Optical Resonance And Two Level Atoms Dover Books On Physics

Optical Resonance and Two-Level AtomsCourier Corporation

This volume is composed of papers (invited and contributed) presented at the International Conference on Coherence and Quantum Optics held at the University of Hyderabad January 5-January 10, 1991. It has been organized by Professor Girish Agarwal and his colleagues at the School of Physics, University of Hyderabad, Hyder abad, India under partial support from the Department of Science and Technology, Government of India, International Center for Theoretical Physics, Trieste, Italy and the National Science Foundation, USA. Without the untiring efforts of Prof. Girish Agarwal and the members of his quantum office group, the Conference and the present volume would not have been possible. Some extraordinary circumstances resulted in a delay of the publication of the present volume. Our sincere apologies to all the authors. We deeply regret the inconvenience caused due to the delay. A debt of gratitude is due to Ms. Kim Bella for the excellent typing job of the different versions and the final version of the manuscript. It is a pleasure to acknowl edge the efforts of Ms. Pat Vann, Mr. Greg Safford and Mr. Eric Katz of the Plenum Publishing, without whose interest and persistence this volume would not have been possible. v CONTENTS QUANTUM OPTICS: THEORY The Quantum Mechanics of Particles in Time-Dependent Quadrupole Fields Roy J. Glauber . . . . . 1 Localization of Photons in Random and Quasiperiodic Media S. Dutta Gupta . . . . . 15 Enhanced Fundamental Linewidth of a Laser Due to Outcoupling W. A. Hamel, M. P. van Exter, and J. P. Woerdman . . . . . .

Chess as art and recreation; checkmating combinations, endgame play, strategic principles, more. Full details and analysis of author's famous game with Emanuel Lasker. 94 diagrams; other illustrations. "Very enjoyable." — Cleveland Chess Bulletin.

Undergraduate-level introduction to linear algebra and matrix theory. Explores matrices and linear systems, vector spaces, determinants, spectral decomposition, Jordan canonical form, much more. Over 375 problems. Selected answers. 1972 edition.

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

For students of mathematical biology, an introduction to taxonomic characters, measurement of similarity, analysis of principal components, multidimensional scaling, cluster analysis, identification and assignment techniques, and the construction of evolutionary trees.

Designed as a text for a one-year first course in topology, this authoritative volume offers an excellent general treatment of the main ideas of topology. It includes a large number and variety of topics from classical topology as well as newer areas of research activity.

Superb high-level study of one of the most influential classics in mathematics examines landmark 1859 publication entitled “On the Number of Primes Less Than a Given Magnitude,” and traces developments in theory inspired by it. Topics include Riemann's main formula, the prime number theorem, the Riemann-Siegel formula, large-scale computations, Fourier analysis, and other related topics. English translation of Riemann's original document appears in the Appendix.

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'.

In the nineteenth century, French mathematician Evariste Galois developed the Galois theory of groups-one of the most penetrating concepts in modem mathematics. The elements of the theory are clearly presented in this second, revised edition of a volume of lectures delivered by noted mathematician Emil Artin. The book has been edited by Dr. Arthur N. Milgram, who has also supplemented the work with a Section on Applications. The first section deals with linear algebra, including fields, vector spaces, homogeneous linear equations, determinants, and other topics. A second section considers extension fields, polynomials, algebraic elements, splitting fields, group characters, normal extensions, roots of unity, Noether equations, Jummer's fields, and more. Dr. Milgram's section on applications discusses solvable groups, permutation groups, solution of equations by radicals, and other concepts.

Advances in Magnetic and Optical Resonance, Volume 17 reviews different developing branches of coherent spectroscopy, focusing on the incoherent radiation pulses in optics and magnetic resonance. This book is divided into two chapters. Chapter 1 summarizes the uses and occasional advantages of incoherent radiation pulses in optics and magnetic resonance. The second chapter reviews theoretical developments in zero-field NMR and ESR spectroscopies. Other topics include the nonlinear incoherent spectroscopy; stochastic nonlinear susceptibilities; nonlinear interferometer for magnetic resonance; and nonlinear interference and optics. The zero-field spin dynamics and relaxation and ZF line shapes in the presence of molecular reorientations are also covered. This publication is a good reference for students and researchers interested in coherent spectroscopy.

This book provides a comprehensive introduction to the theoretical and experimental studies of atomic optical bistability and multistability, and their dynamical properties in systems with two- and three-level inhomogeneously-broadened atoms inside an optical cavity. By making use of the modified linear absorption and dispersion, as well as the greatly enhanced nonlinearity in the three-level electromagnetically induced transparency system, the optical bistablity and efficient all-optical switching can be achieved at relatively low laser powers, which can be well controlled and manipulated. Until now, the rapid rate of progress in applications of multilevel systems in cross-disciplinary field has made it difficult to newcomers to the field to obtain a broad overview of this topic. This monograph will serve the purpose.Contents: IntroductionAtomic Optical Bistability in a Two-level SystemThree-level Atoms as the Intracavity Medium and Atomic Optical BistabilityAtomic Optical MultistabilityDynamical Instability to ChaosControlled All-optical SwitchingDynamical Hysteresis and Noise-induced BehaviorsConclusion and Outlooks Readership: Graduate students, researchers and academics in optical physics.

This third edition of a popular, well-received text offers undergraduates an opportunity to obtain an overview of the historical roots and the evolution of several areas of mathematics. The selection of topics conveys not only their role in this historical development of mathematics but also their value as bases for understanding the changing nature of mathematics. Among the topics covered in this wide-ranging text are: mathematics before Euclid, Euclid's Elements, non-Euclidean geometry, algebraic structure, formal axiomatics, the real numbers system, sets, logic and philosophy and more. The emphasis on axiomatic procedures provides important background for studying and applying more advanced topics, while the inclusion of the historical roots of both algebra and geometry provides essential information for prospective teachers of school mathematics. The readable style and sets of challenging exercises from the popular earlier editions have been continued

and extended in the present edition, making this a very welcome and useful version of a classic treatment of the foundations of mathematics. "A truly satisfying book." — Dr. Bruce E. Meserve, Professor Emeritus, University of Vermont.
This classic focuses on the gathering, handling, and interpretation of numerical data from zoological investigations. Contents include types and properties of numerical data, mensuration, frequency distributions and grouping, patterns of frequency distributions, measures of central tendency, measures of dispersion and variability, populations and samples, and probability. "Excellent." — Florida Scientist.
This text bridges the gap between beginning and advanced calculus. It offers a systematic development of the real number system and careful treatment of mappings, sequences, limits, continuity, and metric spaces. 1963 edition.
Advances in Magnetic Resonance, Volume 12, presents a variety of contributions to the theory and practice of magnetic resonance. The book contains six chapters and begins with a discussion of diffusion and self-diffusion measurements by nuclear magnetic resonance. This is followed by separate chapters on spin-lattice relaxation time in hydrogen isotope mixtures; the principles of optical detection of nuclear spin alignment and nuclear quadropole resonance; and the spin-1 behavior, including the relaxation of the quasi-invariants of the motion of a system of pairs of dipolar coupled spin-1/2 nuclei. Subsequent chapters deal with the development and application of crafted pulse shapes in nuclear magnetic resonance, magnetic resonance imaging, and optical coherent transient (laser) spectroscopies; and the application of pulsed proton nuclear magnetic resonance "broad line" spectroscopy as a thermal analysis technique and its use to study thermal transformations in hydrogen-containing solids, in particular coals and related organic materials.
A pioneering study that encompasses both field and laboratory research, this text explores the landscapes of mountains, rivers, and seacoasts. Topics include weathering, climate, and erosion. 1964 edition.
Comprehensive treatment of light-scattering properties of small, independent particles, including a full range of useful approximation methods for researchers in chemistry, meteorology, and astronomy. 46 tables. 59 graphs. 44 illustrations.
A classic text and standard reference for a generation, this volume covers all undergraduate algebra topics, including groups, rings, modules, Galois theory, polynomials, linear algebra, and associative algebra. 1985 edition.
New chapters add coverage of current topics such as cavity polaritons, photonic structures, bulk semiconductors and structures of reduced dimensionality. The mathematics is kept as elementary as possible, sufficient for an intuitive understanding of the experimental results and techniques treated.
This book grew out of a 2-semester graduate course in laser physics and quantum optics. It requires a solid understanding of elementary electro magnetism as well as at least one, but preferably two, semesters of quan tum mechanics. Its present form resulted from many years of teaching and research at the Max-Planck-Institut fi. ir Quantenoptik, the University of Munich, and the University of Arizona. The contents have evolved signi ficantly over the years, due to the fact that quantum optics is a rapidly changing field. Because the amount of material that can be covered in two semesters is finite, a number of topics had to be left out or shortened when new material was added. Important omissions include the manipulation of atomic trajectories by light, superradiance, and descriptions of experiments. Rather than treating any given topic in great depth, this book aims to give a broad coverage of the basic elements that we consider necessary to carry out research in quantum optics. We have attempted to present a var iety of theoretical tools, so that after completion of the course students should be able to understand specialized research literature and to produce original research of their own. In doing so, we have always sacrificed rigor to physical insight and have used the concept of "simplest nontrivial example" to illustrate techniques or results that can be generalized to more complicated situations.
Clear, comprehensive graduate-level account of basic principles involved in all quantum optical resonance phenomena, hailed in Contemporary Physics as "a valuable contribution to the literature of non-linear optics." 53 illustrations.
attention from different communities of physics." --Book Jacket.
Geared toward upper-level undergraduates, this text introduces three aspects of optimal control theory: dynamic programming, Pontryagin's minimum principle, and numerical techniques for trajectory optimization. Numerous problems, which introduce additional topics and illustrate basic concepts, appear throughout the text. Solution guide available upon request. 131 figures. 14 tables. 1970 edition.
A young soldier in training for the special forces in Vietnam learns how to rid himself of anxieties under stress and other emotional factors that may hinder his effectiveness in combat.
In studying the radiation-matter interaction, one can take two different approaches. The first is typical of spectroscopy: one considers the interaction between radi ation and a single atom, i. e. , one studies those phenomena in which the presence of other atoms is irrelevant. The other attitude consists, in contrast, in studying those phenomena which arise just from the simultaneous presence of many atoms. In fact, all the atoms interact with the same electromagnetic field; under suitable conditions, this situation creates strong atom-atom correlations, which in turn give rise to a cooperative behavior of the system as a whole. Cooperative means that the overall behavior is quite different from the superposition of the effects arising from single atoms and is completely unpredictable if one neglects the coup ling between the atoms induced by their common electromagnetic field. This book contains five complete and up-to-date contributions on the theory and experiments of three coherence effects in radiation-matter interaction: resonance fluorescences, optical bistability, and superfluorescence. They have raised in creasing interest in recent years from both a fundamental and an applicative view point. Even if their phenomenology appears completely different, these effects be long in the same book because they are striking examples of open systems driven far from thermal equilibrium, as those considered in Haken's synergetics and in Prigogine's theory of dissipative structures. This aspect is discussed in the in troducting chapter, in which we outline the basic physics and the essential features which unify these three effects.
Established in 1965, Advances in Atomic, Molecular, and Optical Physics continues its tradition of excellence with Volume 34. The latest volume includes nine reviews of topics related to the applications of atomic and molecular physics to atmospheric physics and astrophysics.
This text for graduate students discusses the mathematical foundations of statistical inference for building three-dimensional models from image and sensor data that contain noise--a task involving autonomous robots guided by video cameras and sensors. The text employs a theoretical accuracy for the optimization procedure, which maximizes the reliability of estimations based on noise data. The numerous mathematical prerequisites for developing the theories are explained systematically in separate chapters. These methods range from linear algebra, optimization, and geometry to a

detailed statistical theory of geometric patterns, fitting estimates, and model selection. In addition, examples drawn from both synthetic and real data demonstrate the insufficiencies of conventional procedures and the improvements in accuracy that result from the use of optimal methods.

Advances in Magnetic Resonance: The Waugh Symposium, Volume 14 is a collection of manuscripts presented at the 1989 symposium on “High Resolution NMR in Solids , held at the Massachusetts Institute of Technology. The contributors provide 20- to 30-page articles consistent with AMR’s traditional emphasis on quantitative analysis of NMR techniques. Organized into 13 chapters, this book discusses the principles triple-quantum filtered two-dimensional exchange spectroscopy and its application in the measurement of cross correlation between pairs of dipole-dipole interactions. It then describes alternative ways of using fictitious spin in pulsed nuclear quadrupole resonance or NMR. General topics on the application of optical spectroscopy; the saturation of spin-spin energy by slow continuous bulk rotation; the frequency-switched Lee-Goldburg pulse cycle; and high-resolution proton NMR in solid systems are also explored. A chapter examines an entirely different view of spin dynamics in the presence of radio-frequency fields. This book also deals with the theoretical background and application of solid-state and zero-field NMR spectroscopies to structure determination. Lastly, the utilization of the Floquet formalism in the design of broadband propagators in two-level systems and the two classes of novel NMR phenomena related to the symmetrization postulate are discussed. Analytical and quantum chemists, physicists, biochemists, and materials science researchers will find this book invaluable.

Exploration of stochastic control theory in terms of analysis, parametric optimization, and optimal stochastic control. Limited to linear systems with quadratic criteria; covers discrete time and continuous time systems. 1970 edition.

Four members of a London club relate their former careers in crime

Over 140 examples, preceded by a succinct exposition of general topology and basic terminology. Each example treated as a whole. Numerous problems and exercises correlated with examples. 1978 edition. Bibliography.

Definitive look at modern analysis, with views of applications to statistics, numerical analysis, Fourier series, differential equations, mathematical analysis, and functional analysis. More than 750 exercises. 1981 edition. Includes 34 figures.

Classic work presents Conrady's complete system of optical design. Part One covers all ordinary ray-tracing methods, together with the complete theory of primary aberration and as much of higher aberration as is needed for the design of telescopes, low-power microscopes, and simple optical systems.

Clearly written treament elucidates fundamental concepts and demonstrates their plausibility and usefulness. Language is informal, examples are vivid and lively, and the perspectivie is fresh. Based on lectures delivered to engineering students, this work will also be valued by scientists, engineers, technicians, businessmen, anyone facing energy challenges of the future.

Suitable for advanced undergraduate and graduate students, this text presents the general properties of partial differential equations, including the elementary theory of complex variables. Topics include one-dimensional wave equation, properties of elliptic and parabolic equations, separation of variables and Fourier series, nonhomogeneous problems, and analytic functions of a complex variable. Solutions. 1965 edition.

Designed by two MIT professors, this authoritative text transcends the limitations and ambiguities of traditional treatments to develop a deep understanding of the fundamentals of thermodynamics and its energy-related applications. Basic concepts and applications are discussed in complete detail, with attention to generality, rigorous definitions, and logical consistency. More than 300 solved problems span a wide range of realistic energy systems and processes.

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)

This volume contains ten lectures presented in the series ULB Lectures in Nonlinear Optics at the Universite Libre de Bruxelles during the period October 28 to November 4, 1991. A large part of the first six lectures is taken from material prepared for a book of somewhat larger scope which will be published,by Springer under the title Quantum Statistical Methods in Quantum Optics. The principal reason for the early publication of the present volume concerns the material contained in the last four lectures. Here I have put together, in a more or less systematic way, some ideas about the use of stochastic wavefunctions in the theory of open quantum optical systems. These ideas were developed with the help of two of my students, Murray Wolinsky and Liguang Tian, over a period of approximately two years. They are built on a foundation laid down in a paper written with Surendra Singh, Reeta Vyas, and Perry Rice on waiting-time distributions and wavefunction collapse in resonance fluorescence [Phys. Rev. A, 39, 1200 (1989)]. The ULB lecture notes contain my first serious atte~pt to give a complete account of the ideas and their potential applications. I am grateful to Professor Paul Mandel who, through his invitation to give the lectures, stimulated me to organize something useful out of work that may, otherwise, have waited considerably longer to be brought together.