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QUANTUM OPTICS

Cambridge University Press **An in-depth and wide-ranging introduction to the field of quantum optics.**

QUANTUM OPTICS

Cambridge University Press **The field of quantum optics has witnessed significant theoretical and experimental developments in recent years. This book provides an in-depth and wide-ranging introduction to the subject, emphasising throughout the basic principles and their applications. The book begins by developing the basic tools of quantum optics, and goes on to show the application of these tools in a variety of quantum optical systems, including lasing without inversion, squeezed states and atom optics. The final four chapters are devoted to a discussion of quantum optical tests of the foundations of quantum mechanics, and to particular aspects of measurement theory. Assuming only a background of standard quantum mechanics and electromagnetic theory, and containing many problems and references, this book will be invaluable to graduate students of quantum optics, as well as to researchers in this field.**

QUANTUM OPTICS

QUANTUM MECHANICS FOR BEGINNERS

WITH APPLICATIONS TO QUANTUM COMMUNICATION AND QUANTUM COMPUTING

Oxford University Press, USA **An introduction to the fascinating subject of quantum mechanics. Almost entirely algebra-based, this book is accessible to those with only a high school background in physics and mathematics. In addition to the foundations of quantum mechanics, it also provides an introduction to the fields of quantum communication and quantum computing.**

INTRODUCTION TO QUANTUM OPTICS

FROM LIGHT QUANTA TO QUANTUM TELEPORTATION

Cambridge University Press **Advanced text in quantum optics.**

QUANTUM OPTICS

An in-depth and wide-ranging introduction to the field of quantum optics.

INTRODUCTORY QUANTUM OPTICS

Cambridge University Press **Publisher Description**

QUANTUM MECHANICS

THE NATURE OF LIGHT

WHAT IS A PHOTON?

CRC Press **Focusing on the unresolved debate between Newton and Huygens from 300 years ago, The Nature of Light: What is a Photon? discusses the reality behind enigmatic photons. It explores the fundamental issues pertaining to light that still exist today. Gathering contributions from globally recognized specialists in electrodynamics and quantum optics, the book begins by clearly presenting the mainstream view of the nature of light and photons. It then provides a new and challenging scientific epistemology that explains how to overcome the prevailing paradoxes and confusions arising from the accepted definition of a photon as a monochromatic Fourier mode of the vacuum. The book concludes with an array of experiments that demonstrate the innovative thinking needed to examine the wave-particle duality of photons. Looking at photons from both mainstream and out-of-box viewpoints, this volume is sure to inspire the next generation of quantum optics scientists and engineers to go beyond the Copenhagen interpretation and formulate new conceptual ideas about light-matter interactions and substantiate them through inventive applications.**

ODE TO A QUANTUM PHYSICIST

A Festschrift in Honor of Marlan O. Scully

North Holland **Ode to a Quantum Physicist celebrates the scientific achievements of Marlan O. Scully on the occasion of his sixtieth birthday. It combines personal reminiscences from other renowned physicists who have known and worked with him over the years and 60+ scientific articles from the frontiers of Quantum Optics inspired by the work of M. O. Scully. The topics of these articles, published in the special volume 179 of Optics Communications, range from classical optics via atomic physics and quantum mechanics to non-linear optics. The book opens with special greetings from Tony Siegman, the former president of the Optical Society of America and Benjamin Bederson, the Editor-in-Chief Emeritus of Physical Review. A long time friend, Ali Javan, dating back to Marlan's MIT days, highlights some of Marlan's scientific contributions. Heidi Fearn's poems humanize physical phenomena and set the stage for the more personal reminiscences to come. Friends and colleagues of Marlan from the various stages of his scientific life shed some light on his human side. These stories reflect the admiration and respect the quantum physics community holds for Marlan and bring out many humorous anecdotes of their interactions with him. Judy Scully, his wife, takes us through Marlan's youth and college years in Wyoming. Leon Cohen illuminates the Yale days and Marlan's interactions with Willis E. Lamb. Pierre Meystre describes his arrival in Tucson from Switzerland for his first postdoctoral position with Marlan. The move from Tucson to Albuquerque is one of Suhail Zubairy's memories. Herbert Walther shines light on the impact of the multi-national Marlan and in particular, on the Max-Planck-Institut für Quantenoptik. Wolfgang Schleich looks at his mentor Marlan from a graduate student's point of view and opens the arena for Reesor Woodling's description of Marlan's cattle business. We conclude the trail by the article of Thomas Walther, Ed Fry and George Welsch, who bring us up to date with Marlan's activities in Texas A & M. The actual birthday party and scientific celebration took place as a special two-day colloquium on Modern Trends in Quantum Optics at the Max-Planck-Institut für Quantenoptik in Garching, Germany on June 29-30, 1999. Included in this book is the program of this meeting, as well as some excerpts from the celebration, such as, the after dinner speech by Roy J. Glauber followed by a photo album of Marlan's life. The poems by Olga Kocharovskaya poetically describe Marlan's scientific achievements. The concluding talk by Bruce Shore, given at this meeting, begins the connection to the papers by Don Kobe, Danny Greenberger and Mark Hillary, and Shi-Yao Zhu et al. covering topics from gauge invariance via unbreakable codes to photonic band gaps. The articles from the special issue of Optics Communications conclude this Festschrift.**

A GUIDE TO EXPERIMENTS IN QUANTUM OPTICS

John Wiley & Sons **Provides fully updated coverage of new experiments in quantum optics This fully revised and expanded edition of a well-established textbook on experiments on quantum optics covers new concepts, results, procedures, and developments in state-of-the-art experiments. It starts with the basic building blocks and ideas of quantum optics, then moves on to detailed procedures and new techniques for each experiment. Focusing on metrology, communications, and quantum logic, this new edition also places more emphasis on single photon technology and hybrid detection. In addition, it offers end-of-chapter summaries and full problem sets throughout. Beginning with an introduction to the subject, A Guide to Experiments in Quantum Optics, 3rd Edition presents readers with chapters on classical models of light, photons, quantum models of light, as well as basic optical components. It goes on to give readers full coverage of lasers and amplifiers, and examines numerous photodetection techniques being used today. Other chapters examine quantum noise, squeezing experiments, the application of squeezed light, and fundamental tests of quantum mechanics. The book finishes with a section on quantum information before summarizing of the contents and offering an outlook on the future of the field. -Provides all new updates to the field of quantum optics, covering the building blocks, models and concepts, latest results, detailed procedures, and modern experiments -Places emphasis on three major goals: metrology, communications, and quantum logic -Presents fundamental tests of quantum mechanics (Schrodinger Kitten, multimode entanglement, photon systems as quantum emulators), and introduces the density function -Includes new trends and technologies in quantum optics and photodetection, new results in sensing and metrology, and more coverage of quantum gates and logic, cluster states, waveguides for multimodes, discord and other quantum measures, and quantum control -Offers end of chapter summaries and problem sets as new features A Guide to Experiments in Quantum Optics, 3rd Edition is an ideal book for professionals, and graduate and upper level students in physics and engineering science.**

QUANTUM OPTICS AND NANOPHOTONICS

[Oxford University Press](#) Over the last few decades, the quantum aspects of light have been explored and major progress has been made in understanding the specific quantum aspects of the interaction between light and matter. The domain of classical optics has recently seen many exciting new developments, especially in the areas of nano-optics, nano-antennas, metamaterials, and optical cloaking. Approaches based on single-molecule detection and plasmonics have provided new avenues for exploring light-matter interaction at the nanometre scale. All these topics have in common a trend to consider and use smaller and smaller objects, down to the micrometre, nanometre, and even atomic range. The summer school held in Les Houches in July 2013 treated all these subjects lying at the frontier between nanophotonics and quantum optics, in a series of lectures given by world experts

QUANTUM OPTICS FOR BEGINNERS

[CRC Press](#) Atomic correlations have been studied in physics for over 50 years and known as collective effects until recently when they came to be recognized as a source of entanglement. This is the first book that contains detailed and comprehensive analysis of two currently extensively studied subjects of atomic and quantum physics—atomic correlations and their relations to entanglement between atoms or atomic systems—along with the newest developments in these fields. This book assembles accounts of many phenomena related to or resulting from atomic correlations. The essential language of the book is in terms of density matrices and master equations that provide detailed theoretical treatments and experimental analysis of phenomena such as entanglement between atoms, spontaneously or externally induced atomic coherence, engineering of atomic correlations, storage and controlled transfer of correlations, and dynamics of correlated systems.

INTRODUCTION TO QUANTUM OPTICS

FROM THE SEMI-CLASSICAL APPROACH TO QUANTIZED LIGHT

[Cambridge University Press](#) Covering a number of important subjects in quantum optics, this textbook is an excellent introduction for advanced undergraduate and beginning graduate students, familiarizing readers with the basic concepts and formalism as well as the most recent advances. The first part of the textbook covers the semi-classical approach where matter is quantized, but light is not. It describes significant phenomena in quantum optics, including the principles of lasers. The second part is devoted to the full quantum description of light and its interaction with matter, covering topics such as spontaneous emission, and classical and non-classical states of light. An overview of photon entanglement and applications to quantum information is also given. In the third part, non-linear optics and laser cooling of atoms are presented, where using both approaches allows for a comprehensive description. Each chapter describes basic concepts in detail, and more specific concepts and phenomena are presented in 'complements'.

THEORETICAL ATOMIC PHYSICS

[Springer Science & Business Media](#) After a brief review of quantum mechanics and a summary of conventional atomic theory, H. Friedrich discusses the structure of atomic spectra on the basis of quantum defect theory, which is treated for the first time at such a basic level in a textbook. Special attention is given to highly excited states and to the influence of external fields, which can cause intricate and interesting effects in seemingly simple systems. After a chapter on reaction theory the final chapter treats special topics such as multiphoton absorption and chaos. The book contains the kind of advanced quantum mechanics needed for practical applications in modern atomic physics. The presentation is kept deliberately simple and avoids abstract formalism as far as possible.

MODERN FOUNDATIONS OF QUANTUM OPTICS

[Imperial College Press](#) This textbook offers a comprehensive and up-to-date overview of the basic ideas in modern quantum optics, beginning with a review of the whole of optics, and culminating in the quantum description of light. The book emphasizes the phenomenon of interference as the key to understanding the behavior of light, and discusses distinctions between the classical and quantum nature of light. Laser operation is reviewed at great length and many applications are covered, such as laser cooling, Bose condensation and the basics of quantum information and teleportation. Quantum mechanics is introduced in detail using the Dirac notation, which is explained from first principles. In addition, a number of non-standard topics are covered such as the impossibility of a light-based Maxwell's demon, the derivation of the Second Law of Thermodynamics from the first-order time-dependent quantum perturbation theory, and the concept of Berry's phase. The book emphasizes the physical basics much more than the formal mathematical side, and is ideal for a first, yet in-depth, introduction to the subject. Five sets of problems with solutions are included to further aid understanding of the subject.

MEASURING THE QUANTUM STATE OF LIGHT

[Cambridge University Press](#) Appendix A: Semiclassical approximation

LASERS

QUANTUM ATOM OPTICS

THEORY AND APPLICATIONS TO QUANTUM TECHNOLOGY

[Cambridge University Press](#) The rapid development of quantum technologies has driven a revolution in related research areas such as quantum computation and communication, and quantum materials. The first prototypes of functional quantum devices are beginning to appear, frequently created using ensembles of atoms, which allow the observation of sensitive, quantum effects, and have important applications in quantum simulation and matter wave interferometry. This modern text offers a self-contained introduction to the fundamentals of quantum atom optics and atomic many-body matter wave systems. Assuming a familiarity with undergraduate quantum mechanics, this book will be accessible for graduate students and early career researchers moving into this important new field. A detailed description of the underlying theory of quantum atom optics is given, before development of the key, quantum, technological applications, such as atom interferometry, quantum simulation, quantum metrology, and quantum computing.

FRONTIERS IN OPTICS AND PHOTONICS

[Walter de Gruyter GmbH & Co KG](#) This book provides a cutting-edge research overview on the latest developments in the field of Optics and Photonics. All chapters are authored by the pioneers in their field and will cover the developments in Quantum Photonics, Optical properties of 2D Materials, Optical Sensors, Organic Opto-electronics, Nanophotonics, Metamaterials, Plasmonics, Quantum Cascade lasers, LEDs, Biophotonics and biomedical photonics and spectroscopy.

QUANTUM THEORY OF OPTICAL COHERENCE

SELECTED PAPERS AND LECTURES

[John Wiley & Sons](#) A summary of the pioneering work of Glauber in the field of optical coherence phenomena and photon statistics, this book describes the fundamental ideas of modern quantum optics and photonics in a tutorial style. It is thus not only intended as a reference for researchers in the field, but also to give graduate students an insight into the basic theories of the field. Written by the Nobel Laureate himself, the concepts described in this book have formed the basis for three further Nobel Prizes in Physics within the last decade.

QUANTUM OPTICS

AN INTRODUCTION

[Oxford University Press](#) Written primarily for advanced undergraduate and masters level students in physics, this text includes a broad range of topics in applied quantum optics such as laser cooling, Bose-Einstein condensation and quantum information processing.

QUANTUM MECHANICS FOR BEGINNERS

WITH APPLICATIONS TO QUANTUM COMMUNICATION AND QUANTUM COMPUTING

FRONTIERS OF LASER PHYSICS AND QUANTUM OPTICS

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON LASER PHYSICS AND QUANTUM OPTICS

[Springer Science & Business Media](#) Since the advent of the laser about 40 years ago, the fields of laser physics and quantum optics have evolved into a major disciplines. The early studies included optical coherence theory and semiclassical and quantum mechanical theories of the laser. More recently many new and interesting effects have been predicted. These include the role of coherent atomic effects in lasing without inversion and electromagnetically induced transparency, atom optics, laser cooling and trapping, teleportation, the single-atom micromaser and its role in quantum measurement theory, to name a few. The International Conference on Laser Physics and Quantum Optics was held in Shanghai, China, from August 25 to August 28, 1999, to discuss these and many other exciting developments in laser physics and quantum optics. The international character of the conference was manifested by the fact that scientists from over 13 countries participated and lectured at the conference. There were four keynote lectures delivered by Nobel laureate Willis Lamb, Jr., Profs. H. Walther, A.E. Siegman, and M.O. Scully. In addition, there were 34 invited lectures, 27 contributed oral presentations, and 59 poster papers. We are grateful to all

the participants of the conference and the contributors of this volume.

MODERN CLASSICAL OPTICS

Oxford University Press The book describes classical (non-quantum) optical phenomena and the instruments and technology based on them. It includes many cutting-edge areas of modern physics and its applications which are not covered in many larger and more expensive books.

QED

THE STRANGE THEORY OF LIGHT AND MATTER

Princeton University Press Celebrated for his brilliantly quirky insights into the physical world, Nobel laureate Richard Feynman also possessed an extraordinary talent for explaining difficult concepts to the general public. Here Feynman provides a classic and definitive introduction to QED (namely, quantum electrodynamics), that part of quantum field theory describing the interactions of light with charged particles. Using everyday language, spatial concepts, visualizations, and his renowned "Feynman diagrams" instead of advanced mathematics, Feynman clearly and humorously communicates both the substance and spirit of QED to the layperson. A. Zee's introduction places Feynman's book and his seminal contribution to QED in historical context and further highlights Feynman's uniquely appealing and illuminating style.

QUANTUM MECHANICS IN PHASE SPACE

AN OVERVIEW WITH SELECTED PAPERS

World Scientific Wigner's quasi-probability distribution function in phase space is a special (Weyl) representation of the density matrix. It has been useful in describing quantum transport in quantum optics; nuclear physics; decoherence, quantum computing, and quantum chaos. It is also important in signal processing and the mathematics of algebraic deformation. A remarkable aspect of its internal logic, pioneered by Groenewold and Moyal, has only emerged in the last quarter-century: it furnishes a third, alternative, formulation of quantum mechanics, independent of the conventional Hilbert space, or path integral formulations. In this logically complete and self-standing formulation, one need not choose sides ? coordinate or momentum space. It works in full phase space, accommodating the uncertainty principle, and it offers unique insights into the classical limit of quantum theory. This invaluable book is a collection of the seminal papers on the formulation, with an introductory overview which provides a trail map for those papers; an extensive bibliography; and simple illustrations, suitable for applications to a broad range of physics problems. It can provide supplementary material for a beginning graduate course in quantum mechanics.

LASER THEORY

Springer Science & Business Media This book, written by one of the pioneers of laser theory, is now considered a classic by many laser physicists. Originally published in the prestigious Encyclopedia of Physics series, it is now being republished in paperback to make it available not only to professors and scientists, but also to students. It presents a thorough treatment of the theory of laser resonators, the quantum theory of coherence, and the quantization of electromagnetic fields. Especial emphasis is placed on the quantum-mechanical treatment of laser light by means of quantum-mechanical Langevin equations, the density matrix equation, and the Fokker-Planck equation. The semiclassical approach and the rate equation approach are also presented. The principles underlying these approaches are used to derive the relevant equations, from which, in turn, the various properties of laser light are derived. Preface. The concept of the laser came into existence more than a decade ago when SCHAWLOW and TOWNES showed that the maser principle could be extended to the optical region. Since then this field has developed at an incredible pace which hardly anybody could have foreseen. The laser turned out to be a meeting place for such different disciplines as optics (e. g. spectroscopy), optical pumping, radio engineering, solid state physics, gas discharge physics and many other fields. The underlying structure of the laser theory is rather simple.

ELEMENTS OF QUANTUM OPTICS

Springer Science & Business Media From the reviews: "This is a book that should be found in any physics library. It is extremely useful for all graduate students, Ph.D. students and researchers interested in the quantum physics of light." Optics & Photonics News

METHODS IN THEORETICAL QUANTUM OPTICS

Oxford University Press This work presents the mathematical methods widely used by workers in the field of quantum optics. It deals with the physical assumptions which lead to the models and approximations employed, but the main purpose of the text is to give a firm grounding in those techniques needed to derive analytical solutions to problems.

ATOMIC AND FREE ELECTRONS IN A STRONG LIGHT FIELD

World Scientific This book presents and describes a series of unusual and striking strong-field phenomena concerning atoms and free electrons. Some of these phenomena are: multiphoton stimulated bremsstrahlung, free-electron lasers, wave-packet physics, above-threshold ionization, and strong-field stabilization in Rydberg atoms. The theoretical foundations and causes of the phenomena are described in detail, with all the approximations and derivations discussed. All the known and relevant experiments are described too, and their results are compared with those of the existing theoretical models. An extensive general theoretical introduction gives a good basis for subsequent parts of the book and is an independent and self-sufficient description of the most efficient theoretical methods of the strong-field and multiphoton physics. This book can serve as a textbook for graduate students. Contents: Introduction to the Theory of Field-Induced Atomic Transitions Multiphoton Stimulated Bremsstrahlung Multiphoton Compton Scattering and Ponderomotive Forces in an Inhomogeneous Light Field Free-Electron Lasers Laser Acceleration of Electrons Wave Packets Above-Threshold Ionization Stabilization of Atoms in a Strong Ionizing Field Readership: Physicists. keywords: Multiphoton Ionization; Strong-field Stabilization of Atoms; High-Harmonic Generation; Free-Electron Lasers; Above-Threshold Ionization; Electron Wave Packets; Multiphoton Stimulated Bremsstrahlung

QUANTUM OPTICS

Cambridge University Press Ideal for graduate courses on quantum optics, this textbook provides an up-to-date account of the basic principles and applications. It features end-of-chapter exercises with solutions available for instructors at www.cambridge.org/9781107006409. It is invaluable to both graduate students and researchers in physics and photonics, quantum information science and quantum communications.

ELECTROMAGNETIC NOISE AND QUANTUM OPTICAL MEASUREMENTS

Springer Science & Business Media From the reviews: "Haus' book provides numerous insights on topics of wide importance, and contains much material not available elsewhere in book form. [...] an indispensable resource for those working in quantum optics or electronics." Optics & Photonics News

QUANTUM OPTICS

INCLUDING NOISE REDUCTION, TRAPPED IONS, QUANTUM TRAJECTORIES, AND DECOHERENCE

Springer This new edition gives a unique and broad coverage of basic laser-related phenomena that allow graduate students, scientists and engineers to carry out research in quantum optics and laser physics. It covers quantization of the electromagnetic field, quantum theory of coherence, atom-field interaction models, resonance fluorescence, quantum theory of damping, laser theory using both the master equation and the Langevin theory, the correlated emission laser, input-output theory with applications to non-linear optics, quantum trajectories, quantum non-demolition measurements and generation of non-classical vibrational states of ions in a Paul trap. In this third edition, there is an enlarged chapter on trapped ions, as well as new sections on quantum computing and quantum bits with applications. There is also additional material included for quantum processing and entanglement. These topics are presented in a unified and didactic manner, each chapter is accompanied by specific problems and hints to solutions to deepen the knowledge.

MATHEMATICAL METHODS OF QUANTUM OPTICS

Springer Starting from first principles, this reference treats the theoretical aspects of quantum optics. It develops a unified approach for determining the dynamics of a two-level and three-level atom in combinations of quantized field under certain conditions.

THEORY OF NONCLASSICAL STATES OF LIGHT

CRC Press The term 'nonclassical states' refers to the quantum states that cannot be produced in the usual sources of light, such as lasers or lamps, rather than those requiring more sophisticated apparatus for their production. Theory of Non-classical States of Light describes the current status of the theory of nonclassical states of light including many new and important results as well as introductory material and the history of the subject. The authors concentrate on the most important types of nonclassical states, namely squeezed, even/odd ('Schrodinger cat') and binomial states, including their generalizations. However, a review of other types of nonclassical is also given in the introduction, and methods for generating nonclassical states on various processes of light-matter interaction, their phase-space description, and the time evolution of nonclassical states in these processes is presented in separate chapters. This contributed volume contains all of the necessary formulae and references required to gain a good understanding of the principles and current status of the field. It will provide a valuable information resource for advanced students and researchers in quantum physics.

NONLINEAR OPTICAL WAVES

Springer Science & Business Media A non-linear wave is one of the fundamental objects of nature. They are inherent to aerodynamics and hydrodynamics, solid state physics and plasma physics, optics and field theory, chemistry reaction kinetics and population dynamics, nuclear physics and gravity. All non-linear waves can be divided into two parts: dispersive waves and dissipative ones. The history of investigation of these waves has been lasting about two centuries. In 1834 J. S. Russell discovered the extraordinary type of waves without the dispersive broadening. In 1965 N. J. Zabusky and M. D. Kruskal found that the Korteweg-de Vries equation has solutions of the solitary wave form. This solitary wave demonstrates the particle-like properties, i. e. , stability under propagation and the elastic interaction under collision of the solitary waves. These waves were named solitons. In succeeding years there has been a great deal of progress in understanding of soliton nature. Now solitons have become the primary components in many important problems of nonlinear wave dynamics. It should be noted that non-linear optics is the field, where all soliton features are exhibited to a great extent. This book had been designed as the tutorial to the theory of non-linear waves in optics. The first version was projected as the book covering all the problems in this field, both analytical and numerical methods, and results as well. However, it became evident in the process of work that this was not a real task.

FRONTIERS OF QUANTUM OPTICS AND LASER PHYSICS

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE

Springer The International Conference on Quantum Optics and Laser Physics was held at the Hong Kong Baptist University from January 3 to January 6, 1997, to discuss exciting developments in quantum optics. The international character of the conference was manifested by the fact that scientists from over 15 countries participated and lectured at the conference. There were two plenary lectures delivered by Nobel laureates Willis Lamb, Jr. and Chin-Ning Yang. In addition, there were 21 invited lectures, 35 contributed oral papers, and 34 poster presentations. This volume contains many of the papers presented at the conference.

ATOM-FIELD INTERACTIONS AND DRESSED ATOMS

Cambridge University Press The interaction between atoms and electromagnetic fields is an area of central importance to the investigation of fundamental concepts of quantum mechanics. The authors provide an introduction to the theory concerning this interaction by describing the different forms of the interaction and dealing with how these interactions lead to the formation of dressed states, in the presence of vacuum fluctuations as well as in the presence of external fields. They also cover the role of dressed atoms in quantum measurement theory and the physical interpretation of vacuum radiative effects. Treating a key field on the boundary between quantum optics and quantum electrodynamics, the book will be of great use to graduate students, as well as to established experimentalists and theorists, in either of these areas.

QUANTUM OPTICS AND QUANTUM INFORMATION PROCESSING IN RARE-EARTH-ION-DOPED CRYSTALS
