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Mathematical Physics

This is a textbook on classical mechanics at the intermediate level, but its main purpose is to serve as an introduction to a new mathematical language for physics called geometric algebra. Mechanics is most commonly formulated today in terms of the vector algebra developed by the American physicist J. Willard Gibbs, but for

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some applications of mechanics the algebra of complex numbers is more efficient than vector algebra, while in other applications matrix algebra works better. Geometric algebra integrates all these algebraic systems into a coherent mathematical language which not only retains the advantages of each special algebra but possesses powerful new capabilities. This book covers the fairly standard material for a course on the mechanics of particles and rigid bodies. However, it will be seen that geometric algebra brings new insights into the treatment of

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nearly every topic and produces simplifications that move the subject quickly to advanced levels. That has made it possible in this book to carry the treatment of two major topics in mechanics well beyond the level of other textbooks. A few words are in order about the unique treatment of these two topics, namely, rotational dynamics and celestial mechanics.

"The standard work in the fundamental principles of quantum mechanics, indispensable both to the advanced student and to the mature research worker, who will always find it a fresh

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***source of knowledge and stimulation." --Nature
"This is the classic text on quantum mechanics.
No graduate student of quantum theory should
leave it unread"--W.C Schieve, University of
Texas***

***A comprehensive and engaging textbook,
providing a graduate-level, non-historical,
modern introduction of quantum mechanical
concepts.***

***A Student's Guide to Lagrangians and
Hamiltonians
Mathematical Physics***

Applied Mechanics Reviews
A Computational Approach with Examples Using
Mathematica and Python
Essential Statistical Physics

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

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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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Pedagogical classic and essential reference focuses on mathematics of detailed vibrational analyses of polyatomic molecules, advancing from application of wave mechanics to potential functions and methods of solving secular determinant.

A concise treatment of variational techniques, focussing on Lagrangian and Hamiltonian systems, ideal for physics, engineering and mathematics students.

This book offers an in-depth presentation of the mechanics of particles and systems. The material is thoroughly class-tested and hence eminently suitable as a textbook for a one-semester course in Classical Mechanics for postgraduate students of physics and mathematics. Besides, the book can serve as a useful reference for engineering students at the postgraduate level. The book provides not only a complete treatment of classical theoretical physics but

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also an enormous number of worked examples and problems to show students clearly how to apply abstract principles and mathematical techniques to realistic problems. While abstraction of theory is minimized, detailed mathematical analysis is provided wherever necessary. Besides an all-embracing coverage of different aspects of classical mechanics, the rapidly growing areas of nonlinear dynamics and chaos are also included. The chapter on Central Force Motion includes topics like satellite parameters, orbital transfers and scattering problem. An extensive treatment on the essentials of small oscillations which is crucial for the study of molecular vibrations is included. Rigid body motion and special theory of relativity are also covered in two separate chapters.

Lectures on Symplectic Geometry

Problems and Solutions on Mechanics

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A Treatise on Electricity and Magnetism

Hierarchical Modeling from Quantum Mechanics to Fluid Dynamics

An Introduction to Mechanics

A 2003 textbook on Fourier and Laplace transforms for undergraduate and graduate students.

The book presents a comprehensive study of important topics in Mechanics of pure and applied sciences. It provides knowledge of scalar and vector in optimum depth to make the students understand the concepts of Mechanics in simple, coherent and lucid manner and grasp its principles & theory. It caters to the requirements of students of B.Sc. Pass and Honours courses. Students of engineering disciplines and the

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ones aspiring for competitive exams such as AIME and others, will also find it useful for their preparations. Classical Dynamics of Particles and Systems presents a modern and reasonably complete account of the classical mechanics of particles, systems of particles, and rigid bodies for physics students at the advanced undergraduate level. The book aims to present a modern treatment of classical mechanical systems in such a way that the transition to the quantum theory of physics can be made with the least possible difficulty; to acquaint the student with new mathematical techniques and provide sufficient practice in solving problems; and to impart to the student some degree of sophistication in handling both the formalism of the

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theory and the operational technique of problem solving. Vector methods are developed in the first two chapters and are used throughout the book. Other chapters cover the fundamentals of Newtonian mechanics, the special theory of relativity, gravitational attraction and potentials, oscillatory motion, Lagrangian and Hamiltonian dynamics, central-force motion, two-particle collisions, and the wave equation. The simulation of physical systems requires a simplified, hierarchical approach which models each level from the atomistic to the macroscopic scale. From quantum mechanics to fluid dynamics, this book systematically treats the broad scope of computer modeling and simulations, describing the fundamental theory behind each level of

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approximation. Berendsen evaluates each stage in relation to its applications giving the reader insight into the possibilities and limitations of the models. Practical guidance for applications and sample programs in Python are provided. With a strong emphasis on molecular models in chemistry and biochemistry, this 2007 book will be suitable for advanced undergraduate and graduate courses on molecular modeling and simulation within physics, biophysics, physical chemistry and materials science. It will also be a useful reference to all those working in the field. Additional resources for this title including solutions for instructors and programs are available online at www.cambridge.org/9780521835275.

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GIS Applications in Agriculture

Information Theory, Inference and Learning Algorithms

Molecular Vibrations

Physics and Applications

Textbook of Mechanics

The school held at Villa Marigola, Lerici, Italy, in July 1997 was very much an educational experiment aimed not just at teaching a new generation of students the latest developments in computer simulation methods and theory, but also at bringing together

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researchers from the condensed matter computer simulation community, the biophysical chemistry community and the quantum dynamics community to confront the shared problem: the development of methods to treat the dynamics of quantum condensed phase systems. This volume collects the lectures delivered there. Due to the focus of the school, the contributions divide along natural lines into two broad groups: (1) the most sophisticated forms of the art of

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computer simulation, including biased phase space sampling schemes, methods which address the multiplicity of time scales in condensed phase problems, and static equilibrium methods for treating quantum systems; (2) the contributions on quantum dynamics, including methods for mixing quantum and classical dynamics in condensed phase simulations and methods capable of treating all degrees of freedom quantum-mechanically. Contents:Barrier

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Crossing: Classical Theory of Rare but Important Events (D Chandler) Monte Carlo Simulations (D Frenkel) Molecular Dynamics Methods for the Enhanced Sampling of Phase Space (B J Berne) Constrained and Nonequilibrium Molecular Dynamics (G Ciccotti & M Ferrario) From Eyring to Kramers: Computation of Diffusive Barrier Crossing Rates (M J Ruiz-Montero) Monte Carlo Methods for Sampling of Rare Event States (W Janke) Proton Transfer

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in Ice (D Marx)Nudged Elastic Band Method for Finding Minimum Energy Paths of Transitions (H Jónsson et al.)RAW Quantum Transition State Theory (G Mills et al.)Dynamics of Peptide Folding (R Elber et al.)Theoretical Studies of Activated Processes in Biological Ion Channels (B Roux & S Crouzy)The Semiclassical Initial Value Representation for Including Quantum Effects in Molecular Dynamics Simulations (W H Miller)Tunneling in

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the Condensed Phase: Barrier Crossing and Dynamical Control (N Makri) Feynman Path Centroid Methods for Condensed Phase Quantum Dynamics (G A Voth) Quantum Molecular Dynamics Using Wigner Representation (V S Filinov et al.) Nonadiabatic Molecular Dynamics Methods for Diffusion (D Laria et al.) and other papers Readership: Computational and statistical physicists. Keywords: Quantum; Molecular Dynamics; Dynamics Reviews: "... this

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volume is a useful introduction to currently popular, and widely-used techniques in chemical and statistical physics. The authors are well-respected researchers in the field and the level is appropriate to graduate students and researchers." *Journal of Statistical Physics*

This text forms a bridge between courses in calculus and real analysis. Suitable for advanced undergraduates and graduate students, it focuses on

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the construction of mathematical proofs. 1996 edition.

Table of contents

This textbook covers all the standard introductory topics in classical mechanics, including Newton's laws, oscillations, energy, momentum, angular momentum, planetary motion, and special relativity. It also explores more advanced topics, such as normal modes, the Lagrangian method, gyroscopic motion, fictitious forces, 4-vectors,

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and general relativity. It contains more than 250 problems with detailed solutions so students can easily check their understanding of the topic. There are also over 350 unworked exercises which are ideal for homework assignments. Password protected solutions are available to instructors at www.cambridge.org/9780521876223. The vast number of problems alone makes it an ideal supplementary text for all levels of undergraduate physics courses

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in classical mechanics. Remarks are scattered throughout the text, discussing issues that are often glossed over in other textbooks, and it is thoroughly illustrated with more than 600 figures to help demonstrate key concepts.

Classical Mechanics and Quantum Mechanics: An Historic-Axiomatic Approach

Analytical and Numerical Solutions with Comments

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Fundamentals of Geophysical Fluid

Dynamics

Classical and Quantum Dynamics in

Condensed Phase Simulations

Modern Introductory Physics

The Age of Reason is left the Dark Ages of the history

mechanics. Clifford A. Truesdell) 1. 1 THE INVISIBLE

TRUTH OF CLASSICAL PHYSICS There are some

questions that physics since the days of Newton simp

cannot an swer. Perhaps the most important of these

be categorized as 'questions of eth ics', and 'questions

ultimate meaning'. The question of humanity's place in

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the cosmos and in nature is pre-eminently a philosophical and religious one, and physics seems to have little to contribute to answering it. Although physics claims to have made very fundamental discoveries about the cosmos and nature, its concern with the coherence and order of material phenomena rather than with questions of meaning. Now and then thinkers such as Stephen Hawking or Fritjof Capra emerge, who appear to claim that a total world-view can be derived from physics. Generally, however, such authors do not actually make any great effort to make good on their claim to completeness: their answers to

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questions of meaning often pale in comparison with their answers to conventional questions in physics.

Moreover, to the extent that they do attempt to answer questions of meaning, it is easy to show that they do so on assumptions from outside physics.

Provides thorough coverage of the basic concepts of mechanics and wave motion. Broadly it covers the law of motion and inertial frames, conservation laws, the dynamics of rigid bodies, elasticity, gravitation, simple harmonic motion, damped harmonic oscillator, forced harmonic oscillator, and wave motion.

Newtonian mechanics : dynamics of a point mass

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(1001-1108) - Dynamics of a system of point masses
(1109-1144) - Dynamics of rigid bodies (1145-1223) -
Dynamics of deformable bodies (1224-1272) - Analytical
mechanics : Lagrange's equations (2001-2027) - Small
oscillations (2028-2067) - Hamilton's canonical
equations (2068-2084) - Special relativity (3001-3050)
Quantum Theory is the most revolutionary discovery in
physics since Newton. This book gives a lucid, exciting,
and accessible account of the surprising and
counterintuitive ideas that shape our understanding of
the sub-atomic world. It does not disguise the problems
of interpretation that still remain unsettled 75 years ago.

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the initial discoveries. The main text makes no use of equations, but there is a Mathematical Appendix for those desiring stronger fare. Uncertainty, probabilistic physics, complementarity, the problematic character of measurement, and decoherence are among the many topics discussed. 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

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highly readable.

The Principles of Quantum Mechanics

Computational Inelasticity

Classical Dynamics of Particles and Systems

Mechanics

New Foundations for Classical Mechanics

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

The goal of these notes is to provide a fast introduction to symplectic geometry for graduate students with some knowledge of differential geometry, de Rham theory and classical Lie groups. This text addresses symplectomorphisms

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local forms, contact manifolds, compatible almost complex structures, Kaehler manifolds, hamiltonian mechanics, moment maps, symplectic reduction and symplectic toric manifolds. It contains guided problems, called homework, designed to complement the exposition or extend the reader's understanding. There are by now excellent references on symplectic geometry, a subset of which is in the bibliography of this book. However, the most efficient introduction to the subject is often a short elementary treatment, and these attempt to serve that purpose. This text provides a taste of areas of current research and will prepare the reader to explore recent papers and extensive books on symplectic geometry where the pace is much faster. For this reprint

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numerous corrections and clarifications have been made, and the layout has been improved.

In paperback for the first time, this compact volume presents quantum mechanics for the general reader. It offers a lucid description of the intellectual challenges and disagreements in the study of the behavior of atomic and sub-atomic particles, a field that has completely changed our view of the physical world, but that is still the subject of unresolved debate about its own fundamental interpretation. The work is accessible to those with no background in higher mathematics, but will also interest readers who have a more specialized knowledge of scientific topics. The author has spent most of his working life as a theoretical elementary particle physicist and from 19

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1979 was Professor of Mathematical Physics at the University of Cambridge. In 1979 he resigned to train for the ministry of the Church of England, and he is now an ordained priest. Here he describes a theory that has been spectacularly successful in predicting the behavior of objects the size of atoms and smaller but that has aroused conflicting views about the nature of reality and the degree of independence between the world around us and ourselves as observers. Single-photon generation and detection is at the forefront of modern optical physics research. This book is intended to provide a comprehensive overview of the current status of single-photon techniques and research methods in the spectral region from the visible to the infrared. The use of single

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photons, produced on demand with well-defined quantum properties, offers an unprecedented set of capabilities that are central to the new area of quantum information and are of revolutionary importance in areas that range from the traditional, such as high sensitivity detection for astronomy, remote sensing, and medical diagnostics, to the exotic, such as secretive surveillance and very long communication links for data transmission on interplanetary missions. The goal of this volume is to provide researchers with a comprehensive overview of the technology and techniques that are available to enable them to better design an experimental plan for their intended purpose. The book will be broken into chapters focused specifically on the development and capabilities of

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available detectors and sources to allow a comparative understanding to be developed by the reader along with an idea of how the field is progressing and what can be expected in the near future. Along with this technology, we will include chapters devoted to the applications of this technology, which is in fact much of the driver for its development. This is set to become the go-to reference for this field. Covers all the basic aspects needed to perform single-photon experiments and serves as the first reference to any newcomer who would like to produce an experimental design that incorporates the latest techniques Provides a comprehensive overview of the current status of single-photon techniques and research methods in the spectral region from the visible to the infrared, thus giving

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broad background that should enable newcomers to the field to make rapid progress in gaining proficiency. Written by leading experts in the field, among which, the leading Editor recognized as having laid down the roadmap, thus providing the reader with an authenticated and reliable source.

Fourier and Laplace Transforms

Mechanics and Wave Motion

Introduction to Real Analysis

Solved Problems in Classical Mechanics

Single-Photon Generation and Detection

A description of the theoretical foundations of inelasticity, its numerical formulation and implementation,

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constituting a representative sample of state-of-the-art methodology currently used in inelastic calculations. Among the numerous topics covered are small deformation plasticity and viscoplasticity, convex optimisation theory, integration algorithms for the constitutive equation of plasticity and viscoplasticity, the variational setting of boundary value problems and discretization by finite element methods. Also addressed are the generalisation of the theory to non-smooth yield surface, mathematical numerical analysis issues of general return mapping algorithms, the generalisation to finite-strain inelasticity theory, objective integration

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algorithms for rate constitutive equations, the theory of hyperelastic-based plasticity models and small and large deformation viscoelasticity. Of great interest to researchers and graduate students in various branches of engineering, especially civil, aeronautical and mechanical, and applied mathematics.

This second edition is ideal for classical mechanics courses for first- and second-year undergraduates with foundation skills in mathematics.

Intermediate/advanced textbook which provides concise and accessible introduction to GFD for broad range of students.

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The increased efficiency and profitability that the proper application of technology can provide has made precision agriculture the hottest developing area within traditional agriculture. The first single-source volume to cover GIS applications in agronomy, GIS Applications in Agriculture examines ways that this powerful technology can help farmers

What was Mechanical about Mechanics

Introduction to Classical Mechanics

The Theory of Infrared and Raman Vibrational Spectra

Modern Quantum Mechanics

The Concept of Force between Metaphysics and

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Mechanics from Newton to Lagrange

Classical Mechanics: A Computational Approach with Examples using Python and Mathematica provides a unique, contemporary introduction to classical mechanics, with a focus on computational methods. In addition to providing clear and thorough coverage of key topics, this textbook includes integrated instructions and treatments of computation. Full of pedagogy, it contains both analytical and

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computational example problems within the body of each chapter. The example problems teach readers both analytical methods and how to use computer algebra systems and computer programming to solve problems in classical mechanics. End-of-chapter problems allow students to hone their skills in problem solving with and without the use of a computer. The methods presented in this book can then be used by students when solving problems in other fields both within

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and outside of physics. It is an ideal textbook for undergraduate students in physics, mathematics, and engineering studying classical mechanics. Features: Gives readers the "big picture" of classical mechanics and the importance of computation in the solution of problems in physics Numerous example problems using both analytical and computational methods, as well as explanations as to how and why specific techniques were used Online resources

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containing specific example codes to help students learn computational methods and write their own algorithms. A solutions manual is available via the Routledge Instructor Hub and extra code is available via the Support Material tab.

A lively and engaging introduction to classical mechanics, this easy-to-follow text presents real, modern applications in astrophysics and beyond. It covers the core physics

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concepts, progressing step by step from simple to more complex mathematics. The authors draw on their extensive experience teaching the subject to students in physics, chemistry, astronomy, and engineering. They discuss the conservation laws of momentum, energy, and angular momentum as well as dark matter, dark energy, and the ultimate fate of the Universe. This is the fifth edition of a well-established textbook. It is intended to

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provide a thorough coverage of the fundamental principles and techniques of classical mechanics, an old subject that is at the base of all of physics, but in which there has also in recent years been rapid development. The book is aimed at undergraduate students of physics and applied mathematics. It emphasizes the basic principles, and aims to progress rapidly to the point of being able to handle physically and mathematically interesting problems,

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without getting bogged down in excessive formalism. Lagrangian methods are introduced at a relatively early stage, to get students to appreciate their use in simple contexts. Later chapters use Lagrangian and Hamiltonian methods extensively, but in a way that aims to be accessible to undergraduates, while including modern developments at the appropriate level of detail. The subject has been developed considerably recently while

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retaining a truly central role for all students of physics and applied mathematics. This edition retains all the main features of the fourth edition, including the two chapters on geometry of dynamical systems and on order and chaos, and the new appendices on conics and on dynamical systems near a critical point. The material has been somewhat expanded, in particular to contrast continuous and discrete behaviours. A further appendix has been

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added on routes to chaos (period-doubling) and related discrete maps. The new edition has also been revised to give more emphasis to specific examples worked out in detail.

Classical Mechanics is written for undergraduate students of physics or applied mathematics. It assumes some basic prior knowledge of the fundamental concepts and reasonable familiarity with elementary differential and integral calculus.

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Contents: Linear Motion Energy and Angular Momentum Central Conservative Forces Rotating Frames Potential Theory The Two-Body Problem Many-Body Systems Rigid Bodies Lagrangian Mechanics Small Oscillations and Normal Modes Hamiltonian Mechanics Dynamical Systems and Their Geometry Order and Chaos in Hamiltonian Systems Appendices: Vectors Conics Phase Plane Analysis Near Critical Points Discrete Dynamical Systems – Maps

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Readership: Undergraduates in physics and applied mathematics.

Gregory's Classical Mechanics is a major new textbook for undergraduates in mathematics and physics. It is a thorough, self-contained and highly readable account of a subject many students find difficult. The author's clear and systematic style promotes a good understanding of the subject: each concept is motivated and illustrated by worked examples, while problem sets

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provide plenty of practice for understanding and technique. Computer assisted problems, some suitable for projects, are also included. The book is structured to make learning the subject easy; there is a natural progression from core topics to more advanced ones and hard topics are treated with particular care. A theme of the book is the importance of conservation principles. These appear first in vectorial mechanics where they

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are proved and applied to problem solving. They reappear in analytical mechanics, where they are shown to be related to symmetries of the Lagrangian, culminating in Noether's theorem.

The Quantum World

CLASSICAL MECHANICS

With Problems and Solutions

Quantum Theory: A Very Short

Introduction

Simulating the Physical World

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This book grew out of an ongoing effort to modernize Colgate University's three-term, introductory, calculus-level physics course. The book is for the first term of this course and is intended to help first-year college students make a good transition from high-school physics to university physics. The book concentrates on the physics that explains why we believe that atoms exist and have the properties we ascribe to them. This story line, which motivates much of our professional research, has helped us limit the material

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presented to a more humane and more realistic amount than is presented in many beginning university physics courses. The theme of atoms also supports the presentation of more non-Newtonian topics and ideas than is customary in the first term of calculus-level physics. We think it is important and desirable to introduce students sooner than usual to some of the major ideas that shape contemporary physicists' views of the nature and behavior of matter. Here in the second decade of the twenty-first century such a

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goal seems particularly appropriate. The quantum nature of atoms and light and the mysteries associated with quantum behavior clearly interest our students. By adding and -phasizing more modern content, we seek not only to present some of the physics that engages contemporary physicists but also to attract students to take more physics. Only a few of our beginning physics students come to us sharply focused on physics or astronomy. Nearly all of them, however, have taken physics in high school and found it

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interesting.

Delivers a clear and concise exposition of key topics in statistical physics, accompanied by detailed derivations and practice problems.

Physics from Planet Earth

Classical Mechanics

CLASSICAL MECHANICS.