Chapter 6 Magnetic Fields In Matter 6 1 2 Torques And

After an introductory chapter concerned with the history of force-free magnetic fields, and the relation of such fields to hydrodynamics and astrophysics, the book examines the limits imposed by the virial theorem for finite force-free configurations. Various techniques are then used to find solutions to the field equations. The fact that the field lines corresponding to these solutions have the common feature of being “twisted”, and may be knotted, motivates a discussion of field line topology and the concept of helicity. The topics of field topology, helicity, and magnetic energy in multiply connected domains make the book of interest to a rather wide audience. Applications to solar prominence models, type-II superconductors, and force-reduced magnets are also discussed. The book contains many figures and a wealth of material not readily available elsewhere. Contents:IntroductionThe Virial TheoremSolutions to the Force-Free Field EquationsField TopologyMagnetic Energy in Multiply Connected DomainsApplicationsForce-Free Fields and Electromagnetic WavesProof of the Jacobi Polynomial IdentitiesSeparation of the Wave Equation, Cyclides, and Boundary Conditions Readership: Students and researchers working in physics, astrophysics, hydrodynamics, plasma physics and energy research. keywords:Force-Free;Magnetic Filed Topology;Helicity (Twist, Kink, Link);Magnetic Energy in Multiply-Connected Domains;Magnetic Knots

This book presents a detailed account of one of the most mysterious problems in science — whether ordinary magnetic fields can exert an appreciable influence on chemical and biochemical reactions. The first aim of the book is to introduce this research, through theoretical and dynamic spin chemistry, to graduate students and researchers, by means of detailed theoretical and experimental descriptions. The second aim is to review typical recent investigations, which will stimulate new interest and applications in the 21st century. Because dynamic spin chemistry is based on established science, it is expected to provide a guide for all situations in which radicals, radical pairs, and higher spin species occur, including the effects of environmental electromagnetic fields on the human body.

Nanomagnetic Materials: Fabrication, Characterization and Application explores recent studies of conventional nanomagnetic materials in spintronics, data storage, magnetic sensors and biomedical applications. In addition, the book also reviews novel magnetic characteristics induced in two-dimensional materials, diamonds, and those induced by the artificial formation of lattice defect and heterojunction as novel nanomagnetic materials. Nanomagnetic materials are usually based on d- and f-electron systems. They are an important solution to the demand for higher density of information storage, arising from the emergence of novel technologies required for non-volatile memory systems. Advances in the understanding of magnetization dynamics and in the characteristics of nanoparticles or surface of nanomagnetic materials is resulting in greater expansion of applications of nanomagnetic materials, including in biotechnology, sensor devices, energy harvesting, and power generating systems. This book provides a cogent overview of the latest research on novel nanomagnetic materials, including spintronic nanomagnets, molecular nanomagnets, self-assembling magnetic nanomaterials, nanoparticles, multifunctional materials, and heterojunction-induced novel magnetism. Explains manufacturing principles and process for nanomagnetic materials Discusses physical and chemical properties and potential industrial applications, such as magnetic data storage, sensors, oscillator, permanent magnets, power generations, and biomedical applications Assesses the major challenges of using magnetic nanomaterials on a broad scale

In September 1984 a Summer School on Solar System Plasmas was held at Imperial College with the support of the Science and Engineering Research Council. An excellent group of lecturers was assembled to give a series of basic talks on the various aspects of the subject, aimed at Ph. D. students or researchers from related areas wanting to learn about the plasma physics of the solar system. The students were so appreciative of the lectures that it was decided to write them up as the present book. Traditionally, different areas of solar system science, such as solar and magnetospheric physics, have been studied by separate communities with little contact. However, it has become clear that many common themes cut right across these distinct topics, such as magnetohydrodynamic instabilities and waves, magnetic reconnect ion , convection, dynamo activity and particle acceleration. The plasma parameters may well be quite different in the Sun's atmosphere, a cometary tailor Jupiter's magnetosphere, but many of the basic processes are similar and it is by studying them in different environments that we come to understand them more deeply. Furthermore, direct in situ measurements of plasma properties at one point in the solar wind or the magnetosphere complement the more global view by remote sensing of a similar phenomenon at the Sun.

The Committee to Assess the Current Status and Future Direction of High Magnetic Field Science in the United States was convened by the National Research Council in response to a request by the National Science Foundation. This report answers three questions: (1) What is the current state of high-field magnet science, engineering, and technology in the United States, and are there any conspicuous needs to be addressed? (2) What are the current science drivers and which scientific opportunities and challenges can be anticipated over the next ten years? (3) What are the principal existing and planned high magnetic field facilities outside of the United States, what roles have U.S. high field magnet development efforts played in developing those facilities, and what potentials exist for further international collaboration in this area? A magnetic field is produced by an electrical current in a metal coil. This current exerts an expansive force on the coil, and a magnetic field is "high" if it challenges the strength and current-carrying capacity of the materials that create the field. Although lower magnetic fields can be achieved using commercially available magnets, research in the highest achievable fields has been, and will continue to be, most often performed in large research centers that possess the materials and systems know-how for forefront research. Only a few high field centers exist around the world; in the United States, the principal center is the National High Magnetic Field Laboratory (NHMFL). High Magnetic Field Science and Its Application in the United States considers continued support for a centralized high-field facility such as NHFML to be the highest priority. This report contains a recommendation for the funding and siting of several new high field nuclear magnetic resonance magnets at user facilities in different regions of the United States. Continued advancement in high-magnetic field science requires substantial investments in magnets with enhanced capabilities. High Magnetic Field Science and Its Application in the United States contains recommendations for the further development of all-superconducting, hybrid, and higher field pulsed magnets that meet ambitious but achievable goals.

ElectromagnetismProblems and SolutionsMorgan & Claypool Publishers

The physics of strongly interacting matter in an external magnetic field is presently emerging as a topic of great cross-disciplinary interest for particle, nuclear, astro- and condensed matter physicists. It is known that strong magnetic fields are created in heavy ion collisions, an insight that has made it possible to study a variety of surprising and intriguing phenomena that emerge from the interplay of quantum anomalies, the topology of non-Abelian gauge fields, and the magnetic field. In particular, the non-trivial topological configurations of the gluon field induce a non-dissipative electric current in the presence of a magnetic field. These phenomena have led to an extended formulation of relativistic hydrodynamics, called chiral magnetohydrodynamics. Hitherto unexpected applications in condensed matter physics include graphene and topological insulators. Other fields of application include astrophysics, where strong magnetic fields exist in magnetars and pulsars. Last but not least, an important new theoretical tool that will be revisited and which made much of the progress surveyed in this book possible is the holographic principle - the correspondence between quantum field theory and gravity in extra dimensions. Edited and authored by the pioneers and leading experts in this newly emerging field, this book offers a valuable resource for a broad community of physicists and graduate students.

This volume deals with the theory of electromagnetism using a descriptive and geometrical approach. It also contains biological topics which can serve as applications of the theory for students of chemistry or biology.

Today's standard textbooks treat the theoretical structure of electric and magnetic fields, but their emphasis is on electromagnetic radiation and static-electric and magnetic fields. In this book, Eugene Parker provides advanced graduate students and researchers with a much-needed complement to existing texts, one that discusses the dynamic electromagnetism of the cosmos--that is, the vast magnetic fields that are carried bodily in the swirling ionized gases of stars and galaxies and throughout intergalactic space. Parker is arguably the world's leading authority on solar wind and the effects of magnetic fields in the heliosphere, and his originality of thought and distinctive approach to physics are very much in evidence here. Seeking to enrich discussions in standard texts and correct misconceptions about the dynamics of these large-scale fields, Parker engages readers in a series of "conversations" that are at times anecdotal and even entertaining without ever sacrificing theoretical rigor. The dynamics he describes represents the Maxwell stresses of the magnetic field working against the pressure and inertia of the bulk motion of ionized gases, characterized in terms of the magnetic field and gas velocity. Parker shows how this dynamic interaction cannot be fully expressed in terms of the electric current and electric field. Conversations on Electric and Magnetic Fields in the Cosmos goes back to basics to explain why classical hydrodynamics and magnetohydrodynamics are inescapable, even in the deepest reaches of space.

This text examines how knowledge of many branches of physics can help provide an understanding of the structure and evolution of stars. Topics covered include: observational properties of stars, equations that govern their structure and recent theoretical work on stellar evolution.

Electromagnetism: Problems and solutions is an ideal companion book for the undergraduate student—sophomore, junior, or senior—who may want to work on more problems and receive immediate feedback while studying. Each chapter contains brief theoretical notes followed by the problem text with the solution and ends with a brief bibliography. Also presented are problems more general in nature, which may be a bit more challenging.

I. Theoretical Considerations.- 1. Introduction.- 2. Simple Theoretical Models for Magnetic Interactions with Biological Units.- 3. Basic Concepts Related to Magnetic Fields and Magnetic Susceptibility.- 4. The Vector Character of Field and Gradient and Its Possible Implications for Biomagnetic Experiments and Space Travel.- 5. Rotational Diffusion in a Magnetic Field and Its Possible Magnetobiological Implications.- 6. Distortion of the Bond Angle in a Magnetic Field and Its Possible Magnetobiological Implications.- 7. A Possible Effect of the Magnetic Field Upon the Genetic Code.- II. Effect.

Drawing together topics from a wide range of disciplines, this text provides a comprehensive insight into the fundamentals of magnetic biosensors and the applications of magnetic nanoparticles in medicine. Internationally renowned researchers showcase topics ranging from the basic physical principles of magnetism to the detection and manipulation, synthesis protocols and natural occurrence of magnetic nanoparticles. Up-to-date examples of their clinical usage and research applications in the biomedical fields of sensing by diverse magnetic detection methods, in imaging by MRI and in therapeutic strategies such as hyperthermia, are also discussed, providing a thorough introduction to this rapidly developing field. Each chapter features questions with answers, highlighted definition boxes, and numerous illustrations which help readers grasp key concepts. Mathematical tools, together with key literature references, provide a strong underpinning for the material, making it ideal for graduate students, lecturers, medical researchers and industrial scientific strategists.

A four year Electrical and Electronic engineering curriculum normally contains two modules of electromagnetic field theories during the first two years. However, some curricula do not have enough slots to accommodate the two modules. This book, Electromagnetic Field Theories, is designed for Electrical and Electronic engineering undergraduate students to provide fundamental knowledge of electromagnetic fields and waves in a structured manner. A comprehensive fundamental knowledge of electric and magnetic fields is required to understand the working principles of generators, motors and transformers. This knowledge is also necessary to analyze transmission lines, substations, insulator flashover mechanism, transient phenomena, etc. Recently, academics and researches are working for sending electrical power to a remote area by designing a suitable antenna. In this case, the knowledge of electromagnetic fields is considered as important tool.

Magnetic Fields, Special Relativity and Potential Theory is an introduction to electromagnetism, special relativity, and potential theory, with emphasis on the magnetic field of steady currents (magnetostatics). Topics covered range from the origin of the magnetic field and the magnetostatic scalar potential to magnetization, electromagnetic induction and magnetic energy, and the displacement current and Maxwell's equations. This volume is comprised of five chapters and begins with an overview of magnetostatics, followed by a chapter on the methods of solving potential problems drawn from electrostatics, magnetism, current flow, and gravitation. Relaxing the constraint of stationary steady currents, the next chapter considers electromagnetic induction when the current strengths in closed circuits vary or when the circuits move. This leads to the necessity of assessing the breakdown of Newtonian ideas and the introduction of special relativity. When the constraint of closed circuits is further relaxed and the motion of charges in open circuits is taken into account, the discussion turns to displacement current because of the relativistic theory already set up, leading to Maxwell's equations. This book will be a valuable resource for undergraduate students of physics.

This book deals with electromagnetic theory and its applications at the level of a senior-level undergraduate course for science and engineering. The basic concepts and mathematical analysis are clearly developed and the important applications are analyzed. Each chapter contains numerous problems ranging in difficulty from simple applications to challenging. The answers for the problems are given at the end of the book. Some chapters which open doors to more advanced topics, such as wave theory, special relativity, emission of radiation by charges and antennas, are included. The material of this book allows flexibility in the choice of the topics covered. Knowledge of basic calculus (vectors, differential equations and integration) and general physics is assumed. The required mathematical techniques are gradually introduced. After a detailed revision of time-independent phenomena in electrostatics and magnetism in vacuum, the electric and magnetic properties of matter are discussed. Induction, Maxwell equations and electromagnetic waves, their reflection, refraction, interference and diffraction are also studied in some detail. Four additional topics are introduced: guided waves, relativistic electrodynamics, particles in an electromagnetic field and emission of radiation. A useful appendix on mathematics, units and physical constants is included. Contents 1. Prologue. 2. Electrostatics in Vacuum. 3. Conductors and Currents. 4. Dielectrics. 5. Special Techniques and Approximation Methods. 6.

Magnetic Field in Vacuum. 7. Magnetism in Matter. 8. Induction. 9. Maxwell's Equations. 10. Electromagnetic Waves. 11. Reflection, Interference, Diffraction and Diffusion. 12. Guided Waves. 13. Special Relativity and Electrodynamics. 14. Motion of Charged Particles in an Electromagnetic Field. 15. Emission of Radiation.

This self-contained introduction to astrophysical magnetic fields provides a comprehensive review of the current state of the field and a critical discussion of the latest research. Its emphasis on results that are likely to form the basis for future progress benefits a broad audience of advanced students and active researchers.

Provides information about Electric & Magnetic Fields (EMF) exposure in the workplace. Describes what researchers have learned (& have yet to learn) about EMFs & identifies come sources of EMFs in various industries. This information should help workers & employers understand the scientific basis for the concerns & the uncertainties about EMF exposure. Contents: EMF basics; human health studies; biological studies; summaries & opinions; ongoing research; your EMF environment; sources of additional information. Extensive references.

Particle dynamics in the solar corona are of interest since the behaviour of the coronal plasma is important for the understanding of how the solar corona is heated to such high temperatures compared to the photosphere (? 1 million Kelvin, compared to a photospheric temperature of ? 6 thousand Kelvin). This thesis deals with particle behaviour in various forms of magnetic and electric fields. The method via which particles are accelerated at reconnection regions is of particular interest as particle acceleration at a magnetic reconnection region is the basis for many solar flare models. Solar flares are releases of energy in the solar corona. The amounts of energy released range from the very small amounts released by nanoflares, that cannot be observed individually, to large events such as X-class flares and coronal mass ejections. Chapter one provides background information about the structure of the Sun and about various forms of solar activity, including solar flares, sunspots, and the generation of the solar magnetic field. Chapter 2 explores various theories of magnetic reconnection. Magnetic reconnection re- gions are usually characterised as containing a central 'null', a region where the magnetic field is zero, and particles can be freely accelerated in the presence of an electric field, as they decouple from the magnetic field and move non-adiabatically. Chapter 2 gives examples of how such reconnection regions could be formed. Chapter 3 deals with the construction of a 'noisy' reconnection region. For the purposes of this work, 'noisy' fields were created by perturbing the magnetic and electric fields with a superposition of eigenmode oscillations. The method for the calculation of such eigenmodes, and the creation of the electric and magnetic fields is detailed here. Chapter 4 details the consequences for particle behaviour in a noisy reconnection region. The behaviour of electrons and protons in such fields was studied. It was found that adding perturbations to the magnetic field caused many smaller nulls to form, which increased the size of the non-adiabatic region. This increased non-adiabatic region led to greater energisa- tion of particles. The X-ray spectra that could be produced by the accelerated electrons were 4 5 also calculated. In this chapter I also investigate the consequences of altering the distribution of the spectrum of modes, and altering the value of the inertial resistivity. In chapter 5, the effects of collisional scattering on particles was also investigated. Colli- sional scattering was introduced by integrating particle trajectories using a stochastic Runge- Kutta method (which is a form of numerical integration). It was found that adding collisional scattering at a reconnection region causes a significant change in particle dynamics in suffi- ciently small electric fields. Particles which undergo collisional scattering in the presence of a small electric field gain more energy than those which do not undergo collisional scatter- ing. This effect decreases as the size of the electric field is increased. The correct relativistic expressions for particle collisions were derived. It was found that collisions have a negligible effect on relativistic particles. Collisional scattering was also used to simulate the drift of particles across magnetic fields. It was found that adding more scattering caused the trajectories of the particles to change from normal gyromotion around the magnetic field, and that particles instead travelled across the magnetic field. I also developed a diffusion coefficient to allow the calculation of a particle's drift across a magnetic field using only 1D equations. Chapter 6 discusses the findings made in this thesis, and explores how these findings could be built upon in the near future.

High magnetic fields have been an important tool in semiconductor physics for a long time. The area has been growing very rapidly since quantum effects in silicon field-effect transistors have become of practical interest. Since the discovery of the quantum Hall effect by Klaus von Klitzing in 1980, this subject has grown exponentially. The book contains 42 invited papers and 37 contributed papers which were presented at the 7th of the traditional Würzburg conferences. For the area of high magnetic fields applied in semiconductor physics recent results are discussed, and the state-of-the-art is reviewed. More than 50% of the papers concern two-dimensional electronic systems. Other subjects of current interest are magneto-optics and magneto transport in three-dimensional semiconductors. Special attention has been paid to the rapidly growing field of semimagnetic semiconductors.

This open access book gives a complete and comprehensive introduction to the fields of medical imaging systems, as designed for a broad range of applications. The authors of the book first explain the foundations of system theory and image processing, before highlighting several modalities in a dedicated chapter. The initial focus is on modalities that are closely related to traditional camera systems such as endoscopy and microscopy. This is followed by more complex image formation processes: magnetic resonance imaging, X-ray projection imaging, computed tomography, X-ray phase-contrast imaging, nuclear imaging, ultrasound, and optical coherence tomography.

A unique resource for physicists and engineers working with magnetic fields An understanding of magnetic phenomena is essential for anyone working on the practical application of electromagnetic theory. Magnetic Fields: A Comprehensive Theoretical Treatise for Practical Use provides physicists and engineers with a thorough treatment of the magnetic aspects of classical electromagnetic theory, focusing on key issues and problems arising in the generation and application of magnetic fields. From magnetic potentials and diffusion phenomena to magnetohydrodynamics and properties of matter-topics are carefully selected for their relevance to the theoretical framework as well as current technologies. Outstanding in its organization, clarity, and scope, Magnetic Fields: * Examines a wide range of practical problems, from magnetomechanical devices to magnetic acceleration mechanisms * Opens each chapter with reference to pertinent engineering examples * Provides sufficient detail enabling readers to follow the derivation of the results * Discusses solution methods and their application to different problems * Includes more than 300 graphs, 40 tables, 2,000 numbered formulas, and extensive references to the professional literature * Reviews the essential mathematics in the appendices

This 1994 book examines how reversals of the Earth's magnetic field have played a major role in establishing plate tectonics and a geological time scale.

Single Crystal Growth of Semiconductors from Metallic Solutions covers the four principal growth techniques currently in use for the growth of semiconductor single crystals from metallic solutions. Providing an in-depth review of the state-of-the-art of each, both experimentally and by numerical simulations. The importance of a close interaction between the numerical and experimental aspects of the processes is also emphasized. Advances in the fields of electronics and opto-electronics are hampered by the limited number of substrate materials which can be readily produced by melt-growth techniques such as the Czochralski and Bridgman methods. This can be alleviated by the use of alternative growth techniques, and in particular, growth from metallic solutions. The principal techniques currently in use are: Liquid Phase Epitaxy; Liquid Phase Electroepitaxy; the Travelling Heater Method, and; Liquid Phase Diffusion. Single Crystal Growth of Semiconductors from Metallic Solutions will serve as a valuable reference tool for researchers, and graduate and senior undergraduate students in the field of crystal growth. It covers most of the models developed in recent years. The detailed development of basic and constitutive equations and the associated interface and boundary conditions given for each technique will be very valuable to researchers for the development of their new models. * Describes the fundamentals of crystal growth modelling * Providing a state-of-the art description of the mathematical and experimental growth processes * Allows reader to gain clear insight into the practical and mathematical aspects of the topic

Magnetism is one of the basic properties of matter. Mankind has trav elled a long road in discovering and utilizing magnetism, and in this respect the ancient Chinese people have made outstanding contribu tions. In the book 'Lu's Spring and Autumn', written near the end of the Warring States Period, i. e. in the third century B. C. , there is a statement on the "attraction of iron by lodestones". So at that time it was known that magnets can attract ferromagnetic material. At the be ginning ofthe first century A. D. , viz. in the early years ofthe East Hang Dynasty, the famous scholar Wang Chong wrote in his masterpiece 'Len Hen' that the handle of a magnetic dipper pointed to the south. It was thus discovered at the time that magnets can point to the poles of the geomagnetic field. At the beginning of the twelfth century, during the reign of Emperor Hui of the Sung Dynasty, in the two books written by Zhu Yo and Xu Jin, respectively, there are descriptions of the com pass used in navigation. This tells us that the application of compasses was rather widespread at that time. The distinguished scientist Sen Go (1031-1085) discovered the declination of the terrestrial magnetic field. This is four hundred and more years earlier than its discovery by Christopher Columbus in 1492 during his voyage across the Atlantic Ocean. Such facts as these manifest the important contributions of ancient China to global civilization.

This book is an introduction to pulsars, a key area in high energy astrophysics with continuing potential for fundamental discoveries. Throughout the book runs the unifying thread of the evolutionary link between rotation-powered pulsars and accretion-powered pulsars — a milestone of modern astrophysics. Early textbooks on pulsars dealt almost entirely with rotation-powered ones, while accounts of pulsars in volumes on X-ray binaries focused almost exclusively on accretion-powered ones. This is the first textbook to treat these two kinds of pulsars simultaneously with equal importance, stressing the fact that both are rotating, magnetic neutron stars, operating under different conditions during different parts of their lives. It describes the observational properties of both kinds of pulsars, summarizes our physical understanding of these properties, and pays detailed attention to the physics of superdense matter which neutron stars are composed of, as well as to the superfluidity which is expected to occur in neutron stars. Evolution from rotation-power to accretion-power, and vice versa, are carefully described. The effects of the strong magnetic fields of neutron stars on themselves, their emission properties, and their environments are discussed, as are the origin and evolution of such magnetic fields. Also treated is the superbly accurate verification of Einstein's theory of general relativity through timing studies of binary pulsars, which led to the award of the Nobel Prize to Hulse and Taylor in 1993. On each topic, the book starts with simple, basic physical concepts, and builds up the exposition to the point where the latest and most exciting developments become accessible to the reader. Contents:The Discovery of PulsarsPhysics of Neutron StarsOrigin and Evolution of Neutron StarsProperties of Rotation Powered PulsarsSuperfluidity in Neutron Stars and Glitch DiagnosticsProperties of Accretion Powered PulsarsPulsar MagnetospheresPulsar Emission MechanismsSpin Evolution of Neutron StarsNeutron Star Magnetic FieldsStrange Stars Readership: Graduate students and upper level undergraduates, researchers and teachers in astrophysics, astronomy, theoretical physics, astro-plasma physics, general relativity and related subjects. Keywords:Reviews:“Neutron stars are implicated in some of the most fascinating phenomena in the universe. This comprehensive text is unique in its authoritative and clear coverage of what we have learnt about neutron stars in different cosmic environments from observations in all wavebands.”Professor Sir M J Rees Astronomer Royal Cambridge University “Rotation and Accretion Powered Pulsars by Professor Pranab Ghosh is a masterpiece of erudition and pedagogy and can be recommended without hesitation to both beginners and specialists in this fascinating field of modern astrophysics.”Professor Jean-Pierre Lasota Institut d'Astrophysique de Paris “This book is an excellent and up to date basic reference source for all theoretical and observational aspects of neutron stars and will be very much welcomed by everyone working in high-energy astrophysics, stellar evolution and the studies of pulsars. For those teaching courses in these fields of astrophysics it also is highly recommended."Space Science Reviews "The book is written in a very readable style, with clear explanations of the subtleties of the various topics and occasional anecdotal notes on points of historical interest. It would be a valuable addition to the library of anyone interested in the physics of compact stellar objects."Australian Physics

This course-tested textbook conveys the fundamentals of magnetic fields and relativistic plasma in diffuse cosmic media, with a primary focus on phenomena that have been observed at different wavelengths. Theoretical concepts are addressed wherever necessary, with derivations presented in sufficient detail to be generally accessible. In the first few chapters the authors present an introduction to various astrophysical phenomena related to cosmic magnetism, with scales ranging from molecular clouds in star-forming regions and supernova remnants in the Milky Way, to clusters of galaxies. Later chapters address the role of magnetic fields in the evolution of the interstellar medium, galaxies and galaxy clusters. The book is intended for advanced undergraduate and postgraduate students in astronomy and physics and will serve as an entry point for those starting their first research projects in the field.

The book Electromagnetic Field Theory caters to the students of BE/BTech Electronics and Communication Engineering, Electrical and Electronics Engineering, and Electronic Instrumentation Engineering, as electromagnetics is an integral part of their curricula. It covers a wide range of topics that deal with various physical and mathematical concepts, including vector functions, coordinate systems, integration and differentiation, complex numbers, and phasors. The book helps in understanding the electric and magnetic fields on different charge and current distributions, such as line, surface, and volume. It also explains the electromagnetic behaviour of waves, fields in transmission lines, and radiation in antennas. A number of electromagnetic applications are also included to develop the interest of students. SALIENT FEATURES • Simple and easy-to-follow text • Complete coverage of the subject as per the syllabi of most universities • Lucid, well-explained concepts with clear examples • Relevant illustrations for better understanding and retention • Some of the illustrations provide three-dimensional view for in-depth knowledge • Numerous mathematical examples for full clarity of concepts • Chapter objectives at the beginning of each chapter for its overview • Chapter-end summary and exercises for quick review and to test your knowledge

This is the second edition of a useful introductory book on a technique that has revolutionized neuroscience, specifically cognitive neuroscience. Functional magnetic resonance imaging (fMRI) has now become the standard tool for studying the brain systems involved in cognitive and emotional processing. It has also been a major factor in the consilience of the fields of neurobiology, cognitive psychology, social psychology, radiology, physics, mathematics, engineering, and even philosophy. Written and edited by a clinician-scientist in the field, this book remains an excellent user's guide to t

This book is an introduction to astrophysical hydrodynamics for both astronomy and physics students. It provides a comprehensive and unified view of the general problems associated with fluids in a cosmic context, with a discussion of fluid dynamics and plasma physics. It is the only book on hydrodynamics that addresses the astrophysical context. Researchers and students will find this work to be an exceptional reference. Contents include chapters on irrotational and rotational flows, turbulence, magnetohydrodynamics, and instabilities.

Space Radiation Biology and Related Topics provides information pertinent to the fundamental aspects of space radiation biology. This book discusses space radiation hazards as well as the importance of natural radiations in the processes of biogenesis. Organized into 12 chapters, this book begins with an overview of the fundamental aspects of radiobiology. This text then discusses the theoretical treatments of the chronic radiation response and the applicability of some of its features in extended manned space missions. Other chapters review the literature on models for recovery from radiation damage to some cellular systems. This book discusses as well the effects of radiations on mammals, with emphasis on those effects pertinent to the space-flight situation. The final chapter deals with the safety of nuclear power in space and explains the three types of nuclear devices designed for power production in space. This book is a valuable resource for radiologists, radiobiologists, and radiotherapists.

Can the electric and magnetic fields (EMF) to which people are routinely exposed cause health effects? This volume assesses the data and draws conclusions about the consequences of human exposure to EMF. The committee examines what is known about three kinds of health effects associated with EMF: cancer, primarily childhood leukemia; reproduction and development; and neurobiological effects. This book provides a detailed discussion of hazard identification, dose-response assessment, exposure assessment, and risk characterization for each. Possible Health Effects of Exposure to Residential Electric and Magnetic Fields also discusses the tools available to measure exposure, common types of exposures, and what is known about the effects of exposure. The committee looks at correlations between EMF exposure and carcinogenesis, mutagenesis, neurobehavioral effects, reproductive and developmental effects, effects on melatonin and other neurochemicals, and effects on bone healing and stimulated cell growth.

DIVDetailed theoretical study and a practical survey for solid-state physicists, engineers, graduate students. Ferromagnetism and ferrimagnetism, magnetization and domain structure, much more. 227 figures. /div

The Encyclopedia of the Solar System, Third Edition—winner of the 2015 PROSE Award in Cosmology & Astronomy from the Association of American Publishers—provides a framework for understanding the origin and evolution of the solar system, historical discoveries, and details about planetary bodies and how they interact—with an astounding breadth of content and breathtaking visual impact. The encyclopedia includes the latest explorations and observations, hundreds of color digital images and illustrations, and over

1,000 pages. It stands alone as the definitive work in this field, and will serve as a modern messenger of scientific discovery and provide a look into the future of our solar system. New additions to the third edition reflect the latest progress and growth in the field, including past and present space missions to the terrestrial planets, the outer solar systems and space telescopes used to detect extrasolar planets. Winner of the 2015 PROSE Award in Cosmology & Astronomy from the Association of American Publishers Presents 700 full-color digital images and diagrams from current space missions and observatories, bringing to life the content and aiding in the understanding and retention of key concepts. Includes a substantial appendix containing data on planetary missions, fundamental data of relevance for planets and satellites, and a glossary, providing immediately accessible mission data for ease of use in conducting further research or for use in presentations and instruction. Contains an extensive bibliography, providing a guide for deeper studies into broader aspects of the field and serving as an excellent entry point for graduate students aiming to broaden their study of planetary science.

New edition of a classic textbook, introducing students to electricity and magnetism, featuring SI units and additional examples and problems.

Civilization's demands for electricity continue to grow, yet environmental, regulatory, and economic constraints often preclude the construction of new power plants and transmission lines. The challenge now faced by engineers, equipment manufacturers, and regulatory agencies is to find ways to maximize the capacity of existing power lines. Powerline Ampacity System is the first step in meeting that challenge. Along with developing a complete theory of transmission line ampacity, the author uses object-oriented modeling and expert rules to build a power line ampacity system. He describes new transmission line conductor technologies and power electronics FACTS devices that can take full advantage of a dynamic line rating system. He offers examples that clearly show the economic benefit of operating an interconnected transmission network that has a diverse mix of electricity generation sources. He also discusses - with examples - generator stability enhancement by dynamic line rating.

This book explores the application of external physical fields to the solidification processing of metallic alloys. Leading academics from around the world present comprehensive and critical reviews on state-of-the-art research and discuss possible future directions. Major physical fields, including electromagnetic, electric, acoustic, and thermal, are considered. In addition, the most advanced synchrotron X-ray based real-time and in-situ studies and numerical modeling methodologies are reviewed and discussed, with a special emphasis on their applications to the solidification processes. Throughout, all chapters are illustrated with both historical and very recent research cases, including typical examples of in-situ studies, modeling, and simulation. This book contains essential knowledge and information suitable for a wide audience, from undergraduate and postgraduate students to academics, practicing researchers, and engineers in materials, metallurgy, and manufacturing.

"This book by Lisa Tauxe and others is a marvelous tool for education and research in Paleomagnetism. Many students in the U.S. and around the world will welcome this publication, which was previously only available via the Internet. Professor Tauxe has performed a service for teaching and research that is utterly unique."—Neil D. Opdyke, University of Florida

This book contains the first systematic and detailed exposition of the linear theory of the stationary electron transport phenomena in semiconductors. Arbitrary isotropic and anisotropic nonparabolic bands as well as p-Ge-type bands are considered. Phonon drag effect are taken account of in an arbitrary nonquantizing magnetic field. Scattering theory is discussed in detail with account taken of the Bloch wave functions effect. Transport phenomena in the quantizing magnetic field are studied as well as the size effects in thin films. Band structures of the semiconductors and semiconductor compounds of interest are also considered. The main part of the book deals with the three important problems: charge carrier statistics in a semiconductor, classical and quantum theory of the electron transport phenomena. All the theoretical results considered as well as the validity conditions are presented in the form which may be directly used to interpret experimental data. Contents:Energy Spectrum of Charge Carriers in SemiconductorsStatistics of Charge Carriers in SemiconductorsSolution of Boltzmann Equation, Scattering MechanismsElectron Transport Phenomena in Semiconductors with Isotropic BandTransport Phenomena in Semiconductors with Anisotropic Nonparabolic Band, Anisotropic ScatteringTransport Phenomena in Quantizing Magnetic FieldsElectron Transport Phenomena in Semiconductive Films. Size-Dependent Effects Readership: Scientists, engineers dealing with semiconductors and graduates of physical and engineer-physical specialities.

keywords: