Concepts in Thermal Physics

This text provides a modern introduction to the main principles of thermal physics, thermodynamics and statistical mechanics. The key concepts are presented and new ideas are illustrated with worked examples as well as description of the historical background to their discovery.

Laser Physics

This volume presents in a pedagogical yet complete way correlated systems in one dimension. After an introduction to the basic concepts of correlated systems, it gives a step-by-step description of the techniques needed to treat one dimension, and discusses the resulting physics.

A Dictionary of Physics

The volumes of the Symposium Aristotelicum have become essential reference works for the study of Aristotle. In this nineteenth volume, eleven distinguished scholars of ancient philosophy provide a running commentary on the first book of Aristotle’s Physics, a central treatise of the Aristotelian corpus that aims at knowledge of the principles of physical change. Along with the general introduction, the ten chapters together comment on the entirety of the Aristotelian text and discuss the philosophical issues that are raised in it in detail. Aristotle is shown to be in dialogue with the divergent doctrines of earlier philosophers, namely with the Eleatics’ monism, with Anaxagoras’ theory of mixture, and finally with the Platonist dyadism that posits the two principles of Form and the Great and Small. Aristotle uses critical examination of his predecessors’ views as the basis for formulating his own theory of the principles of natural things, which are fundamental for the entire Aristotelian study of the natural world. He provides his own solution to the problem of coming-to-be and passing-away by distinguishing between coming in actuality and in potentiality. Comprehensive analysis of Aristotle’s doctrines and arguments, as well as critical discussion of rival interpretations, will make this volume a valuable resource for scholars of Aristotle.

Quantum Physics in One Dimension

This text brings together traditional solid-state approaches from the 20th century with developments of the early part of the 21st century, to reach an understanding of semiconductor physics in its multifaceted forms. It reveals how an understanding of what happens within the material can lead to insights into what happens in its use.

Quantum Gravity

Applied Computational Physics is a graduate-level text stressing three essential elements: advanced programming techniques, numerical analysis, and physics. The goal of the text is to provide students with essential computational skills that they will need in their careers, and to increase the confidence with which they write computer programs designed for their problem domain, physics. The physics problems give them an opportunity to reinforce their programming skills, while the acquired programming skills augment their ability to solve physics problems. The C++ language is used throughout the text. Physics problems include Hamiltonian systems, chaotic systems, percolation, critical phenomena, few-body and multi-body quantum systems, quantum field theory, simulation of...
The book, the fruit of a collaboration between a theoretical physicist and an experimental physicist, covers a broad diversity of topics from both viewpoints. Examples, program libraries, and additional documentation can be found at the companion website. Hundreds of original problems reinforce programming skills and increase the ability to solve real-life physics problems at and beyond the graduate level.

Introduction to Mathematical Physics This Oxford Handbook provides an overview of many of the topics that currently engage philosophers of physics. It surveys new issues and the problems that have become a focus of attention in recent years. It also provides up-to-date discussions of the still very important problems that dominated the field in the past. In the late 20th Century, the philosophy of physics was largely focused on orthodox Quantum Mechanics and Relativity Theory. The measurement problem, the question of the possibility of hidden variables, and the nature of quantum locality dominated the literature on the quantum mechanics, whereas questions about relationalism vs. substantivalism, and issues about underdetermination of theories dominated the literature on spacetime. These issues still receive considerable attention from philosophers, but many have shifted their attentions to other questions related to quantum mechanics and to spacetime theories. Quantum field theory has become a major focus, particularly from the point of view of algebraic foundations. Concurrent with these trends, there has been a focus on understanding gauge invariance and symmetries. The philosophy of physics has evolved even further in recent years with attention being paid to theories that, for the most part, were largely ignored in the past. For example, the relationship between thermodynamics and statistical mechanics---once thought to be a paradigm instance of unproblematic theory reduction---is now a hotly debated topic. The implicit, and sometimes explicit, reductionist methodology of both philosophers and physicists has been severely criticized and attention has now turned to the explanatory and descriptive roles of “non-fundamental,” phenomenological theories. This shift of attention includes “old” theories such as classical mechanics, once deemed to be of little philosophical interest. Furthermore, some philosophers have become more interested in “less fundamental” contemporary physics such as condensed matter theory. Questions abound with implications for the nature of models, idealizations, and explanation in physics. This Handbook showcases all these aspects of this complex and dynamic discipline.

Why String Theory? This classic monograph provided the first comprehensive account of the physics and chemistry of ice, and remains authoritative and relevant today. The book places emphasis on the basic physical properties of ice (electrical, optical, mechanical, and thermal), the modes of nucleation and growth of ice, and the interpretation of these phenomena in terms of molecular structure. The book should serve both as a reference on ice physics for research workers and as a unified survey of the subject for those new to the field.

Dictionary of Physics Now with over 4,000 entries, this new eighth edition has been fully updated to reflect progress in physics and related fields. It sees expansion to the areas of cosmology, astrophysics, condensed matter, quantum technology, and nanotechnology, with 125 new entries including “Deep Underground Neutrino Experiment”, “kilonova”, “leptoquark”, and “muscovium”. The dictionary’s range of appendices, updated for the new edition, includes the periodic table, the electromagnetic spectrum, and a detailed chronology of key dates. 15 new diagrams add to the clarity and accessibility of the text, with 150 line drawings, tables, and graphs in total, and many entries contain recommended web links. This popular dictionary remains the most up-to-date of its kind: the essential introductory reference tool for students encountering physics terms and concepts, as well as for professionals and anyone with an interest in the subject.

The Oxford Handbook of the History of Physics Soft matter (polymers, colloids, surfactants, liquid crystals) are an important class of materials for modern and future technologies. They are complex materials that behave neither like a fluid nor a solid. This book describes the characteristics of such materials and how we can understand such characteristics in the language of physics.

Exploring Classical Mechanics Advances in nanotechnology have allowed physicists and engineers to miniaturize electronic structures to the limit where finite-size related phenomena start to impact their performance. The book provides an introduction to the fundamental principles of classical mechanics and their application to a wide range of physical systems. The text is written in a clear and accessible style, with numerous examples and exercises to reinforce understanding.
Properties of graphene. This book discusses such phenomena and models made for their description. The book starts from the semiclassical description of nonequilibrium effects, details the scattering theory used for quantum transport calculations, and explains the main interference effects. It also describes how to treat fluctuations and correlations, how interactions affect transport through small islands, and how superconductivity modifies these effects. The last two chapters describe new emerging fields related with graphene and nanoelectromechanics. The focus of the book is on the phenomena rather than formalism, but the book still explains in detail the main models constructed for these phenomena. It also introduces a number of electronic devices, including the single-electron transistor, the superconducting tunnel junction refrigerator, and the superconducting quantum bit.

Random Processes in Physics and Finance
Our Universe is made of a dozen fundamental building blocks. Among these, neutrinos are the most mysterious - but they are the second most abundant particles in the Universe. This book provides detailed discussions of how to describe neutrinos, their basic properties, and the roles they play in nature.

Graphene
Why does time pass and space does not? Are there just three dimensions? What is a quantum particle? Nick Huggett shows that philosophy -- armed with a power to analyze fundamental concepts and their relationship to the human experience -- has much to say about these profound questions about the universe. In Everywhere and Everywhen, Huggett charts a journey that peers into some of the oldest questions about the world, through some of the newest, such as: What shape is space? Does it have an edge? What is the difference between past and future? What is time in relativity? Is time travel possible? Are there other universes? Huggett shows that answers to these profound questions are not just reserved for physics, and that philosophy can not only address but help advance our view of our deepest questions about the universe, space, and time, and their implications for humanity. His lively, accessible introduction to these topics is suitable for a general reader with no previous exposure to these profound and exciting questions.

The Physics of Quantum Mechanics
Introducing physics in the language of mathematics and providing revision of the mathematical techniques and physical concepts, this text also features instructive questions with full solutions and is intended for students starting, or preparing for, the study of physical science or engineering at university.

Particle Astrophysics, Second Edition
This book describes atomic physics and the latest advances in this field at a level suitable for fourth year undergraduates. The numerous examples of the modern applications of atomic physics include Bose-Einstein condensation of atoms, matter-wave interferometry and quantum computing with trapped ions.

Invitation to Philosophy
A complete description of the science and applications of graphene, a revolutionary two-dimensional one-atom-thick material of exceedingly high electrical conductivity and tensile strength.

The Language of Physics
Mathematical physics provides physical theories with their logical basis and the tools for drawing conclusions from hypotheses. Introduction to Mathematical Physics explains to the reader why and how mathematics is needed in the description of physical events in space. For undergraduates in physics, it is a classroom-tested textbook on vector analysis, linear operators, Fourier series and integrals, differential equations, special functions and functions of a complex variable. Strongly correlated with core undergraduate courses on classical and quantum mechanics and electromagnetism, it helps the student master these necessary mathematical skills. It contains advanced topics of interest to graduate students on relativistic square-root spaces and nonlinear systems. It contains many tables of mathematical formulas and references to useful materials on the Internet. It includes short tutorials on basic mathematical topics to help readers refresh their mathematical knowledge. An appendix on Mathematica encourages the reader to use computer-aided algebra to solve problems in mathematical physics. A free Instructor's Solutions Manual is available to instructors who order the book for course adoption.
Physics World's 'Book of the Year' for 2016
An Entertaining and Enlightening Guide to the Who, What, and Why of String Theory, now also available in an updated reflowable electronic format compatible with mobile devices and e-readers. During the last 50 years, numerous physicists have tried to unravel the secrets of string theory. Yet why do these scientists work on a theory lacking experimental confirmation? Why String Theory? provides the answer, offering a highly readable and accessible panorama of the who, what, and why of this large aspect of modern theoretical physics. The author, a theoretical physics professor at the University of Oxford and a leading string theorist, explains what string theory is and where it originated. He describes how string theory fits into physics and why so many physicists and mathematicians find it appealing when working on topics from M-theory to monsters and from cosmology to superconductors.

The Physics of Nanoelectronics
In this revised and updated edition of a classic introductory text, Martin Hollis leads his readers through the age-old philosophical questions of free choice and human nature, appearance and reality, reason and experience, and to newer ones or rationality and morality, other minds and inner selves, and the relation between the natural and human worlds. Using theories and examples ranging from Plato, Descartes, Hume and Kant to T.S. Eliot and Sherlock Holmes, the author paints a delightfully vivid picture of the discipline that is a perfect start for students beginning courses in philosophy or for anyone meeting the subject for the first time.

Magnetism in Condensed Matter
This text gives an introduction to particle physics at a level accessible to advanced undergraduate students. It is based on lectures given to 4th year physics students over a number of years, and reflects the feedback from the students. The aim is to explain the theoretical and experimental basis of the Standard Model (SM) of Particle Physics with the simplest mathematical treatment possible. All the experimental discoveries that led to the understanding of the SM relied on particle detectors and most of them required advanced particle accelerators. A unique feature of this book is that it gives a serious introduction to the fundamental accelerator and detector physics, which is currently only available in advanced graduate textbooks. The mathematical tools that are required such as group theory are covered in one chapter. A modern treatment of the Dirac equation is given in which the free particle Dirac equation is seen as being equivalent to the Lorentz transformation. The idea of generating the SM interactions from fundamental gauge symmetries is explained. The core of the book covers the SM. The tools developed are used to explain its theoretical basis and a clear discussion is given of the critical experimental evidence which underpins it. A thorough account is given of quark flavour and neutrino oscillations based on published experimental results, including some from running experiments. A simple introduction to the Higgs sector of the SM is given. This explains the key idea of how spontaneous symmetry breaking can generate particle masses without violating the underlying gauge symmetry. A key feature of this book is that it gives an accessible explanation of the discovery of the Higgs boson, including the advanced statistical techniques required. The final chapter gives an introduction to LHC physics beyond the standard model and the techniques used in searches for new physics. There is an outline of the shortcomings of the SM and a discussion of possible solutions and future experiments to resolve these outstanding questions. For updates, new results, useful links as well as corrections to errata in this book, please see the book website maintained by the authors: https://pplhcera.physics.ox.ac.uk/
pervasive science came to be and how it works: who funds it, how physicists are trained and how they think, and how physics supports the technology we all use. Sidney Perkowitz presents the theories and outcomes of pure and applied physics from ideas of the Greek natural philosophers to modern quantum mechanics, cosmology, digital electronics and energy production. Considering its most consequential experiments, including recent results in elementary particles, gravitational waves and materials science, he also discusses outside the lab, the effects of physics on society, culture, and humanity's vision of its place in the universe. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

Ice Physics Ice is one of the most abundant and environmentally important materials on Earth, and its unique and intriguing physical properties present fascinating areas of study for a wide variety of researchers. This book is about the physics of ice, by which is meant the properties of the material itself and the ways in which these properties are interpreted in terms of water molecules and crystalline structure. Although ice has a simple crystal structure its hydrogen bonding results in unique properties, which continue to be the subject of active research. In this book the physical principles underlying the properties of ice are carefully developed at a level aimed at pure and applied researchers in the field. Important topics like current understandings of the electrical, mechanical, and surface properties, and the occurrence of many different crystalline phases are developed in a coherent way for the first time. An extensive reference list and numerous illustrations add to the usefulness and readability of the text.

Applied Computational Physics Presents a history of physics, examining the theories and experimental practices of the science.

The Problems of Physics Is the universe infinite, or does it have an edge beyond which there is, quite literally, nothing? Do we live in the only possible universe? Why does it have one time and three space dimensions—or does it? What is it made of? What does it mean when we hear that a new particle has been discovered? Will quantum mechanics eventually break down and give way to a totally new description of the world, one whose features we cannot even begin to imagine? This book aims to give the non-specialist reader a general overview of what physicists think they do and do not know in some representative frontier areas of contemporary physics. After sketching out the historical background, A. J. Leggett goes on to discuss the current situation and some of the open problems of cosmology, high-energy physics, and condensed-matter physics. Unlike most other accounts, this book focuses not so much on recent achievements as on the fundamental problems at the heart of the subject, and emphasizes the provisional nature of our present understanding of things.

Physics of Ice With over 150 alphabetically arranged entries about key scientists, concepts, discoveries, technological innovations, and learned institutions, the Oxford Guide to Physics and Astronomy traces the history of physics and astronomy from the Renaissance to the present. For students, teachers, historians, scientists, and readers of popular science books such as Galileo’s Daughter, this guide deciphers the methods and philosophies of physics and astronomy as well as the historical periods from which they emerged. Meant to serve the lay reader and the professional alike, this book can be turned to for the answer to how scientists learned to measure the speed of light, or consulted for neat, careful summaries of topics as complicated as quantum field theory and as vast as the universe. The entries, each written by a noted scholar and edited by J. L. Heilbron, Professor of History and Vice Chancellor, Emeritus, University of California, Berkeley, reflect the most up-to-date research and discuss the applications of the scientific disciplines to the wider world of religion, law, war, art and literature. No other source on these two branches of science is as informative or as inviting. Thoroughly cross-referenced and accented by dozens of black and white illustrations, the Oxford Guide to Physics and Astronomy is the source to turn to for anyone looking for a quick explanation of alchemy, x-rays and any type of matter or energy in between.

Atomic Physics This book illustrates the frontiers of precise measurements in Atomic Physics. It is written in an introductory style, which makes it useful for advanced undergraduate and graduate students. The topics range from basic methods to more advanced approaches, covering areas such as quantum mechanics, spectroscopy, and atomic collisions. The emphasis is on the experimental techniques used to study atomic systems, including lasers, microwave spectroscopy, and collisions in gas cells. The book is intended for students and researchers interested in pursuing these areas of research.
students as well as for more experienced researchers who want to remain up-to-date with the most recent advances. The book focuses on experimental investigations, illustrating both milestone experiments and key experimental techniques, and discussing the results and perspectives of current research activities. Emphasis is put on the investigations of precision physics: from the determination of fundamental constants of Nature to tests of General Relativity and Quantum Electrodynamics, from the realization of ultra-stable atomic clocks to the precise simulation of condensed matter theories with ultracold gases.

A very active field of research is emerging at the frontier of statistical physics, theoretical computer science/discrete mathematics, and coding/information theory. This book sets up a common language and pool of concepts, accessible to students and researchers from each of these fields.