High Power Laser Interactions Isotopes Separation Nuclear Fusion Control Elementary Particles Sele

The topics covered in the October 1993 Workshop are, as in the previous workshops, high-power and high-intensity laser generation and laser light interaction with matter; new fields opening up in laser-produced high-densit plasma research; unique new applications for such plasmas; and inertial confi

Lasers and Nuclei describes the generation of high-energy-particle radiation with high-intensity lasers and its application to nuclear science. A basic introduction to laser--matter interaction at high fields is complemented by detailed presentations of state of the art laser particle acceleration and elementary laser nuclear experiments. The text also discusses future applications of lasers in nuclear science, for example in nuclear astrophysics, isotope generation, nuclear fuel physics and proton and neutron imaging.

As was the case in the two preceding workshops of 1969 and 1971, the Third Workshop on "Laser Interaction and Related Plasma Phenomena" held in 1973 was of international character. The main purpose was to review the advanced status of this particular and turbulent field of physics as it had developed vigorously in all major laboratories of the world since 1971. Due to recently accelerated advancements, it was hardly possible to present a com plete tutorial review; the subject is still in its premature stages and changing rapidly. A topical conference would have been too specific for a group of physicists with broad backgrounds working in the field or for those just about to enter it. It was the aim of the workshop and it is the aim of these proceedings to help this large group of scientists find their way within the highly complex and sometimes confusing results of a new field. We optimized the task of the workshop with extensive reviews on several topics and at the same time included more detailed infor mation for specialists. The differences in their conclusions were not a matter of contention but rather served to complement the advanced results. As in the preceding workshops, we directed our attention toward critical realism in respect to the complexity of the field. What is meant here is exemplified in the contribution by R. Sigel ~.667).

INIS Atomindeks

Laser Interaction and Related Plasma Phenomena

Lasers and Nuclei

Selected Papers on Laser Isotope Separation

High-power Lasers in Energy Engineering

& Quot;This book explains the fundamental principles of high power laser interactions. & quot. & quot;Beginning with an introduction to the basics of laser technology, it moves on to describe selective photonic action. This advanced process will significantly reduce the energy required for the production of enriched uranium. & quot. & quot;High power laser interactions is a promising new technology which will almost certainly lead to an improved control of thermonuclear fusion. It should also pave the way for a more secure and environmentally friendly means of energy production. & quot. & quot;High power laser interactions will also encourage dramatic new developments of the processes used in the discovery of the elementary particles which make up the universe. & quot. & quot;This book originates from the author's own research which has widely contributed to advances in this area of physics by the use of high power laser interactions. It will prove valuable to university professors, engineers, and both graduate and undergraduate students, as well as to science journalists and industrialists. & quot;--BOOK JACKET.

Conference Location and Date: Frascati (Rome), Italy, 24-29 May 2009

Recently, precision laser spectroscopy on 6He atoms determined accurately the isotope shift between 4He and 6He and, consequently, the charge radius of 6He. A similar experiment for 8He is under way. We have performed large-scale ab initio calculations for {sup 4,6,8}He isotopes using high-precision nucleon-nucleon (NN) interactions within the no-core shell model (NCSM) approach. With the CD-Bonn 2000 NN potential we found point-proton root-mean-square (rms) radii of 4He and 6He 1.45(1) fm and 1.89(4), respectively, in agreement with experiment and predict the 8He point proton rms radius to be 1.88(6) fm. At the same time, our calculations show that the recently developed nonlocal INOY NN potential gives binding energies closer to experiment, but underestimates the charge radii.

Concepts and Techniques

1-4 November 1999, Osaka, Japan

Atomic and Molecular Spectroscopy
Perspectives in Heavy Ion Physics
2nd Japan-Italy Joint Symposium '95 : RIKEN, Japan, May 22-26, 1995

Atomic and Molecular Spectroscopy is a wide-ranging review of modern spectroscopic techniques such as X-ray, photoelectron, optical and laser spectroscopy, and radiofrequency and microwave techniques. On the fundamental side it focuses on physical principles and the impact of spectroscopy on our understanding of the building blocks of matter, while in the area of applications particular attention is given to those in chemical analysis, photochemistry, surface characterisation, environmental and medical diagnostics, remote sensing and astrophyscis. The Fourth Edition also provides the reader with an update on laser cooling and trapping, Bose-Einstein condensation, ultra-fast spectroscopy, high-power laser/matter interaction, satellite-based astronomy and spectroscopic aspects of laser medicine. Important references are&also brought up to date.

High Power Laser InteractionsIsotopes Separation, Nuclear Fusion Control, Elementary Particles Selective CreationLavoisier

Rare Isotope Beams (RIBs) are ion beams of exotic radioactive nuclei. The study of these nuclei is key to understanding the limits of nuclear existence, nucleo-synthesis in such violent stellar sites as supernovae and merging neutron stars, and the fundamental symmetries of nature. These nuclei also provide a unique probe to study condensed matter and many of them are potentially new radioisotopes for more effective medical diagnostics and therapy. Rare Isotope Beams: Concepts and Techniques gives an up-to-date overview of all these aspects of RIB science in a single volume containing the scientific motivation, production techniques, experimental techniques for studying exotic nuclei, methods used in condensed matter research, and medical applications. The emphasis throughout is on concepts to facilitate understanding of the essence of each topic in this diverse and cross-disciplinary field involving nuclear physics, astrophysics, and particle accelerators. A brief description of major RIB facilities is also presented. Exotic nuclei are difficult to produce in enough numbers and their production involves different nuclear reaction routes and a wide range of advanced technologies, which are presented in a comprehensive manner. Experimental techniques used to study exotic nuclei are provided with examples highlighting the intricate nature of such experiments. Another unique feature is the open-ended nature of the discussions, bringing out the future challenges and possibilities in this evolving field. The book offers an excellent overview of concepts and techniques involved in RIB science for new researchers entering the field as well as professionals.

Laser Isotope Separation in Atomic Vapor

Physics Of High Power Laser Matter Interactions - Proceedings Of The Japan-us Seminar

Dictionary of Material Science and High Energy Physics

Physikalische Berichte

Ion Acceleration from the Interaction of Ultra-intense Lasers with Solid Foils

More than 3,000 terms with clear, working definitions, alternative meanings, and related references comprise this uniquely focused lexicon. Published in a convenient, paperback format, it covers chemical, energy, nuclear, plasma, condensed matter, and solid-state physics, fluid dynamics, quantum mechanics, quantum optics, thermodynamics, and materials science.

The discovery that ultra-intense laser pulses (I> 10{sup 18} W/cm{sup 2}) can produce short pulse, high energy proton beams has renewed interest in the fundamental mechanisms that govern particle acceleration from laser-solid interactions. Experiments have shown that protons present as hydrocarbon contaminants on laser targets can be accelerated up to energies> 50 MeV. Different theoretical models that explain the observed results have been proposed. One model describes a front-surface acceleration mechanism based on the ponderomotive potential of the laser pulse. At high intensities (I> 10{sup 18} W/cm{sup 2}), the quiver energy of an electron oscillating in the electric field of the laser pulse exceeds the electron rest mass, requiring the consideration of relativistic effects. The relativistically correct ponderomotive potential is given by U{sub p} = ([1 + I{lambda}{sup 2}/1.3 x 10{sup 18}]{sup 1/2} - 1) m{sub o}c{sup 2}, where I{lambda}{sup 2} is the irradiance in W {micro}m{sup 2}/cm{sup 2} and m{sub o}c{sup 2} is the electron rest mass. At laser irradiance of I{lambda}{sup 2} {approx} 10{sup 20} W {micro}m{sup 2}/cm{sup 2}, the ponderomotive potential can be of order several MeV. A few recent experiments--discussed in Chapter 3 of this thesis--consider this ponderomotive potential sufficiently strong to accelerate protons from the front surface of the target to energies up to tens of MeV. Another model, known as Target Normal Sheath Acceleration (TNSA), describes the mechanism as an electrostatic sheath on the back surface of the laser target. According to the TNSA model, relativistic hot electrons created at the laser-solid interaction penetrate the foil where a few escape to infinity. The remaining hot electrons are retained by the target potential and establish an electrostatic sheath on the back surface of the target. In this thesis we present several experiments that study the accelerated ions by affecting the contamination layer from which they originate. Radiative heating was employed as a method of removing contamination from palladium targets doped with deuterium. We present evidence that ions heavier than protons can be accelerated if hydrogenous contaminants that cover the laser target can be removed. We show that deuterons can be accelerated from the deuterated-palladium target, which has been radiatively heated to remove contaminants. Impinging a

deuteron beam onto a tritiated-titanium catcher could lead to the development of a table-top source of short-pulse, 14-MeV fusion neutrons. We also show that by using an argon-ion sputter gun, contaminants from one side of the laser target can be selectively removed without affecting the other side. We show that irradiating a thin metallic foil with an ultra-intense laser pulse produces a proton beam with a yield of 1.5-2.5 10{sup 11} and temperature, kT = 1.5 MeV with a maximum proton energy> 9 MeV. Removing contaminants from the front surface of the laser target with an argon-ion sputter gun, had no observable effect on the proton beam. However, removing contaminants from the back surface of the laser target reduced the proton beam by two orders of magnitude to, at most, a yield of {approx} 10{sup 9} and a maximum proton energy 4 MeV. Based on these observations, we conclude that the majority (99%) of high energy protons (E> 5 MeV) from the interaction of an ultra-intense laser pulse with a thin foil originate on the back surface of the foil--as predicted by the TNSA model. Our experimental results are in agreement with PIC simulations showing back surface protons reach energies up to 13 MeV, while front surface protons reach a maximum energy of 4 MeV. Well diagnosed and controllable proton beams will have many applications: neutron radiography, material damage studies, production of medical isotopes, and as a high-resolution radiography tool for diagnosing opaque materials and plasmas. Well collimated and focusable ion beams may also prove beneficial for alternative inertial-fusion concepts such as proton fast ignition, a potentially viable method for achieving a controlled fusion reaction in the laboratory earlier than expected.

The Optical Society of America Conference on Applications of High Fields and Short Wavelength Sources, held in Santa Fe, New Mexico, USA, from March 20-22, 1997, was an exceptionally exciting conference. This conference was the seventh in a series of topical con ferences, held every two years, which are devoted to the generation and application of high field and short wavelength sources. The meeting was truly international in scope, with equal participation from both within and outside of the US. In the past two years, there has been dramatic progress in both laser and x-ray coher ent sources, both fundamental and applied. The 1997 meeting highlighted these advances, which are summarized in sections 1 and 2 of this volume. Terawatt-class lasers are now avail able in the UV or at high repetition rates. Michael Perry (LLNL) presented a keynote talk on petawatt class lasers and their applications in inertial confinement fusion, while Jorge Rocca (Colorado State University) presented a keynote talk on tabletop soft-x-ray lasers. Genera tion and measurement techniques are becoming very sophisticated throughout the UV and x ray region of the spectrum, and coherent sources have been extended to wavelengths below 30A. Phase control in the x-ray region is also now possible, and new phase-matching schemes in the UV have been experimentally demonstrated. It is clear that a new field of x-ray nonlin ear optics will deveiop rapidly over the next few years.

Isotopes in Condensed Matter

Applications of High-Field and Short Wavelength Sources

Rare Isotope Beams

Science and Technology

Soviet Physics, Uspekhi

SPIE Milestones are collections of seminal papers from the world literature covering important discoveries and developments in optics and photonics.

Order the Set Medical Physics and save almost 25€. Medical Physics covers the applied branch of physics concerned with the application of concepts and methods of physics to diagnostics and therapeutics of human diseases. This second volume in a series of two complements the imaging modalities presented in the first volume by those methods, which use ionizing radiation. The first chapters in part A on Radiography provide a solid background on radiation sources, interaction of radiation with matter, and dosimetry for the safe handling of radiation before introducing x-ray radiography, scintigraphy, SPECT and PET. The second part B on Radiotherapy starts from basic information on the life cycle of cells, radiation response of healthy and tumorous cells. In subsequent chapters the main methods of radiation treatment are presented, in particular x-ray radiotherapy, proton and neutron radiation therapy, and brachytherapy. The last part C, Diagnostics and Therapeutics beyond Radiology, covers laser applications, multifunctional nanoparticles and prosthetics. The present volume introduces the physical background on ionizing radiation, the biological effectiveness of radiation, as well as radiation based methods for diagnostics and therapeutics. covers the second part of the entire field of medical physics, including imaging methods with the use of ionizing radiation; radiation therapy with photons, protons, and neutrons; laser methods, nanomedicine and prosthetics. provides an introduction for Bachelor students to the main concepts of Medical Physics during their fi rst semesters guiding them to further specialized and advanced literature. contains many questions & answers related to the content of each chapter. is also available as a set together with Volume 1. Contents Part A: Radiography X-ray generation Nuclei and isotopes Interaction of radiation with matter Radiation detection and protection X-ray radiography Scintigraphy Positron emission tomography Part B: Radiotherapy Cell cycle and cancer X-ray radiotherapy Charged particle radiotherapy Neutron radiotherapy Brachytherapy Part C: Diagnostics and therapeutics beyond radiology Laser applications in medicine Nanoparticles for nanomedical applications Prosthetics

Laser isotope separation (LIS) is an emerging technology that uses relatively small, widely-available lasers to achieve civilian or weapons grade concentration of fissile material to fuel nuclear reactions. To date

only a few, limited proliferation risk analyses of LIS technology have been conducted. This paper provides a historically and technically informed update on the current state of LIS technology and it explains the high likelihood of increased global LIS adoption. The paper also explains how international rules governing nuclear energy are ill-equipped to handle such new technology. It traces the current limitations to broader issues in international relations theory, especially the incomplete accounts of the role of technology in the proliferation dynamic in the dominant neorealism and social construction of technology approaches. The paper introduces the concept of "international technology development structure," a framework for understanding how technology-related opportunities and constraints at the international system-level influence state nuclear weapons choices. The paper provides a thorough update of recent international laser innovations relevant to laser isotope separation and it explains how the spread of laser-related knowledge expands state nuclear options and influences their choices. The paper also provides a country-by-country update on LIS programs and it uses the example of Iran's laser isotope separation program to show how existing International Atomic Energy Agency efforts and export control approaches will be inadequate to addressing dual-use technologies such as LIS. It concludes by proposing a new course that links good standing in nuclear non-proliferation agreements to participation in the World Trade Organization, global conferences, and fundamental university research. Ultimately, the paper attempts to provide a comprehensive account of how emerging laser isotope separation technology presents non-proliferation challenges and it attempts to explore options for addressing this new period in technological achievement and change.

Applications of Ultrahigh Intensity Lasers in Nuclear Science

Bibliography of Mass Spectroscopy Literature for 1971

Interaction of Hydrogen Isotopes with Transition Metals and Intermetallic Compounds

Physics Briefs

Studying the interactions between heavy hydrogen isotopes and hydride forming metals or intermetallic compounds (IMC) is of importance for both fundamental and applied sciences. These systems offer, for example, the possibility of technical hydrogen isotope separation due to their considerable isotope effects. In addition, quite a lot of problems of hydrogen recovery, hydrogen purification, and tritium storage can be solved. This review deals with theoretical aspects of the interaction of heavy hydrogen isotopes with metals and IMC, and contains detailed information on phase and isotopic equilibrium and of the kinetics of isotope exchange in systems with hydride phases. Numerical data and results from theoretical and experimental studies are presented as well.

This thesis describes the application of the collinear resonance laser spectroscopy to sensitively measure the electromagnetic nuclear observables of the neutron-rich indium isotopes 115-131In. This entailed a systematic study of the efficiency of resonant ionization schemes to extract the hyperfine structure of the isotopes, the atomic charge exchange process and benchmarking of modern atomic calculations with a laser ablation ion source. This allowed determination of the root-mean-square nuclear charge radii, nuclear magnetic dipole moments, nuclear electric quadrupole moments and nuclear spins of the 113-131In isotopes with high accuracy. With a proton hole in the Z = 50 nuclear shell closure of tin and several nuclear isomer states, these measurements of the indium (Z = 49) isotope chain provided an efficient probe of the evolution of nuclear structure properties towards and at the doubly-magic nuclear shell closure of 132Sn (N = 82) - revealing unpredicted changes.

The theory of operator algebras is generally considered over the field of complex numbers and in the complex Hilbert spaces. So it is a natural and interesting problem: How is the theory in the field of real numbers? Up to now, the theory of operator algebras over the field of real numbers has seemed not to be introduced systematically and sufficiently.The aim of this book is to set up the fundamentals of real operator algebras and to give a systematic discussion for real operator algebras. Since the treatment is from the beginning (real Banach and Hilbert spaces, real Banach algebras, real Banach $*$ algebras, real C$*$-algebras and W$*$-algebras, etc.), and some basic facts are given, one can get some results on real operator algebras easily.The book is also an introduction to real operator algebras, written in a self-contained manner. The reader needs just a general knowledge of Banach algebras and operator algebras.

ERDA Energy Research Abstracts

INIS Atomindex

Nuclear Science Abstracts

The 2nd International Conference on Ultra-Intense Laser Interaction Science

Radiology, Lasers, Nanoparticles and Prosthetics

Written by leading Russian scientists, including Nobel laureate, A.M. Prokhorov (1916-2002), this first book on this important technology allows an understanding of the physics of atomic vapor laser isotope separation and new photochemical methods of laser isotope separation. One entire chapter is devoted to chemical reactions of atoms in excited states, while further chapters deal with the separation of isotopes by one photon isotope-selective and coherent isotope-selective two photon excitation of atoms. A final chapter looks at the prospects for the industrial production of isotope products by laser isotope separation. The whole is rounded off by six appendices.

Experimental Quantum Chemistry is a comprehensive account of experimental quantum chemistry and covers topics ranging from basic quantum theory to atoms and ions, photons, electrons, and positrons. Nuclei, molecules, and free radicals are also discussed. This volume is comprised of eight chapters and begins with an overview of the basic experiments and id

leading to the development of quantum theory, with special emphasis on the problems of chemistry. The main properties of electromagnetic radiation are then considered, along with the important relations of electrons and positrons in chemistry; the quantum theory of isolated atoms and ions; the structure of nuclei and the main applications to organic chemistry; and the chemical structure and reactivity of molecules. The theoretical and experimental aspects of interpreting free radical structures on the basis of the molecular orbital and valence bond theo are also explored. The final chapter is devoted to the chemistry of the organic solid state, paying particular attention to the structure and molecular mobilities of organic solids, collective crystal states (excitons, phonons, and polaritons), energy transfer processes, and reactions in the solid state. This book should be of interest to physicists and organic chemists.

This book provides a concise introduction to the newly created sub-discipline of solid state physics isotopetronics. The role of isotopes in materials and their properties are describe in this book. The problem of the enigma of the atomic mass in microphysics is briefly discussed. The range of the applications of isotopes is wide: from biochemical process in living organisms t modern technical applications in quantum information. Isotopetronics promises to improve nanoelectronic and optoelectronic devices. With numerous illustrations this book is useful to researchers, engineers and graduate students.

Power Lasers and Their Applications

Isotopes Separation, Nuclear Fusion Control, Elementary Particles Selective Creation

Compiled by a Computer Method

Laser Science and Applications

Summaries of Papers Presented at the Quantum Electronics and Laser Science Conference

Abstracts taken from 1994 conference in Geochronology, Cosmochronology and Isotope Geology. Abstracts are organized alphabetically by first author and were printed as recieved from the author-prepared copy. The Author index is comprehensive and includes all authors.

Semiannual, with semiannual and annual indexes. References to all scientific and technical literature coming from DOE, its laboratories, energy centers, and contractors. Includes all works deriving from DOE, other related government-sponsored information, and foreign nonnuclear information. Arranged under 39 categories, e.g., Biomedical sciences, basic studies; Biomedical sciences, applied studies; Health and safety; and Fusion energy. Entry gives bibliographical information and abstract. Corporate, author, subject, report number indexes.

Collinear Resonance Ionization Spectroscopy of Neutron-Rich Indium Isotopes

Los Alamos Science

Experimental Quantum chemistry

Chemical Society Reviews

Volume 3B