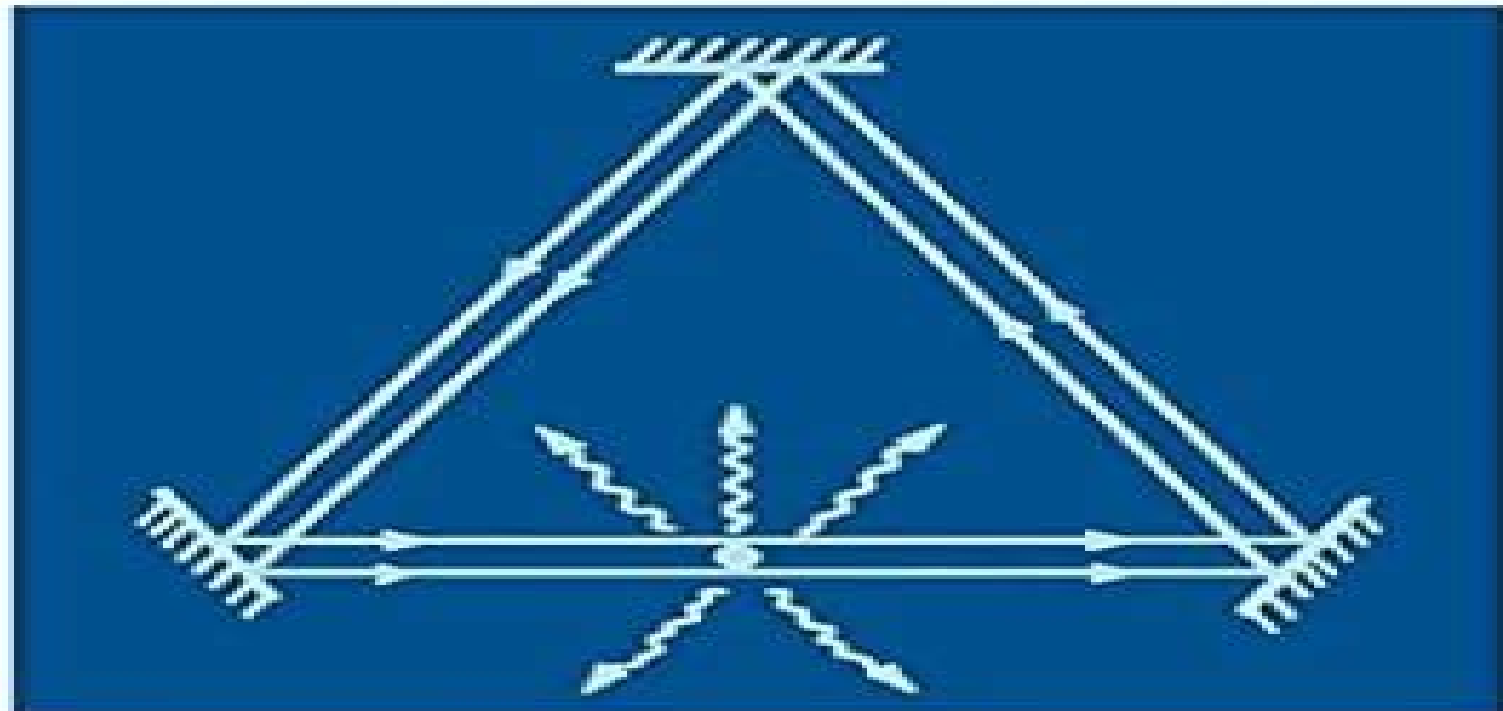


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Jacques Dupont-Roc, Gilbert Grynberg

WILEY-VCH

Atom-Photon Interactions

Basic Processes and Applications



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Atom-Photon Interactions Claude Cohen-Tannoudji, Jacques Dupont-Roc, Gilbert Grynberg, 2024-11-12 Atom Photon Interactions Basic Processes and Applications allows the reader to master various aspects of the physics of the interaction between light and matter It is devoted to the study of the interactions between photons and atoms in atomic and molecular physics quantum optics and laser physics The elementary processes in which photons are emitted absorbed scattered or exchanged between atoms are treated in detail and described using diagrammatic representation The book presents different theoretical approaches including Perturbative methods The resolvent method Use of the master equation The Langevin equation The optical Bloch equations The dressed atom approach Each method is presented in a self contained manner so that it may be studied independently Many applications of these approaches to simple and important physical phenomena are given to illustrate the potential and limitations of each method

Advances In Atomic Physics: An Overview Claude Cohen-tannoudji, David Guery-odelin, 2011-09-02 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 Today This 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

Quantum Network with Multiple Cold Atomic Ensembles Bo Jing, 2022-03-16 This book highlights the novel research in quantum memory networking especially quantum memories based on cold atomic ensembles After discussing the frontiers of quantum networking research and building a DLCZ type quantum memory with cold atomic ensemble the author develops the ring cavity enhanced quantum memory and demonstrates a filter free quantum memory which significantly improves the photon atom entanglement The author then realizes for the first time the GHZ type entanglement of three separate quantum memories a building block of 2D quantum repeaters and quantum networks The author also combines quantum memories and time resolved measurements and reports the first multiple interference of three single photons with different colors The book is of good reference value for graduate students researchers and technical personnel in quantum information sciences

Cooperative Interactions in Lattices of Atomic Dipoles Robert Bettles, 2017-07-20 This thesis reports the remarkable discovery that by arranging the dipoles in an ordered array with

particular spacings it is possible to greatly enhance the cross section and achieve a strong light matter coupling 98% of the incident light It also discusses the broad background to cooperative behaviour in atomic ensembles and analyses in detail effects in one and two dimensional atomic arrays In general when light interacts with matter it excites electric dipoles and since the nineteenth century it has been known that if the amplitude of these induced dipoles is sufficiently large and their distance apart is on the scale of the wavelength of the light then their mutual interaction significantly modifies the light matter interaction However it was not known how to exploit this effect to modify the light matter interaction in a desirable way for example in order to enhance the optical cross section

Atomic and Molecular Spectroscopy Sune

Svanberg,2023-01-06 A wide ranging review of modern spectroscopic techniques such as X ray photoelectron optical and laser spectroscopy and radiofrequency and microwave techniques On the fundamental side the book focuses on physical principles and the impact of spectroscopy on our understanding of the building blocks of matter while in the area of applications particular attention is given to those in chemical analysis photochemistry surface characterisation environmental and medical diagnostics remote sensing and astrophysics The Fourth Edition also provides the reader with an update on laser cooling and trapping Bose Einstein condensation ultra fast spectroscopy high power laser matter interaction satellite based astronomy and spectroscopic aspects of laser medicine

Advances in Atomic, Molecular, and Optical Physics Paul R. Berman,Ennio Arimondo,Chun C. Lin,2011-10-03 Advances in Atomic Molecular and Optical Physics publishes reviews of recent developments in a field which is in a state of rapid growth as new experimental and theoretical techniques are used on many old and new problems Topics covered include related applied areas such as atmospheric science astrophysics surface physics and laser physics Articles are written by distinguished experts and contain both relevant review material and detailed descriptions of important recent developments International experts Comprehensive articles New developments

Advances in Atomic, Molecular, and Optical Physics ,2011-09-29 Advances in Atomic Molecular and Optical Physics publishes reviews of recent developments in a field which is in a state of rapid growth as new experimental and theoretical techniques are used on many old and new problems Topics covered include related applied areas such as atmospheric science astrophysics surface physics and laser physics Articles are written by distinguished experts and contain both relevant review material and detailed descriptions of important recent developments International experts Comprehensive articles New developments

Principles of Laser Spectroscopy and Quantum Optics Paul R. Berman,Vladimir S. Malinovsky,2011-01-02 Principles of Laser Spectroscopy and Quantum Optics is an essential textbook for graduate students studying the interaction of optical fields with atoms It also serves as an ideal reference text for researchers working in the fields of laser spectroscopy and quantum optics The book provides a rigorous introduction to the prototypical problems of radiation fields interacting with two and three level atomic systems It examines the interaction of radiation with both atomic vapors and condensed matter systems the density matrix and the Bloch vector and applications involving linear absorption

and saturation spectroscopy Other topics include hole burning dark states slow light and coherent transient spectroscopy as well as atom optics and atom interferometry In the second half of the text the authors consider applications in which the radiation field is quantized Topics include spontaneous decay optical pumping sub Doppler laser cooling the Heisenberg equations of motion for atomic and field operators and light scattering by atoms in both weak and strong external fields The concluding chapter offers methods for creating entangled and spin squeezed states of matter Instructors can create a one semester course based on this book by combining the introductory chapters with a selection of the more advanced material A solutions manual is available to teachers Rigorous introduction to the interaction of optical fields with atoms Applications include linear and nonlinear spectroscopy dark states and slow light Extensive chapter on atom optics and atom interferometry Conclusion explores entangled and spin squeezed states of matter Solutions manual available only to teachers

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 **Atom Optics** Pierre Meystre, 2001-09-21 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 *Elements of Quantum Optics* Pierre Meystre, Murray Sargent, 2007-09-04 With a new chapter on quantum entanglement and quantum information as well as added discussions of the quantum beam splitter electromagnetically induced transparency slow light and the input output formalism this fourth edition of the brilliant work on quantum optics has been much updated It still gives a self contained and broad coverage of the basic elements necessary to understand and carry out research in laser physics and quantum optics including a review of basic quantum mechanics and pedagogical introductions to system reservoir interactions and to second quantization The text reveals the close connection between many seemingly unrelated topics such as probe absorption four

wave mixing optical instabilities resonance fluorescence and squeezing

Dynamics of Complex Quantum Systems

Vladimir M. Akulin, 2013-12-30 This book gathers together a range of similar problems that can be encountered in different fields of modern quantum physics and that have common features with regard to multilevel quantum systems The main motivation was to examine from a uniform standpoint various models and approaches that have been developed in atomic molecular condensed matter chemical laser and nuclear physics in various contexts The book should help senior level undergraduate graduate students and researchers putting particular problems in these fields into a broader scientific context and thereby taking advantage of well established techniques used in adjacent fields This second edition has been expanded to include substantial new material e g new sections on Dynamic Localization and on Euclidean Random Matrices and new chapters on Entanglement Open Quantum Systems and Coherence Protection It is based on the author's lectures at the Moscow Institute of Physics and Technology at the CNRS Aim Cotton Laboratory and on other courses he has given over the last two decades

Physics, 1996-2000 Gösta Ekspö, Nobelstiftelsen, 2002 This volume is a collection of the Nobel Lectures delivered by the prizewinners together with their biographies portraits and the presentation speeches for the period 1996-2000 Each Nobel Lecture is based on the work that won the prize This volume of inspiring lectures by outstanding physicists should be on the bookshelf of every keen student teacher and professor of physics as well as of those in related fields Below is a list of the prizewinners during the period 1996-2000 with a description of the works which won them their prizes 1996 D M LEE D D OSHEROFF 1997 S CHU C COHEN TANNODJI 1998 R B LAUGHLIN H L STROMER 1999 G t HOOFT 2000 Z I ALFEROV J S KILBY for his part in the invention of the integrated circuit

Coherent Dynamics of Complex Quantum Systems Vladimir M. Akulin, 2005-12-21 A large number of modern problems in physics chemistry and quantum electronics require a consideration of population dynamics in complex multilevel quantum systems The purpose of this book is to provide a systematic treatment of these questions and to present a number of exactly solvable problems It considers the different dynamical problems frequently encountered in different areas of physics from the same perspective based mainly on the fundamental ideas of group theory and on the idea of ensemble average Also treated are concepts of complete quantum control and correction of decoherence induced errors that are complementary to the idea of ensemble average Coherent Dynamics of Complex Quantum Systems is aimed at senior level undergraduate students in the areas of atomic molecular and laser physics physical chemistry quantum optics and quantum informatics It should help them put particular problems in these fields into a broader scientific context and thereby take advantage of the well elaborated technique of the adjacent fields

Light-Matter Interaction John Weiner, P.-T. Ho, 2008-07-11 A thorough introduction to atomic molecular and optical AMO science and engineering Atomic molecular and optical AMO science and engineering stands at the confluence of strong scientific and technological currents in physics chemistry and electrical engineering It seeks ways to expand our ability to use light for many purposes to observe and manipulate matter at the atomic scale to use

nanostructures to manipulate light at the subwavelength scale to develop quantum devices and to control internal molecular motion and modify chemical reactivity with light The two volume *Light Matter Interaction* draws together the principal ideas that form the basis of AMO science and engineering Volume 1 *Fundamentals and Applications* fills many gaps left by standard courses and texts in chemical physics and electrical engineering to supply the basis of what the AMO scientist or engineer needs to build a solid foundation of understanding in the field Organized to serve as both textbook and reliable desk reference to a diverse audience ranging from student and novice to advanced practitioner this book discusses both the fundamentals and common applications including Classical absorption and emission of radiation Quantum dipole coupling to the two level system The optical Bloch equations Quantized fields and dressed states Optical forces and cooling from atom light interaction The laser in theory and practice Geometrical and wave optics theory and applications The Gaussian beam and optical resonators

Casimir Physics Diego Dalvit, Peter Milonni, David Roberts, Felipe da Rosa, 2011-06-28 Casimir effects serve as primary examples of directly observable manifestations of the nontrivial properties of quantum fields and as such are attracting increasing interest from quantum field theorists particle physicists and cosmologists Furthermore though very weak except at short distances Casimir forces are universal in the sense that all material objects are subject to them They are thus also an increasingly important part of the physics of atom surface interactions while in nanotechnology they are being investigated not only as contributors to stiction but also as potential mechanisms for actuating micro electromechanical devices While the field of Casimir physics is expanding rapidly it has reached a level of maturity in some important respects on the experimental side where most sources of imprecision in force measurements have been identified as well as on the theoretical side where for example semi analytical and numerical methods for the computation of Casimir forces between bodies of arbitrary shape have been successfully developed This book is then a timely and comprehensive guide to the essence of Casimir and Casimir Polder physics that will have lasting value serving the dual purpose of an introduction and reference to the field While this volume is not intended to be a unified textbook but rather a collection of largely independent chapters written by prominent experts in the field the detailed and carefully written articles adopt a style that should appeal to non specialist researchers in the field as well as to a broader audience of graduate students

Dressed Photons Motoichi Ohtsu, 2013-11-09 Authored by the developer of dressed photon science and technology as well as nanophotonics this book outlines concepts of the subject using a novel theoretical framework that differs from conventional wave optics It provides a quantum theoretical description of optical near fields and related problems that puts matter excitation such as electronic and vibrational ones on an equal footing with photons By this description optical near fields are interpreted as quasi particles and named dressed photons which carry the material excitation energy in a nanometric space The author then explores novel nanophotonic devices fabrications and energy conversion based on the theoretical picture of dressed photons Further this book looks at how the assembly of nanophotonic devices produces

information and communication systems Dressed photon science and technology is on its way to revolutionizing various applications in devices fabrications and systems Promoting further exploration in the field this book presents physically intuitive concepts theories and technical details for students engineers and scientists engaged in research and development in dressed photon science and technology as well as nanophotonics

Atomic Physics C.J. Foot, 2005 This text will thoroughly update the existing literature on atomic physics Intended to accompany an advanced undergraduate course in atomic physics the book will lead the students up to the latest advances and the applications to Bose Einstein Condensation of atoms matter wave interferometry and quantum computing with trapped ions The elementary atomic physics covered in the early chapters should be accessible to undergraduates when they are first introduced to the subject To complement the usual quantum mechanical treatment of atomic structure the book strongly emphasizes the experimental basis of the subject especially in the later chapters It includes ample tutorial material examples illustrations chapter summaries graded problem sets

Condensazione Di Bose-Einstein Nei Gas Atomici M. Inguscio, S. Stringari, Carl Edwin Wieman, 1999 Although first proposed by Einstein in 1924 Bose Einstein condensation BEC in a gas was not achieved until 1995 when using a combination of laser cooling and trapping and magnetic trapping and evaporation it was first observed in rubidium and then in lithium and sodium cooled down to extremely low temperatures This book brought together many leaders in both theory and experiment on Bose Einstein condensation in gases Their lectures provided a detailed coverage of the experimental techniques for the creation and study of BEC as well as the theoretical foundation for understanding the properties of this novel system This volume provides the first systematic review of the field and the many developments that have taken place in the past three years

Molecular Dynamics and Spectroscopy by Stimulated Emission Pumping Hai-Lung Dai, 1995 Since the first stimulated emission pumping SEP experiments more than a decade ago this technique has proven powerful for studying vibrationally excited molecules SEP is now widely used by increasing numbers of research groups to investigate fundamental problems in spectroscopy intramolecular dynamics intermolecular interactions and even reactions SEP provides rotationally pre selected spectra of vibrationally highly excited molecules undergoing large amplitude motions A unique feature of SEP is the ability to access systematically a wide variety of extreme excitations localized in various parts of a molecule and to prepare populations in specific high vibrational levels SEP has made it possible to ask and answer specific questions about intramolecular vibrational redistribution and the role of vibrational excitation in chemical reactions

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