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Fusion combines quite

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instabilities, radiative energy transfer as well as fusion reactions.

Particular attention is given to simple and useful modelling, including dimensional analysis and similarity solutions.

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Particular attention is given to simple and useful modelling, including dimensional analysis and similarity

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amounts (micrograms)  
of fuel to thousand  
times solid density and  
pressures otherwise  
existing only in the  
centre of stars.

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illustrated reference that

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of the physics

underlying inertial

confinement fusion



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## Fusion: Beam Plasma Interaction ...

The next part of the book is mostly devoted to the underlying physics involved in inertial fusion, and covers hydrodynamics, hydrodynamic stability, radiative transport and equations-of-state of hot dense matter, laser and ion beam interaction with plasma. It

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discusses different approaches to inertial fusion (direct-drive by laser, indirect-drive by laser or ion beams), including recent developments in fast ignition.

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The Physics of Inertial Fusion: Beam Plasma

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Interaction,  
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Physics of Inertial

Fusion.: Stefano

Atzeni, Jürgen Meyer-  
ter-Vehn. OUP Oxford,

Jun 3, 2004 - Science...

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Tutorial on the Physics  
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Fusion for energy  
applications R. Betti  
University of Rochester  
and Princeton Plasma

Physics Laboratory 3rd  
Meeting of the NAS  
panel on Inertial Fusion  
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Albuquerque, NM,

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Tutorial on the Physics  
of Inertial Confinement

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## Fusion

Inertial confinement fusion (ICF) is a type of fusion energy research that attempts to initiate nuclear fusion reactions by heating and compressing a fuel target, typically in the form of a pellet that most often contains a mixture of deuterium and tritium. Typical fuel pellets are about the size



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of a pinhead and contain  
around 10 milligrams of  
fuel.

Inertial confinement

fusion - Wikipedia

The Magnetized Liner  
Inertial Fusion

(MagLIF) experimental  
platform [M. R. Gomez  
et al., Phys. Rev. Lett.  
113, 155003 (2014)]

represents the most  
successful

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demonstration of  
magneto-inertial fusion  
(MIF) techniques to date  
in pursuit of ignition  
and significant fusion  
yields.

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European R&D  
roadmap for an inertial

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The Physics of Inertial Fusion  
Fusion - Paperback -  
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This book provides an excellent description of the necessary physics of inertial fusion.

However, it is not for beginners. A solid understanding of hydrodynamics, thermodynamics, and statistical mechanics

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is required in order to understand several chapters. The necessary nuclear physics is described in the first chapter.

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A fusor is a device that uses an electric field to heat ions to nuclear fusion conditions. The

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machine induces a voltage between two metal cages, inside a vacuum. Positive ions fall down this voltage drop, building up speed. If they collide in the center, they can fuse.

This is one kind of an inertial electrostatic confinement device – a branch of fusion research.

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Fusor - Wikipedia

The Inertial Fusion  
Technology (IFT)  
division supports the  
DOE National Nuclear  
Security  
Administration's  
research in Inertial  
Confinement Fusion  
(ICF) and high-energy-  
density physics.

Inertial Fusion | General

Atomics

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The origination of the inertial confinement fusion (ICF) program from nuclear weapons research and the important differences between laboratory ICF and weapons use of fusion are described, including the need for compression in laboratory ICF and the importance of drive symmetry and the



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avoidance of preheat.

The direct-drive and indirect-drive (hohlraum) approaches to laboratory ICF are differentiated.

Inertial Fusion I

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Fusion is the rate of fusion energy produced by the plasma Number density is the density in particles per unit

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volume of the respective fuels (or just one fuel, in some cases) Cross section is a measure of the probability of a fusion event, which is based on the plasma temperature Energy per reaction is the energy released in each fusion reaction

Lawson criterion -

Wikipedia

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Abstract While major progress has been made in the research of inertial confinement fusion, significant challenges remain in the pursuit of ignition. To tackle the challenges, we propose a double-cone ignition (DCI) scheme, in which two head-on gold cones are used to confine deuterium-tritium (DT)

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shells imploded by high-power laser pulses.

Beam Plasma

Interaction

This book is on inertial confinement fusion, an alternative way to produce electrical power from hydrogen fuel by using powerful lasers or particle beams. It involves the compression of tiny

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amounts (micrograms) of fuel to thousand times solid density and pressures otherwise existing only in the centre of stars. Thanks to advances in laser technology, it is now possible to produce such extreme states of matter in the laboratory. Recent developments have boosted laser intensities again with new

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possibilities for laser particle accelerators, laser nuclear physics, and fast ignition of fusion targets. This is a reference book for those working on beam plasma physics, be it in the context of fundamental research or applications to fusion energy or novel ultra-bright laser sources. The book combines quite

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different areas of physics: beam target interaction, dense plasmas, hydrodynamic implosion and instabilities, radiative energy transfer as well as fusion reactions.

Particular attention is given to simple and useful modelling, including dimensional analysis and similarity solutions. Both authors

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have worked in this field for more than 20 years. They want to address in particular those teaching this topic to students and all those interested in understanding the technical basis.

This book is on fusion energy, burning hydrogen which is available from water. It



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is the energy source of the sun. It produces neither greenhouse gases leading to global warming nor long-lived nuclear waste. Here we describe how to use powerful lasers to ignite the hydrogen fuel. There are presently two large laser facilities under construction to demonstrate that this method works. This

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book is about the physics of this future energy source and addresses people who work on it or want to understand its technical basis.

This book is on fusion energy, burning hydrogen which is available from water. It is the energy source of the sun. It produces

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neither greenhouse gases leading to global warming nor long-lived nuclear waste. Here we describe how to use powerful lasers to ignite the hydrogen fuel. There are presently two large laser facilities under construction to demonstrate that this method works. This book is about the physics of this future

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energy source and addresses people who work on it or want to understand its technical basis.

Newcomers to the field of inertial confinement fusion (ICF) often have difficulty establishing a clear picture of the overall field. The reason for this is because, while there are many books

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devoted to special topics within the field, there is none that provides an overview of the field as a whole. An

Introduction to Inertial Confinement Fusion fi

In the fall of 2010, the Office of the U.S. Department of Energy's (DOE's) Secretary for Science asked for a National Research

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Council (NRC)

committee to investigate  
the prospects for

generating power using  
inertial confinement

fusion (ICF) concepts,  
acknowledging that a

key test of viability for  
this concept-ignition

-could be demonstrated  
at the National Ignition

Facility (NIF) at

Lawrence Livermore

National Laboratory

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(LLNL) in the relatively near term. The committee was asked to provide an unclassified report. However, DOE indicated that to fully assess this topic, the committee's deliberations would have to be informed by the results of some classified experiments and information, particularly in the area

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of ICF targets and nonproliferation. Thus, the Panel on the Assessment of Inertial Confinement Fusion Targets ("the panel") was assembled, composed of experts able to access the needed information. The panel was charged with advising the Committee on the Prospects for Inertial Confinement



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Fusion Energy Systems

on these issues, both by  
internal discussion and  
by this unclassified

report. A Panel on

Fusion Target Physics  
("the panel") will serve  
as a technical resource

to the Committee on

Inertial Confinement  
Energy Systems ("the  
Committee") and will

prepare a report that  
describes the R&D

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challenges to providing suitable targets, on the basis of parameters established and

provided to the Panel by the Committee. The Panel on Fusion Target Physics will prepare a report that will assess the current performance of fusion targets associated with various ICF concepts in order to understand: 1. The

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spectrum output; 2. The illumination geometry; 3. The high-gain geometry; and 4. The robustness of the target design. The panel addressed the potential impacts of the use and development of current concepts for Inertial Fusion Energy on the proliferation of nuclear weapons information and technology, as

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appropriate. The Panel examined technology options, but does not provide

recommendations

specific to any currently operating or proposed ICF facility.

This book provides readers with an introductory

understanding of Inertial Electrostatic

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Confinement (IEC), a type of fusion meant to retain plasma using an electrostatic field. IEC provides a unique approach for plasma confinement, as it offers a number of spin-off applications, such as a small neutron source for Neutron Activity Analysis (NAA), that all work towards creating fusion power. The IEC

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has been identified in recent times as an ideal fusion power unit because of its ability to burn aneutronic fuels like p-B11 as a result of its non-Maxwellian plasma dominated by beam-like ions. This type of fusion also takes place in a simple mechanical structure small in size, which also contributes to its

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viability as a source of power. This book posits that the ability to study the physics of IEC in very small volume plasmas makes it possible to rapidly investigate a design to create a power-producing device on a much larger scale.

Along with this hypothesis the book also includes a conceptual

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experiment proposed for demonstrating breakeven conditions for using p-B11 in a hydrogen plasma simulation. This book also: Offers an in-depth look, from introductory basics to experimental simulation, of Inertial Electrostatic Confinement, an emerging method for generating fusion power



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Discusses how the Inertial Electrostatic Confinement method can be applied to other applications besides fusion through theoretical experiments in the text Details the study of the physics of Inertial Electrostatic Confinement in small-volume plasmas and suggests that their rapid reproduction could lead

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to the creation of a large-scale power-producing device Perfect for researchers and students

working with nuclear

fusion, Inertial

Electrostatic

Confinement (IEC)

Fusion: Fundamentals

and Applications also

offers the current

experimental status of

IEC research, details

supporting theories in

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the field and introduces other potential applications that stem from IEC.

Interaction

Nuclear Fusion by Inertial Confinement provides a

comprehensive analysis of directly driven inertial confinement fusion. All important aspects of the process are covered, including

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scientific considerations that support the concept, lasers and particle beams as drivers, target fabrication, analytical and numerical hydrodynamics calculations, and materials and engineering considerations. Authors from Australia, Germany, Italy, Japan, Russia, Spain, and the U.S. have contributed to

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the volume, making it an internationally significant work for all scientists working in the Inertial Confinement Fusion (ICF) field, as well as for graduate students in engineering and physics with interest in ICF.

The potential for using fusion energy to produce commercial

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electric power was first explored in the 1950s. Harnessing fusion energy offers the prospect of a nearly carbon-free energy source with a virtually unlimited supply of fuel. Unlike nuclear fission plants, appropriately designed fusion power plants would not produce the large amounts of high-level

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nuclear waste that requires long-term disposal. Due to these prospects, many nations have initiated research and development (R&D) programs aimed at developing fusion as an energy source. Two R&D approaches are being explored:

magnetic fusion energy (MFE) and inertial fusion energy (IFE). An

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Assessment of the Prospects for Inertial Fusion Energy describes and assesses the current status of IFE research in the United States; compares the various technical approaches to IFE; and identifies the scientific and engineering challenges associated with developing inertial confinement fusion



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(ICF) in particular as an energy source. It also provides guidance on an R&D roadmap at the conceptual level for a national program focusing on the design and construction of an inertial fusion energy demonstration plant.

The raw numbers of high-energy-density physics are amazing:

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Physics of  
shock waves at  
hundreds of km/s  
(approaching a million  
km per hour),  
temperatures of millions  
of degrees, and  
pressures that exceed  
100 million  
atmospheres. This title  
surveys the production  
of high-energy-density  
conditions, the  
fundamental plasma and  
hydrodynamic models

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that can describe them

and the problem of

scaling from the

laboratory to the

cosmos. Connections to

astrophysics are

discussed throughout.

The book is intended to

support coursework in

high-energy-density

physics, to meet the

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researchers in this field,

and also to serve as a

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useful reference on the fundamentals.

Specifically the book has been designed to enable academics in physics, astrophysics, applied physics and engineering departments to provide in a single-course, an introduction to fluid mechanics and radiative transfer, with dramatic applications in the field of high-energy-

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density systems. This second edition includes pedagogic improvements to the presentation throughout and additional material on equations of state, heat waves, and ionization fronts, as well as problem sets accompanied by solutions.

This book takes a

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holistic approach to  
plasma physics and  
controlled fusion via  
Inertial Confinement  
Fusion (ICF)

techniques, establishing  
a new standard for clean  
nuclear power

generation. Inertial  
Confinement Fusion  
techniques to enable

laser-driven fusion have  
long been confined to  
the black-box of

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government  
classification due to  
related research on  
thermonuclear weapons  
applications. This book  
is therefore the first of  
its kind to explain the  
physics, mathematics  
and methods behind the  
implosion of the Nd-  
Glass tiny balloon  
(pellet), using reliable  
and thoroughly  
referenced data sources.

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The associated computer code and numerical analysis are included in the book. No prior knowledge of Laser Driven Fusion and no more than basic background in plasma physics is required.

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