Atoms In Intense Laser Fields

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Atoms, Solids, and Plasmas in Super-Intense Laser Fields Springer Science & Business Media
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.
Quantum Information with Continuous Variables of Atoms and Light CRC Press
The recent developement of high power lasers, delivering femtosecond pulses of 20 2 intensities up to 10 W/cm , has led to the discovery of new phenomena in laser interactions with matter. At these enormous laser intensities, atoms, and molecules are exposed to extreme conditions and new phenomena occur, such as the very rapid multi photon ionization of atomic systems, the emission by these systems of very high order harmonics of the exciting laser light, the Coulomb explosion of molecules, and the acceleration of electrons close to the velocity of light. These phenomena generate new behaviour of bulk matter in intense laser fields, with great potential for wide ranging applications which include the study of ultra-fast processes, the development of high-frequency lasers, and the investigation of the properties of plasmas and condensed matter under extreme conditions of temperature and pressure. In particular, the concept of the "fast ignitor" approach to inertial confinement fusion (ICF) has been proposed, which is based on the separation of the compression and the ignition phases in laser-driven ICF. The aim of this course on "Atom, Solids and Plasmas in Super-Intense Laser fields" was to bring together senior researchers and students in atomic and molecular physics, laser physics, condensed matter and plasma physics, in order to review recent developments in high-intensity laser-matter interactions. The course was held at the Ettore Majorana International Centre for Scientific Culture in Erice from July 8 to July 14,2000.
Advances in Solid State Lasers Springer Science & Business Media
This book discusses quantum optics and investigates the quantum properties of interactions between atoms and laser fields. It is divided into three parts. Part I introduces the elementary theory of the interaction between atoms and light. Part II provides a concentrated discussion on the quantum properties of light fields. Part III deals with the quantum dynamic properties of the atoms interacting with laser fields. This book can be used as a text for both graduate and undergraduate students; it will also benefit scientists who are interested in quantum optics and theoretical physics.
Physics in a New Era Springer Science & Business Media
Quantum mechanics does away with the distinction between particles and waves, and one of the more interesting implications of the wave/particle duality - the discovery that atoms may be manipulated in ways analogous to the manipulation of light with lenses and mirrors - has formed the basis for the relatively new field of atom optics. Pierre

Meystre's Atom Optics is the first book entirely devoted to this exciting area of research. Reference links to the leading journals in the field, links to research sites, graphics, and updates can be found online.

Molecules in Laser Fields Cambridge University Press

A Solid Compendium of Advanced Diagnostic and Simulation ToolsExploring the most exciting and topical areas in this field, Laser-Plasma Interactions focuses on the interaction of intense laser radiation with plasma. After discussing the basic theory of the interaction of intense electromagnetic radiation fields with matter, the book covers three ap

Atoms in Intense Laser Fields Cambridge University Press

The first broad and in-depth overview of current research in attosecond nanophysics, covering the field of active plasmonics via attosecond science in metals and dielectrics to novel imaging techniques with the highest spatial and temporal resolution. The authors are pioneers in the field and present here new developments and potential novel applications for ultra-fast data communication and processing, discussing the investigation of the natural timescale of electron dynamics in nanoscale solid state systems. Both an introduction for starting graduate students, as well as a look at the current state of the art in this hot and emerging field.

Super-Intense Laser—Atom Physics Oxford University Press

The first systematic treatment of fragmentation processes, ideal for graduate students and researchers in atomic collisions, laser physics and chemistry.

Advances In Atomic Physics: An Overview 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.

Atoms in Intense Laser Fields National Academies Press

The study of atomic systems exposed to super-intense laser fields de fines an important area in atomic, molecular and optical physics. Although the concept of super-intense field has no absolute meaning, it is now usual to call an electromagnetic field super-intense when it exceeds the atomic binding field. In the case of the simplest atomic system, hydrogen in its 16 2 ground state, this occurs above an intensity of 3. 5 x 10 Wattfcm which is the atomic unit of intensity. Presently at the laboratory scale and in ex tremely short and tightly focussed laser pulses, the electric field strength 16 18 2 reaches peak values which are of the order of 10 - 10 Wattfcm in the infrared frequency regime, the prospect being that such peak intensities may be reached within a few years in a regime of much higher frequencies (XUV or even X). The interaction of such

electromagnetic fields with an atomic system has a highly non-linear character which has led to the observation of to tally unexpected phenomena. There are three fundamental processes which have marked the beginning of an intensive research in the field of super intense laser-atom physics (SILAP). These processes which only involve one atomic electron are (i) the so-called above-threshold ionisation i. e.

Atoms in Intense Laser Fields CRC Press

Intended for advanced undergraduates and beginning graduates with some basic knowledge of optics and quantum mechanics, this text begins with a review of the relevant results of quantum mechanics, before turning to the electromagnetic interactions involved in slowing and trapping atoms and ions, in both magnetic and optical traps. The concluding chapters discuss a broad range of applications, from atomic clocks and studies of collision processes, to diffraction and interference of atomic beams at optical lattices and Bose-Einstein condensation.

Ultracold Atoms in Optical Lattices National Academies Press

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.

Progress in Ultrafast Intense Laser Science XIV Springer

Proceedings of the 30th Course of the International School of Quantum Electronics on Atoms, Solids and Plasmas in Super-Intense Laser Fields, held 8-14 July, in Erice, Sicily

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

An applications-oriented approach gives graduate students and researchers in the physical sciences the tools needed to analyze any physical system.

Atom Optics World Scientific

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.

Mechanical Action Of Light On Atoms Springer

This book covers a broad range of topics from the interdisciplinary research field of ultrafast intense laser science, focusing on atoms and molecules interacting with intense laser fields, laser-induced filamentation, high-order harmonics generation, and high power lasers and their applications. This sixteenth volume features contributions from world-renowned researchers, introducing the latest reports on probing molecular chirality with intense laser fields, and the most recent developments in the Shanghai Superintense Ultrafast Laser Facility project. 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 to 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.

Strong Field Laser Physics Springer Science & Business Media

Invention of the solid-state laser has initiated the beginning of the laser era. Performance of solid-state lasers improved amazingly during five decades. Nowadays, solid-state lasers remain one of the most rapidly developing branches of laser science and become an increasingly important tool for modern technology. This book represents a selection of chapters exhibiting various investigation directions in the field of solid-state lasers and the cutting edge of related applications. The materials are contributed by leading researchers and each chapter represents a comprehensive study reflecting advances in modern laser physics. Considered topics are intended to meet the needs of both specialists in laser system design and those who use laser techniques in fundamental science and applied research. This book is the result of efforts of experts from different countries. I would like to acknowledge

the authors for their contribution to the book. I also wish to acknowledge Vedran Kordic for indispensable technical assistance in the book preparation and publishing.

Attosecond Nanophysics Springer Science & Business Media

As part of the Physics 2010 decadal survey project, the Department of Energy and the National Science Foundation requested that the National Research Council assess the opportunities, over roughly the next decade, in atomic, molecular, and optical (AMO) science and technology. In particular, the National Research Council was asked to cover the state of AMO science, emphasizing recent accomplishments and identifying new and compelling scientific questions. Controlling the Quantum World, discusses both the roles and challenges for AMO science in instrumentation; scientific research near absolute zero; development of extremely intense x-ray and laser sources; exploration and control of molecular processes; photonics at the nanoscale level; and development of quantum information technology. This book also offers an assessment of and recommendations about critical issues concerning maintaining U.S. leadership in AMO science and technology.

Quantum Radiation in Ultra-Intense Laser Pulses BoD – Books on Demand

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.

Laser Cooling and Trapping SIF Edizioni Scientifiche

“French Nobel Laureate Claude Cohen-Tannoudji is second to none in his understanding of the modern theory and application of atom-photon interactions. He is also known for his lucid and accessible writing style … Advances in Atomic Physics is an impressive and wonderful-to-read reference text … Certainly researchers in the fields of atom-photon interactions and atom traps will want it as a reference on their bookshelves … A selection of chapters may be of benefit to students: the early chapters for those entering the field, the later chapters for those already doing atom-laser PhD thesis work.”Physics TodayThis book presents a comprehensive overview of the spectacular advances seen in atomic physics during the last 50 years. The authors explain how such progress was possible by highlighting connections between developments that occurred at different times. They discuss the new perspectives and the new research fields that look promising. The

emphasis is placed, not on detailed calculations, but rather on physical ideas. Combining both theoretical and experimental considerations, the book will be of interest to a wide range of students, teachers and researchers in quantum and atomic physics.

Fragmentation Processes

Springer

Quantum information describes the new field which bridges quantum physics and information science. The quantum world allows for completely new architectures and protocols. While originally formulated in continuous quantum variables, the field worked almost exclusively with discrete variables, such as single photons and photon pairs. The renaissance of continuous variables came with European research consortia such as ACQUIRE (Advanced Coherent Quantum Information Research) in the late 1990s, and QUICOV (Quantum Information with Continuous Variables) from 2000OCo2003. The encouraging research results of QUICOV and the new conference series CVQIP (Continuous Variable Quantum Information Processing) triggered the idea for this book. This book presents the state of the art of quantum information with continuous quantum variables. The individual chapters discuss results achieved in QUICOV and presented at the first five CVQIP conferences from 2002OCo2006. Many world-leading scientists working on continuous variables outside Europe also contribute to the book.