Accelerator Physics Paperback

This text provides the reader with a comprehensive understanding of the key ideas behind the physics of particle accelerators. Supported by a clear mathematical treatment and a range of calculations which develop a genuine feeling for the subject, it is a thorough introduction to the many aspects of accelerator physics.

This course-tested text is an ideal starting point for engineers and physicists entering the field of particle accelerators. The fundamentals are comprehensively introduced, derivations of essential results are provided and a consistent notation style used throughout the book allows readers to quickly familiarize themselves with the field, providing a solid theoretical basis for further studies. Emphasis is placed on the essential features of the longitudinal motion of charged particle beams, together with the corresponding RF generation and power amplification devices for synchrotron and storage ring systems. In particular, electrical engineering aspects such as closed-loop control of system components are discussed. The book also offers a valuable resource for graduate students in physics, electronics engineering, or mathematics looking for an introductory and self-contained text on accelerator physics.

This book presents the developments in accelerator physics and technology implemented at the Tevatron proton-antiproton collider, the world’s most powerful accelerator for almost twenty years prior to the completion of the Large Hadron Collider. The book covers the history of collider operation and upgrades, novel arrangements of beam optics and methods of orbit control, antiproton production and cooling, beam instabilities and feedback systems, halo collimation, and advanced beam instrumentation. The topics discussed show the complexity and breadth of the issues associated with modern hadron accelerators, while providing a systematic approach needed in the design and construction of next generation colliders. This book is a valuable resource for researchers in high energy physics and can serve as an introduction for students studying the beam physics of colliders.

A broad class of accelerators rests on the induction principle whereby the accelerating electrical fields are generated by time-varying magnetic fluxes. Particularly suitable for the transport of bright and high-intensity beams of electrons, protons or heavy ions in any geometry (linear or circular) the research and development of induction accelerators is a thriving subfield of accelerator physics. This text is the first comprehensive account of both the fundamentals and the state of the art about the modern conceptual design and implementation of such devices. Accordingly, the first part of the book is devoted to the essential features of and key technologies used for induction accelerators at a level suitable for postgraduate students and newcomers to the field. Subsequent chapters deal with more specialized and advanced topics.

This monograph presents research on the transversal beam dynamics of accelerators and evaluates and describes the respective magnetic field homogeneity. The widely used cylindrical circular multipoles have disadvantages for elliptical apertures or curved trajectories, and the book also introduces new types of advanced multipole magnets, detailing their application, as well as the numerical data and measurements obtained. The research presented here provides more precise descriptions of the field and better estimates of the beam dynamics. Moreover, the effects of field inhomogeneity can be estimated with higher precision than before. These findings are further elaborated to demonstrate their usefulness for real magnets and accelerator set ups, showing their advantages over cylindrical circular multipoles. The research findings are complemented with data obtained from the new superconducting beam guiding magnet models (SIS100) for the FAIR (Facility for Antiproton and Ion Research) project. Lastly, the book offers a comprehensive survey of error propagation in multipole measurements and an appendix with Mathematica scripts to calculate advanced magnetic coil designs.

This book takes the readers through the science behind particle accelerators, colliders and detectors: the physics principles that each stage of the development of particle accelerators helped to reveal, and the particles they helped to discover. The book culminates with a description of the Large Hadron Collider, one of the world’s largest and most complex machines operating in a 27-km circumference tunnel near Geneva. The book provides the material honestly without misrepresenting the science for the sake of excitement or glossing over difficult notions. The principles behind each type of accelerator is made accessible to the undergraduate student and even to a lay reader with cartoons, illustrations and metaphors. Simultaneously, the book also caters to different levels of reader’s background and provides additional materials for the more interested or diligent reader.

Annotation Proceedings of the September 1996 Computational Accelerator Physics Conference held in Williamsburg, Virginia, highlighting developments in electromagnetic and PIC simulation, particle tracking and beam transport, simulations for control systems, new computer techniques and environments, scripting languages and their role in building programmable application software, and high-performance computing. Specific topics include an object model for beamline descriptions, a particle beam optics interactive computer laboratory, and space charge effects with periodic focusing. No index. Annotation c. by Book News, Inc., Portland, Or.

Borne out of twentieth-century science and technology, the field of RF (radio frequency) linear accelerators has made significant contributions to basic research, energy, medicine, and national defense. As we advance into the twenty-first century, the linac field has been undergoing rapid development as the demand for its many applications, emphasizing high-energy, high-intensity, and high-brightness output beams, continues to grow. RF Linear Accelerators is a textbook that is based on a US Particle Accelerator School graduate-level course that fills the need for a single introductory source on linear accelerators. The text provides the scientific principles and up-to-date technological aspects for both electron and ion linacs. This second edition has been completely revised and expanded to include examples of modern RF linacs, special linacs and special techniques as well as superconducting linacs. In addition, problem sets at the end of each chapter supplement the material covered. The book serves as a must-have reference for professionals interested in beam physics and accelerator technology.

Edited by internationally recognized authorities in the field, this handbook focuses on Linacs, Synchrotrons and Storage Rings and is intended as a vade mecum for professional engineers and physicists engaged in these subjects. Here one will find, in addition to the common formulae of previous compilations, hard to find specialized formulae, recipes and material data pooled from the lifetime experiences of many of the world's most able practitioners of the art and science of accelerator building and operation.

This book is written for students who ever wondered about the mysterious and fascinating world of particle accelerators. What exciting physics and technologies lie within? What clever and ingenious ideas were applied in their seven decades of evolution? What promises still lay ahead in the future?Accelerators have been driving research and industrial advances for decades. This textbook illustrates the physical principles behind these incredible machines, often with intuitive pictures and simple mathematical

models. Pure formalisms are avoided as much as possible. It is hoped that the readers would enjoy the fascinating physics behind these state-of-the-art devices.The style is informal and aimed for a graduate level without prerequisite of prior knowledge in accelerators. To serve as a textbook, references are listed only on the more established original literature and review articles instead of the constantly changing research frontiers.

This book introduces some of the key ideas of RF Superconductivity by using a pedagogic approach, and presents a comprehensive overview of the field. It is divided into four parts. The first part introduces the basic concepts of microwave cavities for particle acceleration. The second part is devoted to the observed behavior of superconducting cavities. In the third part, general issues connected with beam-cavity interaction and related issues for critical components are covered. The final part discusses applications of superconducting cavities to frontier accelerators of the future, drawing heavily on examples that are in their most advanced stage. Each part of the book ends in a problems section to illustrate and amplify text material as well as to draw on example applications of superconducting cavities to existing and future accelerators. FROM THE CONTENTS: * Basics * Performance of Superconducting Cavities * Couplers and Tuners * Frontier Accelerators

This book is a brief exposition of the principles of beam physics and particle accelerators with emphasis on numerical examples employing readily available computer tools. Avoiding detailed derivations, we invite the reader to use general high-end languages such as Mathcad and Matlab, as well as specialized particle accelerator codes (e.g. MAD, WinAgile, Elegant, and others) to explore the principles presented. This approach allows the student to readily identify relevant design parameters and their scaling and easily adapt computer input files to other related situations.

This book, written by researchers who had been professionals in accelerator physics before becoming leaders of groups in astroparticle physics, introduces both fields in a balanced and elementary way, requiring only a basic knowledge of quantum mechanics on the part of the reader. The new profile of scientists in fundamental physics ideally involves the merging of knowledge in astroparticle and particle physics, but the duration of modern experiments is such that people cannot simultaneously be practitioners in both. Introduction to Particle and Astroparticle Physics is designed to bridge the gap between the fields. It can be used as a self-training book, a consultation book, or a textbook providing a “modern” approach to particles and fundamental interactions.

This BriefBook is a much extended glossary or a much condensed handbook, depending on the way one looks at it. In encyclopedic format, it covers subjects in statistics, computing, analysis, and related fields, resulting in a book that is both an introduction and a reference for scientists and engineers, especially experimental physicists dealing with data analysis.

This is an introductory text on charged particle accelerators for beginners, who have not been exposed earlier to the subject of accelerator physics. The subject has been developed from a very elementary level up to a reasonably advanced level. This book Handbook of Accelerator Physics and EngineeringWorld Scientific

This is the second book to RF Superconducting, written by one of the leading experts. The book provides fast and up-to-date access to the latest advances in the key technology for future accelerators. Experts as well as newcomers to the field will benefit from the discussion of progress in the basic science, technology as well as recent and forthcoming applications. Researchers in accelerator physics will also find much that is relevant to their discipline.

Particle Accelerator Physics covers the dynamics of relativistic particle beams, basics of particle guidance and focusing, lattice design, characteristics of beam transport systems and circular accelerators. Particle-beam optics is treated in the linear approximation including sextupoles to correct for chromatic aberrations. Perturbations to linear beam dynamics are analyzed in detail and correction measures are discussed, while basic lattice design features and building blocks leading to the design of more complicated beam transport systems and circular accelerators are studied. Characteristics of synchrotron radiation and quantum effects due to the statistical emission of photons on particle trajectories are derived and applied to determine particle-beam parameters. The discussions specifically concentrate on relativistic particle beams and the physics of beam optics in beam transport systems and circular accelerators such as synchrotrons and storage rings. This book forms a broad basis for further, more detailed studies of nonlinear beam dynamics and associated accelerator physics problems, discussed in the subsequent volume.

Scientists are continuously improving the accelerator and light source technologies to observe the secret of matter as well as the origin of nature which create new opportunities for accelerator physics research. This book provides a glance view on phase space dynamics of electron beam, motion of relativistic electrons in three-dimensional ideal undulator magnetic field, numerical simulation of electron multi-beam linear accelerator EVT, nuclear safety design of high energy accelerator facilities, and radiation safety aspects of operation of electron linear accelerators. The determination of the structure of biomolecules is presently among the best examples of the application of synchrotron radiation. This book also covers synchrotron-based X-ray diffraction study of mammalian connective tissues and related disease. Furthermore, an overview of the versatile applications of ion beam and synchrotron radiation techniques in hair elemental profiling in biomedical studies is also incorporated in this book.

Awarded one of BookAuthority's best new Particle Physics books in 2019! Hands-On Accelerator Physics Using MATLAB® provides an introduction into the design and operational issues of a wide range of particle accelerators, from ion-implanters to the Large Hadron Collider at CERN. Many aspects from the design of beam optical systems and magnets, to the subsystems for acceleration, beam diagnostics, and vacuum are covered. Beam dynamics topics ranging from the beam-beam interaction to free-electron lasers are discussed. Theoretical concepts and the design of key components are explained with the help of MATLAB® code. Practical topics, such as beam size measurements, magnet construction and measurements, and radio-frequency measurements are explored in student labs without requiring access to an accelerator. This unique approach provides a look at what goes on 'under the hood' inside modern accelerators and presents readers with the tools to perform their independent investigations on the computer or in student labs. This book will be of interest to graduate students, postgraduate researchers studying accelerator physics, as well as engineers entering the field. Features: Provides insights into both synchrotron light sources and colliders Discusses technical subsystems, including magnets, radio-frequency engineering, instrumentation and diagnostics, correction of imperfections, control, and cryogenics Accompanied by MATLAB® code, including a 3D-modeler to visualize the accelerators, and additional appendices which are available on the CRC Press website

This book provides systematic coverage of the beam-based techniques that accelerator physicists use to improve the performance of large particle accelerators, including synchrotrons and linacs. It begins by discussing the basic principles of accelerators, before exploring the various error sources in accelerators and their impact on the machine's performances. The book then demonstrates the latest developments of beam-based correction techniques that can be used to address such errors and covers the new and expanding area of beam-based optimization. This book is an ideal, accessible reference book for physicists working on accelerator design and operation, and for postgraduate studying accelerator physics. Features: Entirely self-contained, exploring the theoretic background, including algorithm descriptions, and providing application guidance Accompanied by source codes of the main algorithms and sample codes online Uses real-life accelerator problems to illustrate principles, enabling readers to apply techniques to their own problems Xiaobiao Huang is an accelerator

physicist at the SLAC National Accelerator Laboratory at Stanford University, USA. He graduated from Tsinghua University with a Bachelor of Science in Physics and a Bachelor of Engineering in Computer Science in 1999. He earned a PhD in Accelerator Physics from Indiana University, Bloomington, Indiana, USA, in 2005. He spent three years on thesis research work at Fermi National Accelerator Laboratory from 2003-2005. He has worked at SLAC as a staff scientist since 2006. He became Accelerator Physics Group Leader of the SPEAR3 Division, Accelerator Directorate in 2015. His research work in accelerator physics ranges from beam dynamics, accelerator design, and accelerator modelling and simulation to beam based measurements, accelerator control, and accelerator optimization. He has taught several courses at US Particle Accelerator School (USPAS), including Beam Based Diagnostics, Accelerator Physics, Advanced Accelerator Physics, and Special Topics in Accelerator Physics.

Research and development of high energy accelerators began in 1911. Since then, progresses achieved are:The impacts of the accelerator development are evidenced by the many ground-breaking discoveries in particle and nuclear physics, atomic and molecular physics, condensed matter physics, biology, biomedical physics, nuclear medicine, medical therapy, and industrial processing. This book is intended to be used as a graduate or senior undergraduate textbook in accelerator physics and science. It can be used as preparatory course material in graduate accelerator physics thesis research. The text covers historical accelerator development, transverse betatron motion, synchrotron motion, an introduction to linear accelerators, and synchrotron radiation phenomena in low emittance electron storage rings, introduction to special topics such as the free electron laser and the beam-beam interaction. Hamiltonian dynamics is used to understand beam manipulation, instability and nonlinearity. Each section is followed by exercises, which are designed to reinforce the concept discussed and to solve a realistic accelerator design problem.

This volume, consisting of articles written by experts with international repute and long experience, reviews the state of the art of accelerator physics and technologies and the use of accelerators in research, industry and medicine. It covers a wide range of topics, from basic problems concerning the performance of circular and linear accelerators to technical issues and related fields. Also discussed are recent achievements that are of particular interest (such as RF quadrupole acceleration, ion sources and storage rings) and new technologies (such as superconductivity for magnets and RF cavities). The book will interest not only researchers and engineers in the field of accelerator development but also users of accelerators in research and industry. Moreover, teachers giving courses on accelerators and their applications will profit by learning about the most recent achievements and future possibilities. Contents:Introduction:What Can We Learn from Experiments with Accelerators and Storage Rings (C Jarlskog)Circular Accelerators and Storage Rings:Beam Optics and Lattice Design (P J Bryant)Collective Phenomena and Instabilities (J Gareyte)The Relativistic Heavy Ion Collider, RHIC (H Foelsche et al.)Beauty- and Tau-Charm Factories (Y Baconnier)Linear Accelerators:General Aspects of Linear Accelerators (P Lapostolle)RF Quadrupoles as Accelerators (A Schempp)Accelerator Physics of the Stanford Linear Collider and SLC Accelerator Experiments Towards the Next Linear Collider (J T Seeman)The Road to TeV Electron-Positron Colliders (Y Kimura)New Methods and Technologies:Superconducting Magnets for Accelerators (G Brianti & T Tortschanoff)Superconducting Cavities for High Energy Accelerators and Storage Rings (H Lengeler)Cooling of Particle Beams (D Möhl)Acceleration of Polarized Particles (J Buon)Ion Sources (H Haseroth & H Hora)A Good Idea at the Time (B W Montague)Geodesy for Particle Acceleratos (J Gervais & M Mayoud)Applications:Synchrotron Radiation Sources (S Tazzari)The Impact of Pulsed Spallation Neutron Sources on Condensed Matter Research (J L Finney)Inertial Fusion with Heavy Ions (I Hofmann)High Energy Accelerators in Medicine (P Mandrillon)Industrial Applications of Accelerators (K H W Bethge) Readership: High energy physicists, nuclear physicists and engineers. Reviews: “… essential reading for the accelerator specialist … Bravo to the editor, Herwig Schopper, for making a success out of a timely compilation.” CERN Courier

This book by Helmut Wiedemann is a well-established, classic text, providing an in-depth and comprehensive introduction to the field of high-energy particle acceleration and beam dynamics. The present 4th edition has been significantly revised, updated and expanded. The newly conceived Part I is an elementary introduction to the subject matter for undergraduate students. Part II gathers the basic tools in preparation of a more advanced treatment, summarizing the essentials of electrostatics and electrodynamics as well as of particle dynamics in electromagnetic fields. Part III is an extensive primer in beam dynamics, followed, in Part IV, by an introduction and description of the main beam parameters and including a new chapter on beam emittance and lattice design. Part V is devoted to the treatment of perturbations in beam dynamics. Part VI then discusses the details of charged particle acceleration. Parts VII and VIII introduce the more advanced topics of coupled beam dynamics and describe very intense beams – a number of additional beam instabilities are introduced and reviewed in this new edition. Part IX is an exhaustive treatment of radiation from accelerated charges and introduces important sources of coherent radiation such as synchrotrons and free-electron lasers. The appendices at the end of the book gather useful mathematical and physical formulae, parameters and units. Solutions to many end-of-chapter problems are given. This textbook is suitable for an intensive two-semester course starting at the senior undergraduate level.

This book is written by two world-recognized experts in radio frequency (RF) systems for particle accelerators and is based on many years of experience in dealing with the multipactor phenomenon. The authors introduce and review multipactor in RF cavities for scientists and engineers working in the field of accelerator physics and technology. The multipactor phenomenon of unintended electron avalanches occurs in the RF cavities commonly and quite often is a performance-limiting factor. The book starts with an Introductory Overview which contains historical observations and brief description of most common aspects of the phenomenon. Part I deals with the multipactor in a flat gap. It starts with description of the dynamics of electrons, derivation of the stability condition and analyzing influence of several factors on the multipactor. Then, the initial considerations are extended to derive a generalized phase stability and finally a particular case, called ping-pong multipacting, is considered. The part one is concluded with a brief review of computer codes used in multipactor simulations. Part II is dedicated to the multipactor in crossed RF fields, the typical situation in accelerating cavities. Two cases of MP are considered: a two-point multipactor near the cavity equator in elliptical cavities and a one-point multipactor. Part III describes optimization of the cavity shapes geared toward designing multipactor-free structures. The book will serve as an importance reference on multipactor for those involved in developing and operating radio frequency cavities for particle accelerators.

This book adopts a non-traditional approach to accelerator theory. The exposition starts with the synchro-betatron formalism and continues with the linear and nonlinear theories of transverse betatron motion. Various methods of studying nonlinear dynamical systems (the canonical theory of perturbations and the methods of multiple scales and formal series) are explained through examples. The renormalization group approach to studying nonlinear (continuous and discrete) dynamical systems as applied to accelerators and storage rings is used throughout the book. The statistical description of charged particle beams (the Balescu?Lenard and Landau kinetic equations as well as the Vlasov equation) is dealt with in the second part of the book. The processes of pattern formation and formation of coherent structures (solitons) are also described.

The use of ion accelerators for purposes other than nuclear l physics research has expanded to the point where lother uses are now the most typical. The point has been reached where there are as many ion accelerators in industry, as in universities; and the bulk of new accelerator purchases appears to be for applied pur poses. We mention this as introduction to a tribute to an earlier book: IINew Uses of Low Energy Accelerators" (1968). The authors of tnis book were almost all nuclear physicists. This book ad dressed itself to new uses other than nuclear research. And in great part because of the widespread seminal influence of this book, many of the new uses discussed became mature fields of re search with their own conferences and publications. We have attempted in this book to both update with topics not included in the first book, and to present in a more tutorial and detailed manner the topics discussed. This book is in many ways a joint book. All chapters were the result of considerable collaboration between the authors. We hope that, above all, we have written with clarity. We welcome comments and questions from any reader. James F. Ziegler IBM-Research v CONTENTS CHAPTER 1. Ion-Excited X-Ray Analysis of Environmental Samples Thomas A. Cahill I. Introduction .....•.....

Research and development of high energy accelerators began in 1911. Since then, milestones achieved are: (1) development of high gradient dc and rf accelerators,(2) achievement of high field magnets with excellent field quality,(3) discovery of transverse and longitudinal beam focusing principles,(4) invention of high power rf sources,(5) improvement of ultra-high vacuum technology,(6) attainment of high brightness (polarized/unpolarized) electron/ionsources,(7) advancement of beam dynamics and beam manipulation schemes, such as beam injection, accumulation, slow and fast extraction, beam damping and beam cooling, instability feedback, laser-beam interaction and harvesting instability for high brilliance coherent photon source. The impacts of the accelerator development are evidenced by the many ground-breaking discoveries in particle and nuclear physics, atomic and molecular physics, condensed matter physics, biology, biomedical physics, nuclear medicine, medical therapy, and industrial processing. This book is intended to be used as a graduate or senior undergraduate textbook in accelerator physics and science. It can be used as preparatory course material in graduate accelerator physics thesis research. The text covers historical accelerator development, transverse betatron motion, synchrotron motion, an introduction to linear accelerators, and synchrotron radiation phenomena in low emittance electron storage rings, introduction to special topics such as the free electron laser and the beam-beam interaction. Attention is paid to derivation of the action-angle variables of the phase space, because the transformation is important for understanding advanced topics such as the collective instability and nonlinear beam dynamics. Each section is followed by exercises, which are designed to reinforce concepts and to solve realistic accelerator design problems. Contents:Introduction:Historical DevelopmentsLayout and Components of AcceleratorsAccelerator ApplicationsTransverse Motion:Hamiltonian for Particle Motion in AcceleratorsLinear Betatron MotionEffect of Linear Magnet ImperfectionsOff-Momentum OrbitChromatic AberrationLinear CouplingNonlinear ResonancesCollective Instability and Landau DampingSynchro-Betatron HamiltonianSynchrotron Motion:Longitudinal Equation of MotionAdiabatic Synchrotron MotionRF Phase and Voltage ModulationsNonadiabatic and Nonlinear Synchrotron MotionBeam Manipulation in Synchrotron Phase SpaceFundamentals of RF SystemsLongitudinal Collective InstabilitiesIntroduction to Linear AcceleratorsPhysics of Electron Storage Rings:Fields of a Moving Charged ParticleRadiation Damping and ExcitationEmittance in Electron Storage RingsSpecial Topics in Beam Physics:Free Electron Laser (FEL)Beam-Beam InteractionClassical Mechanics and Analysis:Hamiltonian DynamicsStochastic Beam DynamicsModel Independent AnalysisNumerical Methods and Physical Constants:Fourier TransformCauchy Theorem and the Dispersion RelationUseful Handy FormulasMaxwell's EquationsPhysical Properties and Constants Readership: Accelerator, high-energy, nuclear, plasma and applied physicists.

Particle Accelerator Physics II continues the discussion of particle accelerator physics beyond the introductory Particle Accelerator Physics I. Aimed at students and scientists who plan to work or are working in the field of accelerator physics. Basic principles of beam dynamics already discussed in Vol.I are expanded into the nonlinear regime in order to tackle fundamental problems encountered in present-day accelerator design and development. Nonlinear dynamics is discussed both for the transverse phase space to determine chromatic and geometric aberrations which limit the dynamic aperture as well as for the longitude phase space in connection with phase focusing at very small values of the momentum compaction. Effects derived theoretically are compared with observations made at existing accelerators.

From the linear accelerators used for cancer therapy in hospitals, to the giant atom smashers at international laboratories, this book provides a simple introduction to particle accelerators.

This manual provides solutions to the problems given in the second edition of the textbook entitled An Introduction to the Physics of Particle Accelerators. Simple-to-solve problems play a useful role as a first check of the student's level of knowledge whereas difficult problems will test the student's capacity of finding the bearing of the problems in an interdisciplinary environment. The solutions to several problems will require strong engagement of the student, not only in accelerator physics but also in more general physical subjects, such as the profound approach to classical mechanics (discussed in Chapter 3) and the subtleties of spin dynamics (Chapter 13).

This book, written by researchers who had been professionals in accelerator physics before becoming leaders of groups in astroparticle physics, introduces both fields in a balanced and elementary way, requiring only a basic knowledge of quantum mechanics on the part of the reader. The early history of particle physics cannot be distinguished from the history of cosmic rays. With the advent of accelerators, however, the importance of cosmic rays in particle physics was lost. This situation persisted until the 1990s, when novel techniques allowed breakthrough discoveries, and exploration of new physics scales now requires returning to cosmic rays. The new profile of scientists in fundamental physics ideally involves the merging of knowledge in astroparticle and particle physics, but the duration of modern experiments is such that people cannot simultaneously be practitioners in both. Introduction to Particle and Astroparticle Physics is designed

to bridge the gap between the fields. It can be used as a self-training book, a consultation book, or a textbook providing a “modern” approach to particles and fundamental interactions.
Beschrijving van het complexe stelsel van elementaire deeltjes en hun interacties, met theoretische achtergronden, technische hulpmiddelen en wetenschappelijke onderzoekers.
From novels and short stories to television and film, popular media has made a cottage industry of predicting the end of the world will be caused by particle accelerators. Rather than allay such fears, public pronouncements by particle scientists themselves often unwittingly fan the flames of hysteria. This book surveys media depictions of particle accelerator physics and the perceived dangers these experiments pose. In addition, it describes the role of scientists in propagating such fears and misconceptions, offering as a conclusion ways in which the scientific community could successfully allay such misplaced fears through more effective communication strategies. The book is aimed at the general reader interested in separating fact from fiction in the field of high-energy physics, at science educators and communicators, and, last but not least, at all scientists concerned about these issues. About the Author Kristine M Larsen holds a Ph.D. in Physics and is currently a professor at Central Connecticut State University, New Britain, CT, in the Geological Sciences Department. She has published a number of books, among them The Women Who Popularized Geology in the 19th Century (Springer, 2017), The Mythological Dimensions of Neil Gaiman (eds. Anthony Burdge, Jessica Burke, and Kristine Larsen. Kitsune Press, 2012. Recipient of the Gold Medal for Science Fiction/Fantasy in the 2012 Florida Publishing Association Awards), The Mythological Dimensions of Doctor Who (eds. Anthony Burdge, Jessica Burke, and Kristine Larsen. Kitsune Press, 2010), as well as Stephen Hawking: A Biography (Greenwood Press, 2005) and Cosmology 101 (Greenwood Press, (2007).
This book explains the underlying physics of synchrotron radiation and derives its main properties. It is divided into four parts. The first covers the general case of the electromagnetic fields created by an accelerated relativistic charge. The second part concentrates on the radiation emitted by a charge moving on a circular trajectory. The third looks at undulator radiation, covering plane weak undulators, strong undulators and other more general undulators. The final part deals with applications and investigates the optics of synchrotron radiation dominated by diffraction due to the small opening angle. It also includes a description of electron storage rings as radiation sources and the effect of the emitted radiation on the electron beam. This book provides a valuable reference for scientists and engineers in the field of accelerators, and all users of synchrotron radiation.
The first book that provides a single source of introductory information an all linear accelerators, including electron and ion accelerators.
This book provides a comprehensive overview of the operating principles and technology of electron lenses in supercolliders. Electron lenses are a novel instrument for high energy particle accelerators, particularly for the energy-frontier superconducting hadron colliders, including the Tevatron, RHIC, LHC and future very large hadron colliders. After reviewing the issues surrounding beam dynamics in supercolliders, the book offers an introduction to the electron lens method and its application. Further chapters describe the technology behind the electron lenses which have recently been proposed, built and employed for compensation of beam-beam effects and for collimation of high-energy high-intensity beams, for compensation of space-charge effects and several other applications in accelerators. The book will be an invaluable resource for those involved in the design, construction and operation of the next generation of hadron colliders.
This book provides an in-depth and comprehensive introduction to the field of high-energy particle acceleration and beam dynamics. This is the first modern and comprehensive textbook in the field. It begins by gathering the basic tools, recalling the essentials of electrostatics and electrodynamics as well as of particle dynamics in electromagnetic fields. It includes coverage of advanced topics of coupled beam dynamics. There is an exhaustive treatment of radiation from accelerated charges. Appendices gather useful mathematical and physical formulae, parameters and units, and solutions to the many end-of-chapter problems are given.