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### QUANTUM CONCEPTS IN PHYSICS

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#### AN ALTERNATIVE APPROACH TO THE UNDERSTANDING OF QUANTUM MECHANICS

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**Cambridge University Press** *Written for advanced undergraduates, physicists, and historians and philosophers of physics, this book tells the story of the development of our understanding of quantum phenomena through the extraordinary years of the first three decades of the twentieth century. Rather than following the standard axiomatic approach, this book adopts a historical perspective, explaining clearly and authoritatively how pioneers such as Heisenberg, Schrodinger, Pauli and Dirac developed the fundamentals of quantum mechanics and merged them into a coherent theory, and why the mathematical infrastructure of quantum mechanics has to be as complex as it is. The author creates a compelling narrative, providing a remarkable example of how physics and mathematics work in practice. The book encourages an enhanced appreciation of the interaction between mathematics, theory and experiment, helping the reader gain a deeper understanding of the development and content of quantum mechanics than any other text at this level.*

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### THEORETICAL CONCEPTS IN PHYSICS

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#### AN ALTERNATIVE VIEW OF THEORETICAL REASONING IN PHYSICS FOR FINAL-YEAR UNDERGRADUATES

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**Cambridge University Press** *In this highly individual, and truly novel, approach to theoretical reasoning in physics, the author has provided a course that illuminates the subject from the standpoint of real physics as practised by research scientists. Professor Longair gives the basic insights, attitudes, and techniques that are the tools of the professional physicist, in a manner that conveys the intellectual excitement and beauty of the subject. The book is intended to be a supplement to more traditional courses for physics undergraduates, and the author assumes that his readers already have some knowledge of the main branches of physics. As the story unfolds, much of the core material of an undergraduate course in physics is reviewed from a more mature point of view. This is not, in fact, a substitute for existing texts. Rather it goes beyond them by improving the student's appreciation of the subject.*

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### THE PHYSICS OF QUANTUM MECHANICS

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**Oxford University Press** "First published by Cappella Archive in 2008."

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### MAXWELL'S ENDURING LEGACY

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**Cambridge University Press** *An authoritative scientific history of a world-leading physics laboratory from its origins in the late nineteenth century to the present day.*

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### THEORETICAL CONCEPTS IN PHYSICS

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#### AN ALTERNATIVE VIEW OF THEORETICAL REASONING IN PHYSICS

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**Cambridge University Press** *A novel and integrated approach to physics, covering background history, basic tools and modern techniques.*

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#### CLASSICAL MECHANICS AND QUANTUM MECHANICS: AN HISTORIC-AXIOMATIC APPROACH

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**Bentham Science Publishers** *This unique textbook presents a novel, axiomatic pedagogical path from classical to quantum physics. Readers are introduced to the description of classical mechanics, which rests on Euler's and Helmholtz's rather than Newton's or Hamilton's representations. Special attention is given to the common attributes rather than to the differences between classical and quantum mechanics. Readers will also learn about Schrödinger's forgotten demands on quantization, his equation, Einstein's idea of 'quantization as selection problem'. The Schrödinger equation is derived without any assumptions about the nature of quantum systems, such as interference and superposition, or the existence of a quantum of action,  $h$ . The use of the classical expressions for the potential and kinetic energies within quantum physics is justified. Key features:*

- Presents extensive reference to original texts.

*Includes many details that do not enter contemporary representations of classical mechanics, although these details are essential for understanding quantum physics. · Contains a simple level of mathematics which is seldom higher than that of the common (Riemannian) integral. · Brings information about important scientists · Carefully introduces basic equations, notations and quantities in simple steps This book addresses the needs of physics students, teachers and historians with its simple easy to understand presentation and comprehensive approach to both classical and quantum mechanics..*

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## **MODERN CLASSICAL PHYSICS**

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### **OPTICS, FLUIDS, PLASMAS, ELASTICITY, RELATIVITY, AND STATISTICAL PHYSICS**

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**Princeton University Press** *A groundbreaking text and reference book on twenty-first-century classical physics and its applications This first-year graduate-level text and reference book covers the fundamental concepts and twenty-first-century applications of six major areas of classical physics that every masters- or PhD-level physicist should be exposed to, but often isn't: statistical physics, optics (waves of all sorts), elastodynamics, fluid mechanics, plasma physics, and special and general relativity and cosmology. Growing out of a full-year course that the eminent researchers Kip Thorne and Roger Blandford taught at Caltech for almost three decades, this book is designed to broaden the training of physicists. Its six main topical sections are also designed so they can be used in separate courses, and the book provides an invaluable reference for researchers. Presents all the major fields of classical physics except three prerequisites: classical mechanics, electromagnetism, and elementary thermodynamics Elucidates the interconnections between diverse fields and explains their shared concepts and tools Focuses on fundamental concepts and modern, real-world applications Takes applications from fundamental, experimental, and applied physics; astrophysics and cosmology; geophysics, oceanography, and meteorology; biophysics and chemical physics; engineering and optical science and technology; and information science and technology Emphasizes the quantum roots of classical physics and how to use quantum techniques to elucidate classical concepts or simplify classical calculations Features hundreds of color figures, some five hundred exercises, extensive cross-references, and a detailed index An online illustration package is available*

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### **RADIATIVE PROCESSES IN ASTROPHYSICS**

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**John Wiley & Sons** *Radiative Processes in Astrophysics: This clear, straightforward, and fundamental introduction is designed to present-from a physicist's point of view-radiation processes and their applications to astrophysical phenomena and space science. It covers such topics as radiative transfer theory, relativistic covariance and kinematics, bremsstrahlung radiation, synchrotron radiation, Compton scattering, some plasma effects, and radiative transitions in atoms. Discussion begins with first principles, physically motivating and deriving all results rather than merely presenting finished formulae. However, a reasonably good physics background (introductory quantum mechanics, intermediate electromagnetic theory, special relativity, and some statistical mechanics) is required. Much of this prerequisite material is provided by brief reviews, making the book a self-contained reference for workers in the field as well as the ideal text for senior or first-year graduate students of astronomy, astrophysics, and related physics courses. Radiative Processes in Astrophysics also contains about 75 problems, with solutions, illustrating applications of the material and methods for calculating results. This important and integral section emphasizes physical intuition by presenting important results that are used throughout the main text; it is here that most of the practical astrophysical applications become apparent.*

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### **SOLVED PROBLEMS IN CLASSICAL MECHANICS**

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### **ANALYTICAL AND NUMERICAL SOLUTIONS WITH COMMENTS**

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**Oxford University Press** *simulated motion on a computer screen, and to study the effects of changing parameters. --*

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### **COSMOLOGICAL PHYSICS**

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**Cambridge University Press** *A comprehensive and authoritative introduction to contemporary cosmology for advanced undergraduate and graduate students.*

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### **INFORMATION—CONSCIOUSNESS—REALITY**

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### **HOW A NEW UNDERSTANDING OF THE UNIVERSE CAN HELP ANSWER AGE-OLD QUESTIONS OF EXISTENCE**

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**Springer** *This open access book chronicles the rise of a new scientific paradigm offering novel insights into the age-old enigmas of existence. Over 300 years ago, the human mind discovered the machine code of reality: mathematics. By utilizing abstract thought systems, humans began to decode the workings of the cosmos. From this understanding, the current scientific paradigm emerged, ultimately discovering the gift of technology. Today, however, our island of knowledge is surrounded by ever longer shores of ignorance. Science appears to have hit a dead end when confronted with the nature of reality and consciousness. In this fascinating and accessible volume, James Glattfelder explores a radical paradigm shift uncovering the ontology of reality. It is found to be information-theoretic and participatory, yielding a computational and programmable universe.*

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### **GALAXY FORMATION AND EVOLUTION**

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**Cambridge University Press** *A coherent introduction for researchers in astronomy, particle physics, and cosmology on the formation and evolution of galaxies.*

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### **HIGH ENERGY ASTROPHYSICS**

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**Cambridge University Press** *Providing students with an in-depth account of the astrophysics of high energy phenomena in the Universe, the third edition of this well-established textbook is ideal for advanced undergraduate and beginning graduate courses in*

high energy astrophysics. Building on the concepts and techniques taught in standard undergraduate courses, this textbook provides the astronomical and astrophysical background for students to explore more advanced topics. Special emphasis is given to the underlying physical principles of high energy astrophysics, helping students understand the essential physics. The third edition has been completely rewritten, consolidating the previous editions into one volume. It covers the most recent discoveries in areas such as gamma-ray bursts, ultra-high energy cosmic rays and ultra-high energy gamma rays. The topics have been rearranged and streamlined to make them more applicable to a wide range of different astrophysical problems.

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## CLASSICAL AND QUANTUM THERMAL PHYSICS

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### CONSISTENT QUANTUM THEORY

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**Cambridge University Press** Quantum mechanics is one of the most fundamental yet difficult subjects in physics. Nonrelativistic quantum theory is presented here in a clear and systematic fashion, integrating Born's probabilistic interpretation with Schrödinger dynamics. Basic quantum principles are illustrated with simple examples requiring no mathematics beyond linear algebra and elementary probability theory. The quantum measurement process is consistently analyzed using fundamental quantum principles without referring to measurement. These same principles are used to resolve several of the paradoxes that have long perplexed physicists, including the double slit and Schrödinger's cat. The consistent histories formalism used here was first introduced by the author, and extended by M. Gell-Mann, J. Hartle and R. Omnès. Essential for researchers yet accessible to advanced undergraduate students in physics, chemistry, mathematics, and computer science, this book is supplementary to standard textbooks. It will also be of interest to physicists and philosophers working on the foundations of quantum mechanics.

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### TWENTIETH CENTURY PHYSICS

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**CRC Press** Twentieth Century Physics, Second Edition is a major historical study of the scientific and cultural development of physics in the twentieth century. This unique three-volume work offers a scholarly but highly readable overview of the development of physics, addressing both the cultural and the scientific aspects of the discipline. The three volumes deal with the major themes of physics in a quasi-chronological manner. The first volume covers the early part of the century while the second and third volumes discuss more recent issues. In each case, the development of the theme is traced from its inception to the present day. The list of contributors includes Nobel laureates, fellows of the Royal Society, and other distinguished international physicists. Where appropriate, specialists in the history of physics have written their own commentaries, providing a valuable counterpoint to the physicists' perspectives.

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### THE LARGE, THE SMALL AND THE HUMAN MIND

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**Cambridge University Press** The author of the provocative works *The Emperor's New Mind* and *Shadows of the Mind* now presents a masterful summary of the complex ideas presented in those books, highlighting areas of research where he perceives there are major unsolved problems that strike at the heart of our understanding of the laws of physics. Illustrated with cartoons & diagrams. 3 tables. Copyright © Libri GmbH. All rights reserved.

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### STATISTICAL PHYSICS

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#### VOLUME 1 OF MODERN CLASSICAL PHYSICS

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**Princeton University Press** A groundbreaking textbook on twenty-first-century statistical physics and its applications Kip Thorne and Roger Blandford's monumental *Modern Classical Physics* is now available in five stand-alone volumes that make ideal textbooks for individual graduate or advanced undergraduate courses on statistical physics; optics; elasticity and fluid dynamics; plasma physics; and relativity and cosmology. Each volume teaches the fundamental concepts, emphasizes modern, real-world applications, and gives students a physical and intuitive understanding of the subject. *Statistical Physics* is an essential introduction that is different from others on the subject because of its unique approach, which is coordinate-independent and geometric; embraces and elucidates the close quantum-classical connection and the relativistic and Newtonian domains; and demonstrates the power of statistical techniques—particularly statistical mechanics—by presenting applications not only to the usual kinds of things, such as gases, liquids, solids, and magnetic materials, but also to a much wider range of phenomena, including black holes, the universe, information and communication, and signal processing amid noise. Includes many exercise problems Features color figures, suggestions for further reading, extensive cross-references, and a detailed index Optional "Track 2" sections make this an ideal book for a one-quarter, half-semester, or full-semester course An online illustration package is available to professors

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### QUANTUM ASPECTS OF LIFE

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**World Scientific** This book presents the hotly debated question of whether quantum mechanics plays a non-trivial role in biology. In a timely way, it sets out a distinct quantum biology agenda. The burgeoning fields of nanotechnology, biotechnology, quantum technology, and quantum information processing are now strongly converging. The acronym BINS, for Bio-Info-Nano-Systems, has been coined to describe the synergetic interface of these several disciplines. The living cell is an information replicating and processing system that is replete with naturally-evolved nanomachines, which at some level require a quantum mechanical description. As quantum engineering and nanotechnology meet, increasing use will be made of biological structures, or hybrids of biological and fabricated systems, for producing novel devices for information storage and processing and other tasks. An understanding of these systems at a quantum mechanical level will be indispensable. Contents:Foreword (Sir R Penrose)Emergence and Complexity:A Quantum Origin of Life? (P C W Davies)Quantum Mechanics and Emergence (S Lloyd)Quantum Mechanisms in Biology:Quantum Coherence and the Search for the First Replicator (J Al-Khalili & J McFadden)Ultrafast Quantum Dynamics in Photosynthesis (A O Castro, F F Olsen, C F Lee & N F Johnson)Modelling Quantum Decoherence in Biomolecules (J Bothma, J Gilmore &

R H McKenzie) *The Biological Evidence: Molecular Evolution: A Role for Quantum Mechanics in the Dynamics of Molecular Machines that Read and Write DNA* (A Goel) *Memory Depends on the Cytoskeleton, but is it Quantum?* (A Mershin & D V Nanopoulos) *Quantum Metabolism and Allometric Scaling Relations in Biology* (L Demetrius) *Spectroscopy of the Genetic Code* (J D Bashford & P D Jarvis) *Towards Understanding the Origin of Genetic Languages* (A D Patel) *Artificial Quantum Life: Can Arbitrary Quantum Systems Undergo Self-Replication?* (A K Pati & S L Braunstein) *A Semi-Quantum Version of the Game of Life* (A P Flitney & D Abbott) *Evolutionary Stability in Quantum Games* (A Iqbal & T Cheon) *Quantum Transmemetic Intelligence* (E W Piotrowski & J S~adkowski) *The Debate: Dreams versus Reality: Plenary Debate Session on Quantum Computing* (For Panel: C M Caves, D Lidar, H Brandt, A R Hamilton, Against Panel: D K Ferry, J Gea-Banacloche, S M Bezrukov, L B Kish, Debate Chair: C R Doering, Transcript Editor: D Abbott) *Plenary Debate: Quantum Effects in Biology: Trivial or Not?* (For Panel: P C W Davies, S Hameroff, A Zeilinger, D Abbott, Against Panel: J Eisert, H M Wiseman, S M Bezrukov, H Frauenfelder, Debate Chair: J Gea-Banacloche, Transcript Editor: D Abbott) *Nontrivial Quantum Effects in Biology: A Skeptical Physicist's View* (H Wiseman & J Eisert) *That's Life! — The Geometry of  $\pi$  Electron Clouds* (S Hameroff) *Readership: Graduate students and researchers in quantum physics, biophysics, nanosciences, quantum chemistry, mathematical biology and complexity theory, as well as philosophers of science. Keywords: Quantum Biology; Quantum Computation; Quantum Mechanics; Biophysics; Nanotechnology; Quantum Technology; Quantum Information Processing; Bio-Info-Nano-Systems (BINS); Emergence; Complexity; Complex Systems; Cellular Automata; Game Theory; Biomolecules; Photosynthesis; DNA; Genetic Code; Decoherence* *Key Features: Is structured in a debate style, where contributors argue opposing positions Brings together some of the finest minds and latest developments in the field Is entirely unique and there are no competing titles*

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## OUR EVOLVING UNIVERSE

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**CUP Archive** *An inspiring and highly illustrated introduction to current astronomy and cosmology for the general reader or student.*

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## THEORETICAL CONCEPTS IN PHYSICS

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## AN ALTERNATIVE VIEW OF THEORETICAL REASONING IN PHYSICS

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**Cambridge University Press** *An innovative integrated approach to classical physics and the beginnings of quantum physics through a sequence of historical case studies.*

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## THE COSMIC CENTURY

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## A HISTORY OF ASTROPHYSICS AND COSMOLOGY

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**Cambridge University Press** *Reviews the historical development of all the key areas of modern astrophysics.*

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## QUANTUM PHYSICS FOR BEGINNERS

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## DISCOVER THE SCIENCE OF QUANTUM MECHANICS AND LEARN THE BASIC CONCEPTS FROM INTERFERENCE TO ENTANGLEMENT BY ANALYZING THE MOST FAMOUS QUANTUM EXPERIMENTS

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**Charlie Creative Lab** *Is it possible for two objects to be in two places at once? Can cause and effect happen in reverse? Is time travel possible? Believe it or not, it is possible: welcome to the Quantum World! Unlike other arguments, however, the real difficulty is not in understanding, but in accepting something completely senseless, precisely in the right meaning of the term: not sensible, that is, contrary to the perception of our senses. You will notice that quantum mechanics is much "easier" than the theory of relativity. In fact, you could get a child to help you digest certain concepts. The great difficulty does not lie in their complexity, but their absurdity in terms of logic acquired after many years of existence in a world that constantly follows certain rules. The more the brain is free of preconceptions and ingrained notions, the better it is. You will learn: What is interference; The Double-Slit Experiment; Quantum wave function; Feynman's works; The relation between waves and particles; The Heisenberg Uncertainty Principle; How particles can be in multiple places at once; Quantum entanglement; The Schrödinger's cat thought experiment; The Copenhagen interpretation and need for an observer; ...and much more! Quantum Physics is at the basis of all the technological innovations of today, from atomic energy to computer microelectronics, from digital clocks to lasers, semiconductor systems, photoelectric cells, diagnostic and treatment equipment for many diseases. In short, today we can live in a "modern" way thanks to Quantum Physics and its applications. This comprehensive beginner's guide to quantum mechanics explains the most important and stunning quantum experiments that show quantum physics is real. Are you ready? Let's dive deep into the fascinating science of Quantum Physics. Happy reading!*

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## UBIQUITOUS QUANTUM STRUCTURE

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## FROM PSYCHOLOGY TO FINANCE

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**Springer Science & Business Media** *Quantum-like structure is present practically everywhere. Quantum-like (QL) models, i.e. models based on the mathematical formalism of quantum mechanics and its generalizations can be successfully applied to cognitive science, psychology, genetics, economics, finances, and game theory. This book is not about quantum mechanics as a physical theory. The short review of quantum postulates is therefore mainly of historical value: quantum mechanics is just the first example of the successful application of non-Kolmogorov probabilities, the first step towards a contextual probabilistic description of natural, biological, psychological, social, economical or financial phenomena. A general contextual probabilistic model (Växjö model) is presented. It can be used for describing probabilities in both quantum and classical (statistical) mechanics as well as in the above mentioned phenomena. This model can be represented in a quantum-like way, namely, in complex and more general Hilbert spaces. In this way quantum probability is totally demystified: Born's representation of quantum probabilities by complex probability amplitudes, wave functions, is simply a special representation of this type.*

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## **PARTICLE PHYSICS AND INFLATIONARY COSMOLOGY**

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**CRC Press** A monograph on inflationary cosmology and cosmological phase transitions, investigating modern cosmology's relationship to elementary particle physics. This work also includes a non-technical discussion of inflationary cosmology for those unfamiliar with the theory.

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## **EMBEDDED RANDOM MATRIX ENSEMBLES IN QUANTUM PHYSICS**

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**Springer** Although used with increasing frequency in many branches of physics, random matrix ensembles are not always sufficiently specific to account for important features of the physical system at hand. One refinement which retains the basic stochastic approach but allows for such features consists in the use of embedded ensembles. The present text is an exhaustive introduction to and survey of this important field. Starting with an easy-to-read introduction to general random matrix theory, the text then develops the necessary concepts from the beginning, accompanying the reader to the frontiers of present-day research. With some notable exceptions, to date these ensembles have primarily been applied in nuclear spectroscopy. A characteristic example is the use of a random two-body interaction in the framework of the nuclear shell model. Yet, topics in atomic physics, mesoscopic physics, quantum information science and statistical mechanics of isolated finite quantum systems can also be addressed using these ensembles. This book addresses graduate students and researchers with an interest in applications of random matrix theory to the modeling of more complex physical systems and interactions, with applications such as statistical spectroscopy in mind.

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## **SYMMETRIES AND GROUP THEORY IN PARTICLE PHYSICS**

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### **AN INTRODUCTION TO SPACE-TIME AND INTERNAL SYMMETRIES**

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**Springer** Symmetries, coupled with the mathematical concept of group theory, are an essential conceptual backbone in the formulation of quantum field theories capable of describing the world of elementary particles. This primer is an introduction to and survey of the underlying concepts and structures needed in order to understand and handle these powerful tools. Specifically, in Part I of the book the symmetries and related group theoretical structures of the Minkowskian space-time manifold are analyzed, while Part II examines the internal symmetries and their related unitary groups, where the interactions between fundamental particles are encoded as we know them from the present standard model of particle physics. This book, based on several courses given by the authors, addresses advanced graduate students and non-specialist researchers wishing to enter active research in the field, and having a working knowledge of classical field theory and relativistic quantum mechanics. Numerous end-of-chapter problems and their solutions will facilitate the use of this book as self-study guide or as course book for topical lectures.

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## **FUNDAMENTALS OF GALAXY DYNAMICS, FORMATION AND EVOLUTION**

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**UCL Press** Galaxies, along with their underlying dark matter halos, constitute the building blocks of structure in the Universe. Of all fundamental forces, gravity is the dominant one that drives the evolution of structures from small density seeds at early times to the galaxies we see today. The interactions among myriads of stars, or dark matter particles, in a gravitating structure produce a system with fascinating connotations to thermodynamics, with some analogies and some fundamental differences. Ignacio Ferreras presents a concise introduction to extragalactic astrophysics, with emphasis on stellar dynamics, and the growth of density fluctuations in an expanding Universe. Additional chapters are devoted to smaller systems (stellar clusters) and larger ones (galaxy clusters). *Fundamentals of Galaxy Dynamics, Formation and Evolution* is written for advanced undergraduates and beginning postgraduate students, providing a useful tool to get up to speed in a starting research career. Some of the derivations for the most important results are presented in detail to enable students appreciate the beauty of maths as a tool to understand the workings of galaxies. Each chapter includes a set of problems to help the student advance with the material.

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## **FINDING THE BIG BANG**

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**Cambridge University Press** A collection of essays on research on CMBR in the 1960s by eminent cosmologists who pioneered the work.

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## **QUANTUM TELEPORTATION AND ENTANGLEMENT**

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### **A HYBRID APPROACH TO OPTICAL QUANTUM INFORMATION PROCESSING**

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**John Wiley & Sons** Unique in that it is jointly written by an experimentalist and a theorist, this monograph presents universal quantum computation based on quantum teleportation as an elementary subroutine and multi-party entanglement as a universal resource. Optical approaches to measurement-based quantum computation are also described, including schemes for quantum error correction, with most of the experiments carried out by the authors themselves. Ranging from the theoretical background to the details of the experimental realization, the book describes results and advances in the field, backed by numerous illustrations of the authors' experimental setups. Aimed at researchers, physicists, and graduate and PhD students in physics, theoretical quantum optics, quantum mechanics, and quantum information.

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## **THE QUANTUM AND THE LOTUS**

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### **A JOURNEY TO THE FRONTIERS WHERE SCIENCE AND BUDDHISM MEET**

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**Crown** Matthieu Ricard trained as a molecular biologist, working in the lab of a Nobel prize-winning scientist, but when he read some Buddhist philosophy, he became drawn to Buddhism. Eventually he left his life in science to study with Tibetan teachers, and he is now a Buddhist monk and translator for the Dalai Lama, living in the Shechen monastery near Kathmandu in Nepal. Trinh Thuan was born into a Buddhist family in Vietnam but became intrigued by the explosion of discoveries in astronomy during the 1960s. He made

his way to the prestigious California Institute of Technology to study with some of the biggest names in the field and is now an acclaimed astrophysicist and specialist on how the galaxies formed. When Matthieu Ricard and Trinh Thuan met at an academic conference in the summer of 1997, they began discussing the many remarkable connections between the teachings of Buddhism and the findings of recent science. That conversation grew into an astonishing correspondence exploring a series of fascinating questions. Did the universe have a beginning? Or is our universe one in a series of infinite universes with no end and no beginning? Is the concept of a beginning of time fundamentally flawed? Might our perception of time in fact be an illusion, a phenomenon created in our brains that has no ultimate reality? Is the stunning fine-tuning of the universe, which has produced just the right conditions for life to evolve, a sign that a "principle of creation" is at work in our world? If such a principle of creation undergirds the workings of the universe, what does that tell us about whether or not there is a divine Creator? How does the radical interpretation of reality offered by quantum physics conform to and yet differ from the Buddhist conception of reality? What is consciousness and how did it evolve? Can consciousness exist apart from a brain generating it? The stimulating journey of discovery the authors traveled in their discussions is re-created beautifully in *The Quantum and the Lotus*, written in the style of a lively dialogue between friends. Both the fundamental teachings of Buddhism and the discoveries of contemporary science are introduced with great clarity, and the reader will be profoundly impressed by the many correspondences between the two streams of thought and revelation. Through the course of their dialogue, the authors reach a remarkable meeting of minds, ultimately offering a vital new understanding of the many ways in which science and Buddhism confirm and complement each other and of the ways in which, as Matthieu Ricard writes, "knowledge of our spirits and knowledge of the world are mutually enlightening and empowering."

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## THE MULTIVERSE

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The multiverse is a concept that acknowledges the existence of a multiplicity of worlds or universes. The designs of these universes do not have to be the same as our universe, but we have no clear view of what the "other" designs might be. It is suspected that they can obey different laws of physics and different constants of physics, which further implies different chemistry, biology, and life. Some say that the universes within the multiverse allow for different mathematics or even for different metamathematical logic. This book discusses most of the above aspects of the multiverse concept starting with the philosophy, through all the mathematical and physical subtleties, finally exploring the origin of life and consciousness. This book provides a satisfying intellectual exploration of front-edge advances in contemporary cosmology.

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## EINSTEIN, RELATIVITY AND ABSOLUTE SIMULTANEITY

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**Routledge** *Einstein, Relativity and Absolute Simultaneity* is an anthology of original essays by an international team of leading philosophers and physicists who have come together to reassess the contemporary paradigm of the relativistic concept of time. A great deal has changed since 1905 when Einstein proposed his Special Theory of Relativity, and this book offers a fresh reassessment of Special Relativity's relativistic concept of time in terms of epistemology, metaphysics, and physics.

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## THE PHILOSOPHY OF PHYSICS

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**John Wiley & Sons** Does the future exist already? What is space? Are time machines physically possible? What is quantum mechanical reality like? Are there many universes? Is there a 'true' geometry of the universe? Why does there appear to be an arrow of time? Do humans play a special role in the world? In this unique introductory book, Dean Rickles guides the reader through these and other core questions that keep philosophers of physics up at night. He discusses the three pillars of modern physics (quantum mechanics, statistical mechanics, and the theories of relativity), in addition to more cutting-edge themes such as econophysics, quantum gravity, quantum computers, and gauge theories. The book's approach is based on the idea that philosophy of physics is a kind of 'interpretation game' in which we try to map physical theories onto our world. But the rules of this game often lead to a multiplicity of possible victors: rarely do we encounter a simple answer. *The Philosophy of Physics* offers a highly accessible introduction to the latest developments in this exciting field. Written in a lively style, with many visual examples, it will appeal to beginner-level students in both physics and philosophy.

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## INTRODUCTION TO BLACK HOLE PHYSICS

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**Oxford University Press** What is a black hole? How many of them are in our Universe? Can black holes be created in a laboratory or in particle colliders? Can objects similar to black holes be used for space and time travel? This book discusses these and many other questions providing the reader with the tools required to explore the Black Hole Land independently.

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## INTRODUCTION TO COSMOLOGY

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**Cambridge University Press** A substantial update of this award-winning and highly regarded cosmology textbook, for advanced undergraduates in physics and astronomy.

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## ANALOGUE GRAVITY PHENOMENOLOGY

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## ANALOGUE SPACETIMES AND HORIZONS, FROM THEORY TO EXPERIMENT

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**Springer** *Analogue Gravity Phenomenology* is a collection of contributions that cover a vast range of areas in physics, ranging from surface wave propagation in fluids to nonlinear optics. The underlying common aspect of all these topics, and hence the main focus and perspective from which they are explained here, is the attempt to develop analogue models for gravitational systems. The original and main motivation of the field is the verification and study of Hawking radiation from a horizon: the enabling feature is the possibility to generate horizons in the laboratory with a wide range of physical systems that involve a flow of one kind or another. The years around 2010 and onwards witnessed a sudden surge of experimental activity in this expanding field of research. However, building an expertise in analogue gravity requires the researcher to be equipped with a rather broad range of knowledge and

interests. The aim of this book is to bring the reader up to date with the latest developments and provide the basic background required in order to appreciate the goals, difficulties, and success stories in the field of analogue gravity. Each chapter of the book treats a different topic explained in detail by the major experts for each specific discipline. The first chapters give an overview of black hole spacetimes and Hawking radiation before moving on to describe the large variety of analogue spacetimes that have been proposed and are currently under investigation. This introductory part is then followed by an in-depth description of what are currently the three most promising analogue spacetime settings, namely surface waves in flowing fluids, acoustic oscillations in Bose-Einstein condensates and electromagnetic waves in nonlinear optics. Both theory and experimental endeavours are explained in detail. The final chapters refer to other aspects of analogue gravity beyond the study of Hawking radiation, such as Lorentz invariance violations and Brownian motion in curved spacetimes, before concluding with a return to the origins of the field and a description of the available observational evidence for horizons in astrophysical black holes.

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## HOMOGENEOUS RELATIVISTIC COSMOLOGIES

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**Princeton University Press** Addressing a variety of theoretical cosmological problems, and emphasizing a mathematical approach, this volume nicely complements Peebles' *Physical Cosmology* (Princeton Series in Physics, 1971). Ryan and Shepley have concentrated on the structure of models of the universe. By using a modern terminology that emphasizes the operator nature of vectors and tensors, as opposed to their components in a particular coordinate system, the authors develop modern tensor analysis to the point where it can be applied to general relativistic cosmology. They then use it to describe homogeneous cosmologies in considerable detail. Both students and researchers are likely to find these techniques especially useful. Among their subjects are: spaces with groups of motions; singularities; Taub-NUT-Misner space; Bianchitype models; Hamiltonian cosmology; and perturbations in anisotropic models. A brief section on observations is also included, as is a complete bibliography. A final section presents graded exercises that underscore the potential yet unrealized in this area of study. Originally published in 1975. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

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## TIME: FROM EARTH ROTATION TO ATOMIC PHYSICS

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**Cambridge University Press** This accessible reference presents the evolution of concepts of time and methods of time keeping, for historians, scientists, engineers, and educators. The second edition has been updated throughout to describe twentieth- and twenty-first-century advances, progress in devices, time and cosmology, the redefinition of SI units, and the future of UTC.

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## QUANTUM PHYSICS

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### A FUNDAMENTAL APPROACH TO MODERN PHYSICS

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**Univ Science Books** This innovative modern physics textbook is intended as a first introduction to quantum mechanics and its applications. Townsend's new text shuns the historical ordering that characterizes other so-called modern physics textbooks and applies a truly modern approach to this subject, starting instead with contemporary single-photon and single-atom interference experiments. The text progresses naturally from a thorough introduction to wave mechanics through applications of quantum mechanics to solid-state, nuclear, and particle physics, thereby including most of the topics normally presented in a modern physics course.