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Atoms, Solids, and Plasmas in Super-Intense Laser Fields

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Atoms Solids And Plasmas In Super Intense Laser Fields

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Atoms Solids And Plasmas In Super Intense Laser Fields:

Atoms, Solids, and Plasmas in Super-Intense Laser Fields Dimitri Batani, 2001-09-30 Proceedings of the 30th Course of the International School of Quantum Electronics on Atoms Solids and Plasmas in Super Intense Laser Fields held 8-14 July in Erice Sicily

Atoms, Solids, and Plasmas in Super-Intense Laser Fields Dimitri Batani, Charles J. Joachain, S. Martellucci, Arthur N. Chester, 2012-12-06 The recent development of high power lasers delivering femtosecond pulses of 2×10^{22} intensities up to 10 W cm^{-2} has led to the discovery of new phenomena in laser interactions with matter. At these enormous laser intensities atoms and molecules are exposed to extreme conditions and new phenomena occur such as the very rapid multi-photon ionization of atomic systems, the emission by these systems of very high order harmonics of the exciting laser light, the Coulomb explosion of molecules and the acceleration of electrons close to the velocity of light. These phenomena generate new behaviour of bulk matter in intense laser fields with great potential for wide ranging applications which include the study of ultra fast processes, the development of high frequency lasers and the investigation of the properties of plasmas and condensed matter under extreme conditions of temperature and pressure. In particular the concept of the fast ignitor approach to inertial confinement fusion (ICF) has been proposed which is based on the separation of the compression and the ignition phases in laser driven ICF. The aim of this course on Atom Solids and Plasmas in Super Intense Laser fields was to bring together senior researchers and students in atomic and molecular physics, laser physics, condensed matter and plasma physics in order to review recent developments in high intensity laser-matter interactions. The course was held at the Ettore Majorana International Centre for Scientific Culture in Erice from July 8 to July 14 2000.

Atoms in Intense Laser Fields C. J. Joachain, N. J. Kylstra, R. M. Potvliege, 2012 A unified account of the rapidly developing field of high intensity laser-atom interactions suitable for both graduate students and researchers

Laser Interactions with Atoms, Solids and Plasmas Richard M. More, 2013-11-21 The aim of this NATO Advanced Study Institute was to bring together scientists and students working in the field of laser-matter interactions in order to review and stimulate development of fundamental science with ultra short pulse lasers. New techniques of pulse compression and colliding pulse mode locking have made possible the construction of lasers with pulse lengths in the femtosecond range. Such lasers are now in operation at several research laboratories in Europe and the United States. These laser facilities present a new and exciting research direction with both pure and applied science components. In this ASI the emphasis is on fundamental processes occurring in the interaction of short laser pulses with atoms, molecules, solids and plasmas. In the case of laser-atom-molecule interactions, high power lasers provide the first access to extreme high intensity conditions above $10^{18} \text{ W cm}^{-2}$ a new frontier for nonlinear interaction of photons with atoms and molecules. New phenomena observed include multiphoton ionization processes, atomic collisions in the presence of a strong laser field, Coulomb explosion following rapid ionization of a molecule and the production of high harmonics of the laser source. Another important topic reviewed in this ASI is the laser cooling of atoms.

Relativistically

Intense Laser-Microplasma Interactions Tobias Ostermayr, 2019-07-16 This dissertation covers several important aspects of relativistically intense laser microplasma interactions and some potential applications A Paul trap based target system was developed to provide fully isolated well defined and well positioned micro sphere targets for experiments with focused petawatt laser pulses The laser interaction turned such targets into microplasmas emitting proton beams with kinetic energies exceeding 10 MeV The proton beam kinetic energy spectrum and spatial distribution were tuned by variation of the acceleration mechanism reaching from broadly distributed spectra in relatively cold plasma expansions to spectra with relative energy spread as small as 20% in spherical multi species Coulomb explosions and in directed acceleration processes Numerical simulations and analytical calculations support these experimental findings and show how microplasmas may be used to engineer laser driven proton sources In a second effort tungsten micro needle targets were used at a petawatt laser to produce few keV x rays and 10 MeV level proton beams simultaneously both measured to have only few micrometer effective source size This source was used to demonstrate single shot simultaneous radiographic imaging with x rays and protons of biological and technological samples Finally the dissertation discusses future perspectives and directions for laser microplasma interactions including non spherical target shapes as well as thoughts on experimental techniques and advanced quantitative image evaluation for the laser driven radiography *Progress in Ultrafast Intense Laser Science I* See Leang Chin, Pierre Agostini, Gaetano Ferrante, 2006-10-03 This is the first of a series of books on Ultrafast Intense Laser Science a newly emerging interdisciplinary research field that spans atomic and molecular physics molecular science and optical science It covers intense VUV laser cluster interaction resonance and chaos assisted tunneling and the effects of the carrier envelope phase on high order harmonic generation *Progress in Ultrafast Intense Laser Science III* See Leang Chin, Pierre Agostini, Gaetano Ferrante, 2008-01-23 The PUILS series presents Progress in Ultrafast Intense Laser Science This third volume in the series covers a diverse range of disciplines focusing on such topics as strong field ionization of atoms ionization and fragmentation of molecules and clusters generation of high order harmonics and attosecond pulses filamentation and laser plasma interaction and the development of ultrashort and ultrahigh intensity light sources *Laser Pulse Phenomena and Applications* F. J. Duarte, 2010-12-30 Pulsed lasers are available in the gas liquid and the solid state These lasers are also enormously versatile in their output characteristics yielding emission from very large energy pulses to very high peak power pulses Pulsed lasers are equally versatile in their spectral characteristics This volume includes an impressive array of current research on pulsed laser phenomena and applications Laser Pulse Phenomena and Applications covers a wide range of topics from laser powered orbital launchers and laser rocket engines to laser matter interactions detector and sensor laser technology laser ablation and biological applications **Advances in Solid State Lasers** Mikhail Grishin, 2010-02-01 Invention of the solid state laser has initiated the beginning of the laser era Performance of solid state lasers improved amazingly during five decades Nowadays solid state lasers remain one of the most rapidly developing branches of laser

science and become an increasingly important tool for modern technology This book represents a selection of chapters exhibiting various investigation directions in the field of solid state lasers and the cutting edge of related applications The materials are contributed by leading researchers and each chapter represents a comprehensive study reflecting advances in modern laser physics Considered topics are intended to meet the needs of both specialists in laser system design and those who use laser techniques in fundamental science and applied research This book is the result of efforts of experts from different countries I would like to acknowledge the authors for their contribution to the book I also wish to acknowledge Vedran Kordic for indispensable technical assistance in the book preparation and publishing Laser-Plasma Interactions Dino A. Jaroszynski, R.A. Bingham, R.A Cairns, 2009-03-27 A Solid Compendium of Advanced Diagnostic and Simulation Tools Exploring the most exciting and topical areas in this field Laser Plasma Interactions focuses on the interaction of intense laser radiation with plasma After discussing the basic theory of the interaction of intense electromagnetic radiation fields with matter the book covers three ap

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