecular physics, molecular science, and optical science, which has been stimulated by the rapid developments in ultrafast laser technologies. Each chapter begins with an overview of the topics to be discussed, so that researchers unfamiliar to the subfield, as well as graduate students, can grasp the importance and appeal of the respective subject matter; this is followed by reports on cutting-edge discoveries. This volume covers a broad range of topics from this interdisciplinary field, e.g. atoms and molecules interacting in intense laser fields, laser-induced filamentation, high-order harmonics generation, and high-intensity lasers and their applications.

Atomic and Molecular Processes with Short Intense Laser Pulses Springer Science & Business Media

The ionization of atoms and molecules in strong laser fields is an active field in modern physics and has versatile applications in such as attosecond physics, X-ray generation, inertial confined fusion (ICF), medical science and so on. Classical Trajectory Perspective of Atomic Ionization in Strong Laser Fields covers the basic concepts in this field and discusses many interesting topics using the semiclassical model of classical trajectory ensemble simulation, which is one of the most successful ionization models and has the advantages of a clear picture, feasible computing and accounting for many exquisite experiments quantitatively. The book also presents many applications of the model in such topics as the single ionization, double ionization, neutral atom acceleration and other timely issues in strong field physics, and delivers useful messages to readers with presenting the classical trajectory perspective on the strong field atomic ionization. The book is intended for graduate students and researchers in the field of laser physics, atom molecule physics and theoretical physics. Dr. Jie Liu is a professor of Institute of Applied Physics and Computational Mathematics, China and Peking University.

Multiphoton Ionization of Atoms World Scientific

Multiphoton ionization of atoms in intense laser-light fields is gaining ground as a spectroscopic diagnostic tool. In this volume, Delone and Krainov present their and others' theoretical description of the process occurring in atoms under conditions of multi-photon impacts, in particular, the shift, broadening, and mixing of electronic states which complicate the interpretation of spectra. The topics of individual chapters include tunneling ionization, above-threshold ionization, ionization of multiply charged ions, resonance-enhenced ionization, super-intense radiation fields, and properties of Rydberg states in strong fields.