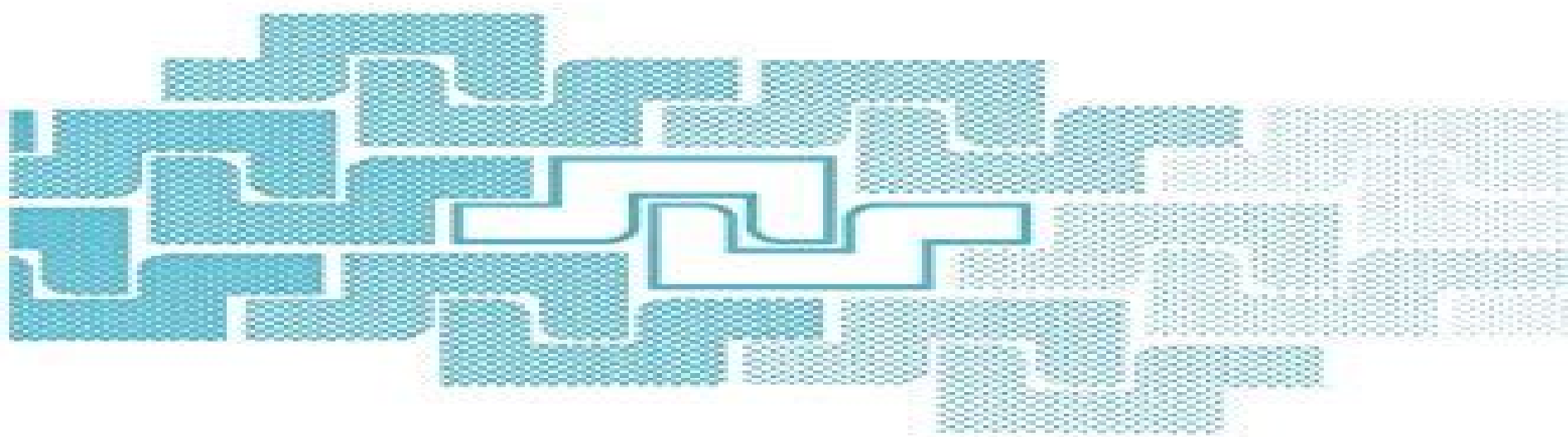




Relativistic Channeling

Edited by
**Richard A. Carrigan, Jr., and
James A. Ellison**

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Relativistic Channeling

Sultan B. Dabagov



Relativistic Channeling:

Relativistic Channeling R. A. Carrigan, James A. Ellison, 1987-09 Channeling by its nature involves a wide and disparate range of disciplines Crystal preparation material science accelerator physics sophisticated theoretical analysis and of course channeling itself all must work in concert in a research program In spite of the gulfs separating some of these activities researchers have drawn together over the last decade to carry out remarkable experiments in relativistic channeling and channeling radiation Several informal workshops on high energy channeling have been held over the years at Aarhus and Fermilab However with the vigorous progress in the field in the last several years it became clear that a more formal comprehensive workshop was needed along with a book that covered the whole spectrum of the new developments probed the future and also laid out some of the foundations of the subject This volume is the outcome of that process The organization and preparation of both the volume and the workshop owe much to several outstanding scientific committees The membership of these included J Andersen Aarhus S Baker Fermilab B Berman G Washington G Bologna Torino E Bonderup Aarhus S Datz Oak Ridge J Forster Chalk River F Fujimoto Tokyo W Gibson Albany I Mitchell Chalk River Y Ohtsuki Waseda R Pantell Stanford S Picraux Sandia J Remillieux Lyon A Saenz NRL V Schegelsky Gatchina C Sun Albany H Tiberall Catholic U E Uggerhøj CERN and R Wedell Humboldt Others from across the spectrum of scientific disciplines agreed to serve as session chairmen *Crystal Channeling and Its Application at High-Energy Accelerators* Valery M. Biryukov, Yuri A. Chesnokov, Vladilen I. Kotov, 2013-03-09 Nature performs not hing vainly and makes nothing unnecessary Aristotle Interest in the passage of charged particles through crystals first appeared at the beginning of this century following experiments on x ray diffraction in crystal lattices which provided the proof of an ordered distribution of atoms in a crystal Stark 1 put forward the hypothesis that certain directions in a crystal should be relatively transparent to charged particles These first ideas on the channeling of charged particles in crystals were forgotten but became topical again in the early 1960s when the channeling effect was rediscovered by computer simulation 2 and in experiments 3 that revealed anomalously long ion ranges in crystals The orientational effects during the passage of charged particles through crystals have been found for a whole range of processes characterized by small impact parameters for collisions between particles and atoms nuclear reactions large angle scattering energy losses Lindhard explained the channeling of charged particles in crystals 4 The results of the numerous investigations into the channeling of low energy amounting to several MeV charged particles in crystals have been summarized in several monographs and reviews 5 81 **Relativistic Nonlinear Electrodynamics** Hamlet Karo Avetissian, 2015-11-20 This revised edition of the author's classic 2006 text offers a comprehensively updated review of the field of relativistic nonlinear electrodynamics It explores the interaction of strong and super strong electromagnetic laser radiation with the electromagnetic quantum vacuum and diverse types of matter including free charged particles and antiparticles acceleration beams plasma and plasmous media The appearance of laser sources of

relativistic and ultra relativistic intensities over the last decade has stimulated investigation of a large class of processes under such super strong radiation fields Revisions for this second edition reflect these developments and the book includes new chapters on Bremsstrahlung and nonlinear absorption of superintense radiation in plasmas the nonlinear interaction of relativistic atoms with intense laser radiation nonlinear interaction of strong laser radiation with Graphene and relativistic nonlinear phenomena in solid plasma targets under supershort laser pulses of ultrarelativistic intensities The only book devoted to the subject of relativistic nonlinear electrodynamics this second edition will be a valuable resource for graduate students and researchers involved in any aspect of the field including those working with intense x ray gamma ray lasers the new generation of small size laser plasma accelerators of superhigh energies and high brightness particle beams

Laser Physics at Relativistic Intensities A.V. Borovsky,A.L. Galkin,O.B. Shiryaev,T. Auguste,2013-04-17 One of the major accomplishments of laser technology that took place during the last 15 years is the possibility of generating coherent radiation that can be focused so that its intensity reaches the magnitude of 10^{18} W/cm² Even higher intensities result from nonlinear self focusing of such radiation in matter The unique character of these magnitudes is illustrated by the fact that these intensities are substantially higher than those occurring inside the Sun A range of previously unexplored physical mechanisms come into play as laser pulses interact with matter under the conditions of an extreme concentration of laser energy In particular free electrons of plasma formed by rapid nonlinear ionization of gases and solid targets during the pulse rise time are driven by a laser radiation electric field at velocities comparable to the speed of light and the corresponding relativistic increase in their masses entails a modification of the plasma's optical properties Laser radiation intensities at which the above effect occurs are called relativistic This book is intended to provide an introduction to the field of laser physics at relativistic intensities Extensive theoretical and experimental studies have been performed in this area in the last decade At present laser physics at relativistic intensities can be considered a new and rapidly evolving area of modern physics Important basic new phenomena and concepts of applications are associated with it among them relativistic and charge displacement self channeling wake field particle acceleration generation of free electron harmonics and X rays and fast ignition

Channeling and Other Penetration Phenomena E. Uggerhoj,A. Zucker,1989

Planar Waveguides and other Confined Geometries Gerd Marowsky,2014-10-07 This book provides a comprehensive overview of the theoretical concepts and experimental applications of planar waveguides and other confined geometries such as optical fibres Covering a broad array of advanced topics it begins with a sophisticated discussion of planar waveguide theory and covers subjects including efficient production of planar waveguides materials selection nonlinear effects and applications including species analytics down to single molecule identification and thermo optical switching using planar waveguides Written by specialists in the techniques and applications covered this book will be a useful resource for advanced graduate students and researchers studying planar waveguides and optical fibers

Charged and Neutral Particles Channeling Phenomena Sultan

B. Dabagov, 2010 The book Channeling 2008 Charged and Neutral Particles Channeling Phenomena is formed by the same title conference contributions This volume includes papers by leading researchers from different world centers Their recent results on the coherent phenomena of charged and neutral particles propagating through the structures of various sizes and periodicities are included here along with historical reviews by pioneers of coherent Bremsstrahlung and channeling radiation as well as crystal channeling collimation Novel Lights Sources Beyond Free Electron Lasers Andrei Korol, Andrey V. Solov'yov, 2022-06-09 This book discusses possibilities and perspectives for designing and practical realization of novel intensive gamma ray crystal based light sources that can be constructed through exposure of oriented crystals linear bent and periodically bent to beams of ultrarelativistic positrons and electrons The book shows case studies like the tunable light sources based on periodically bent crystals that can be designed with the state of the art beam facilities A special focus is given to the analysis of generation of the gamma rays because the current technologies based on particle motion in the magnetic field become inefficient or incapable to achieve the desired gamma rays intensities It is demonstrated that the intensity of radiation from crystal based light sources can be made comparable to or even higher than what is achievable in conventional synchrotrons and undulators operating although in the much lower photon energy range By exploring the coherence effects the intensity can be boosted by orders of magnitude The practical realization of such novel light sources will lead to the significant technological breakthroughs and societal impacts similar to those created earlier by the developments of lasers synchrotrons and X rays free electron lasers Readers learn about the underlying fundamental physics and familiarize with the theoretical experimental and technological advances made during last two decades in exploring various features of investigations into crystal based light sources This research draws upon knowledge from many research fields such as material science beam physics physics of radiation solid state physics and acoustics to name but a few The authors provide a useful introduction in this emerging field to a broad readership of researchers and scientists with various backgrounds and accordingly make the book as self contained as possible **Quantum Aspects Of Beam Physics, 18th Advanced Icfa Beam Dynamics Workshop** Pisin Chen, 2002-05-24 This proceedings volume records the advances in quantum beam physics since the first meeting in Monterey 1998 In addition to further progress regarding quantum effects in beam dynamics photon electron interaction in beam handling beam phenomena under strong fields and quantum methodologies in beam physics the newly introduced topics the physics of condensed beams as well as astro beam physics and laboratory astrophysics have also been well documented by world experts in the field This book should be a valuable reference to those who are interested in the joint frontiers of beam physics and other fields such as astrophysics and condensed matter physics **Proceedings of the Fifty-first Workshop of the INFN Eloisatron Project** INFN ELOISATRON Project. Workshop, Sultan B. Dabagov, Istituto nazionale di fisica nucleare, 2010 The book Channeling 2008 Charged and Neutral Particles Channeling Phenomena is formed by the same title conference contributions This volume

includes papers by leading researchers from different world centers Their recent results on the coherent phenomena of charged and neutral particles propagating through the structures of various sizes and periodicities are included here along with historical reviews by pioneers of coherent bremsstrahlung and channeling radiation as well as crystal channeling collimation

Handbook Of Accelerator Physics And Engineering (3rd Printing) Maury Tigner, 1999-03-26 Edited by internationally recognized authorities in the field this expanded edition of the bestselling Handbook first published in 1999 is aimed at the design and operation of modern accelerators including Linacs Synchrotrons and Storage Rings It is intended as a vade mecum for professional engineers and physicists engaged in these subjects With a collection of 2200 equations 345 illustrations and 185 tables 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 experience of many of the world's most able practitioners of the art and science of accelerators The eight chapters include both theoretical and practical matters as well as an extensive glossary of accelerator types Chapters on beam dynamics and electromagnetic and nuclear interactions deals with linear and nonlinear single particle and collective effects including spin motion beam environment beam beam and intrabeam interactions The impedance concept and calculations are dealt with at length as are the instabilities associated with the various interactions mentioned A chapter on operational considerations deals with orbit error assessment and correction Chapters on mechanical and electrical considerations present material data and important aspects of component design including heat transfer and refrigeration Hardware systems for particle sources feedback systems confinement and acceleration both normal conducting and superconducting receive detailed treatment in a subsystems chapter beam measurement techniques and apparatus being treated therein as well The closing chapter gives data and methods for radiation protection computations as well as much data on radiation damage to various materials and devices A detailed index is provided together with reliable references to the literature where the most detailed information available on all subjects treated can be found

Energy Research Abstracts, 1993 *Electron-Photon Interaction in Dense Media* Helmut Wiedemann, 2012-12-06 A comprehensive survey of recent theoretical and experimental progress in the area of electron photon interaction and dense media A state of the art discussion of radiation production with descriptions of new ideas and technologies that enhance the production of X rays in the form of channelling transition and parametric X ray production Progress in electron beam physics to produce sub picosecond electron bunches from low energy linear accelerators make it possible to produce coherent high brightness submillimeter radiation and sub picosecond X ray pulses Micro undulators in the form of bent crystalline structures hold great promise as future X ray sources

Advanced Radiation Sources and Applications Helmut Wiedemann, 2006-01-14 A NATO Advanced Research Workshop on Advanced Radiation Sources and Applications was held from August 29 to September 2 2004 Hosted by the Yerevan Physics Institute Yerevan Armenia 30 invited researchers from former Soviet Union and NATO countries gathered at Nor Hamberd Yerevan on

the slopes of Mount Aragats to discuss recent theoretical as well as experimental developments on means of producing photons from mostly low energy electrons This meeting became possible through the generous funding provided by the NATO Science Committee and the programme director Dr Fausto Pedrazzini in the NATO Scientific and Environmental Affairs Division The workshop rectors were Robert Avakian Yerevan Physics Institute Armenia and Helmut Wiedemann Stanford USA Robert Avakian provided staff logistics and frastructure from the Yerevan Physics institute to assure a smooth execution of the workshop Special thanks goes to Mrs Ivetta Keropyan for administrative and logistics support to foreign visitors The workshop was held at the institute s resort in Nor Hamberd on the slopes of Mount Aragats not far from the Yerevan cosmic ray station The isolation and peaceful setting of the resort provided the background for a fruitful week of presentations and discussions Following our invitations 38 researchers in this eld came to the workshop from Armenia Belarus Romania Russia Ukraine Denmark France G many and the USA Commuting from Yerevan local scientists joined the daily presentations Over a ve day period 40 presentations were given Radiation and Solid State Physics, Nuclear and High Energy Physics, Mathematical Physics Pier P Delsanto, Albert W Saenz, 1998-05-06 The first of two volumes presenting an overview of the important research areas in which Professor H berall has done his life s work and constitutes a festschrift for this distinguished physicist Each chapter is intended to serve as a bridge between advanced textbooks and the most recent research literature thereby providing a valuable reference for active researchers as well as for graduate students

Non-accelerator Astroparticle Physics - Proceedings Of The 7th School Giorgio Giacomelli, Nello Paver, Richard A Carrigan Jr, 2005-05-03 This comprehensive volume of articles from the seventh school on non accelerator astroparticle physics presents a timely coverage of this interesting and rapidly expanding subject The contributions enlarge and complement the earlier volumes prepared for the fourth fifth and sixth schools An informative pedagogical approach has been maintained so that the book can serve as the basis for a modern course on the subject The first section introduces the fundamentals of particle physics with a review of the standard model and beyond The comprehensive section on neutrino physics and astrophysics covers neutrino masses and oscillations short and long baseline neutrino experiments atmospheric and solar neutrinos and neutrino telescopes The section on dark matter includes a theoretical presentation and a review of existing and potential dark matter searches Searches for axions magnetic monopoles and nuclearites are also discussed Cosmic rays and astrophysics are covered with reviews on experiments in space extreme energy cosmic rays and photons and antimatter in space The theory of gravitational waves and searches for gravitational waves are considered A section deals with the LEP legacy and future accelerators and superbeams Large scale facilities detectors data acquisition and large scale computing are reviewed The volume concludes with an in depth look at the impact of science on the world with essays looking back on the past century of scientific progress and its effects on society Interaction of Charged Particles with Solids and Surfaces Alberto Gras-Martí, Herbert M. Urbassek, Nestor R. Arista, Fernando Flores, 2012-12-06 Early in 1989

while most of us were gathered in the Mediterranean five centuries old city of Alacant the idea of a school on stopping and particle penetration phenomena came to our minds Later that year when discussing this plan with some of the participants in the 13th International Conference on Atomic Collisions in Solids in Aarhus we were pleased to note that the proposal was warmly welcomed indeed by the community An Advanced Study Institute on this or a related subject had not been organized in the last decade Because of the progress made particularly in the interaction of high energy beams with matter and the many applications which the general subject of the stopping of charged particles ions and electrons in matter enjoys a Study Institute appeared a worthy enterprise Even though several international conference series cover developments in these areas they miss tutorial introductions to the field The title chosen was Interaction of Charged Particles with Solids and Surfaces and the objectives were stated as follows to cover theory and experiments including selected applications and hot topics of the stopping of charged particles ions and electrons in matter The emphasis will be on outlining the areas where further effort is needed and on specifying the basic needs in applications Fundamental concepts will prevail over applications and the character of the Institute as a school will be stressed The school was directed by Fernando Flores Spain Herbert M Urbassek Germany Nestor R [High Energy Physics Index](#) ,1991 **Quantum Aspects Of Beam Physics - Advanced Icf Beam Dynamics Workshop** Pisin Chen,1999-04-19 The frontiers of beam research point to increasingly high energy greater brightness and lower emittance beams with ever increasing particle species These demands in turn have triggered a rapidly growing number of beam phenomena that involve quantum effects Concurrently the violent accelerations which are becoming available through novel accelerator research may perhaps help to investigate fundamental physics associated with general relativity In view of these exciting developments and the important role they may play in the next century the world's first conference on the Quantum Aspects of Beam Physics held at Monterey California in January 1998 attracted a broad spectrum of experts from beam physics particle physics laser science astrophysics condensed matter physics nuclear and atomic physics At the end of the meeting a new term quantum beam physics was coined This book collects together the excellent reviews and papers on new advances in the field which were presented during the workshop It should be a valuable reference to all physicists interested in the frontiers of quantum beam physics **Dynamics of Systems on the Nanoscale** Ilia A. Solov'yov,Alexey V. Verkhovtsev,Andrei V. Korol,Andrey V. Solov'yov,2022-06-03 This book presents the structure formation and dynamics of animate and inanimate matter on the nanometre scale This is a new interdisciplinary field known as Meso Bio Nano MBN science that lies at the intersection of physics chemistry biology and material science Special attention in the book is devoted to investigations of the structure properties and dynamics of complex MBN systems by means of photonic electronic heavy particle and atomic collisions This includes problems of fusion and fission fragmentation surfaces and interfaces reactivity nanoscale phase and morphological transitions irradiation driven transformations of complex molecular systems collective electron excitations radiation damage and biodamage channeling phenomena and

many more Emphasis in the book is placed on the theoretical and computational physics research advances in these areas and related state of the art experiments Particular attention in the book is devoted to the utilization of advanced computational techniques and high performance computing in studies of the dynamics of systems

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