New Ideas In Tokamak Confinement

Physicists around the world celebrated the year 2005 as The World Year of Physics 2005, honoring the achievements in physics research of Albert Einstein. This booklet is dedicated to the World Year of Physics. In this booklet I refute the claims that Mileva Marich Einstein played an important scientific role in his research. Mileva Marich Einstein is of a Serb origin, as am I. I am a naturalized American of a Serb origin.I based this presentation on the available material.

The purpose of this assessment of the fusion energy sciences program of the Department of Energy's (DOE's) Office of Science is to evaluate the quality of the research program and to provide guidance for the future program strategy aimed at strengthening the research component of the program. The committee focused its review of the fusion program on magnetic confinement, or magnetic fusion energy (MFE), and touched only briefly on inertial fusion energy (IFE), because MFE-relevant research accounts for roughly 95 percent of the funding in the Office of Science's fusion program. Unless otherwise noted, all references to fusion in this report should be assumed to refer to magnetic fusion. Fusion research carried out in the United States under the sponsorship of the Office of Fusion Energy Sciences (OFES) has made remarkable strides over the years and recently passed several important milestones. For example, weakly burning plasmas with temperatures greatly exceeding those on the surface of the Sun have been created and diagnosed. Significant progress has been made in understanding and controlling instabilities and turbulence in plasma fusion experiments, thereby facilitating improved plasma confinement-remotely controlling turbulence in a 100-million-degree medium is a premier scientific achievement by any measure. Theory and modeling are now able to provide useful insights into instabilities and to guide experiments. Experiments and associated diagnostics are now able to extract enough information about the processes occurring in high-temperature plasmas to guide further developments in theory and modeling. Many of the major experimental and theoretical tools that have been developed are now converging to produce a qualitative change in the program's approach to scientific discovery. The U.S. program has traditionally been an important source of innovation and discovery for the international fusion energy effort. The goal of understanding at a fundamental level the physical processes governing observed plasma behavior has been a distinguishing feature of the program.

In this monograph the author presents the Canonical Profile Transport Model or CPTM as a rather general mathematical framework to simulate plasma discharges. The description of hot plasmas in a magnetic fusion device is a very challenging task and many plasma properties still lack a physical explanation. One important property is plasma self-organization. It is very well known from experiments that the radial profile of the plasma pressure and temperature remains rather unaffected by changes of the deposited power or plasma density. The attractiveness of the CPTM is that it includes the effect of self-organization in the mathematical model without having to recur to particular physical mechanisms. The CPTM model contains one dimensional transport equations for ion and electron temperatures, plasma density and toroidal rotation velocity. These equations are well established and in fact are essentially a reformulation the laws of energy, particle and momentum conservation. But the expressions for the energy and particle fluxes, including certain critical gradients, are new. These critical gradients can be determined using the concept of canonical profiles for the first time formulated in great detail in the book. This concept represents a totally new approach to the description of transport in plasmas. Mathematically, the canonical profiles are

formulated as a variational problem. To describe the temporal evolution of the plasma profiles, the Euler equation defining the canonical profiles is solved together with the transport equations at each time step. The author shows that in this way it is possible to describe very different operational scenarios in tokamaks (L-Mode, H-Mode, Advanced Modes, Radiating Improved Modes etc...), using one unique principle. The author illustrates the application of this principle to the simulation of plasmas on leading tokamak devices in the world (JET, MAST, T-10, DIII-D, ASDEX-U, JT-60U). In all cases the small differences between the calculated profiles for the ion and electron temperatures and the experimental is rather confirm the validity of the CPTM. In addition, the model also describes the temperature and density pedestals in the H-mode and non steady-state regimes with current and density ramp up. The proposed model therefore provides a very useful mathematical tool for the analysis of experimental results and for the prediction of plasma parameters in future experiments.

The Framework Of Plasma Physics

Hearings Before the Subcommittee on Energy of the Committee on Science, Space, and Technology, U.S. House of Representatives, One Hundred Third Congress, Second Session, April 21; August 2, 1994

Status and Direction : Hearings Before the Subcommittee on Investigations and Oversight of the Committee on Science, Space, and Technology, U.S. House of Representatives, One Hundred First Congress, First Session, October 3, 4, 5, 26, 1989

Chaotic Dynamics and Transport in Fluids and Plasmas

An Assessment of the Department of Energy's Office of Fusion Energy Sciences Program

Essays in Honor of Victor Frederick Weisskopf by the International Community of Physicists

Market: Scientists and students involved in thermonuclear fusion research. Thermonuclear fusion research using the confinement device tokamak represents one of the most prominent science projects in the second half of the 20th century. International Tokamak Community is now committing significant effort and funds to experiments with burning plasma, hot and dense enough to produce significant nuclear fusion reactions. The methods used to enhance tokamak performance have a profound and immediate effect on machine design. This book provides an up-to-date account of research in tokamak fusion and puts forward innovative ideas in confinement physics.

Market: Researchers in plasma physics and astrophysics. This informative work contains the papers of the International Topical Conference on Research Trends in Nonlinear Space Plasma Physics, held in February 1991. Leading figures in the field met to discuss subjects including chaotic phenomena in space plasma, ionospheric and alfven waves, plasma instabilities and turbulence, and collisionless shock waves.

The Mountain Wreath is the anathema upon the Ottomanization of some small areas of Montenegro. Njegosh dedicates the Mountain Wreath to the dust of the Father of Serbia, Karageorge Petrovich. The Mountain Wreath is the epic about the glory of the Cross of the Serbs in Montenegro. In the 19th century, Alfred Lord Tennyson, (1809—1892), referred to Montenegrins as the mighty race of the mountaineers—the defenders of Christian faith. Njegosh, our great and beloved Prince-Bishop of Montenegro was a wise judge of his time, but Time itself is

the ultimate judge. Today there are some small areas in Montenegro populated by the Slavic Muslims who love their Montenegro and build it in a brotherly unity together with other Montenegrins.

Future Energy Conferences and Symposia

THUS SPOKE EINSTEIN on LIFE and LIVING

Energy and Water Development Appropriations for 1987: Department of Energy

Applications of Laser-Plasma Interactions

Energy and Water Development Appropriations for 1986

An Introduction to Plasma Science, 2nd Edition

TO THE SECOND EDITION In the nine years since this book was first written, rapid progress has been made scientifically in nuclear fusion, space physics, and nonlinear plasma theory. At the same time, the energy shortage on the one hand and the exploration of Jupiter and Saturn on the other have increased the national awareness of the important applications of plasma physics to energy production and to the understanding of our space environment. In magnetic confinement fusion, this period has seen the attainment 13 of a Lawson number nTE of 2 x 10 cm -3 sec in the Alcator tokamaks at MIT; neutral-beam heating of the PL T tokamak at Princeton to KTi = 6. 5 keV; increase of average ß to 3%-5% in tokamaks at Oak Ridge and General Atomic; and the stabilization of mirror-confined plasmas at Livermore, together with injection of ion current to near field-reversal conditions in the 2XIIß device. Invention of the tandem mirror has given magnetic confinement a new and exciting dimension. New ideas have emerged, such as the compact torus, surface-field devices, and the EßT mirror-torus hybrid, and some old ideas, such as the stellarator and the reversed-field pinch, have been revived. Radiofrequency heat ing has become a new star with its promise of dc current drive. Perhaps most importantly, great progress has been made in the understanding of the MHD behavior of toroidal plasmas: tearing modes, magnetic Vll Vlll islands, and disruptions.

Fusion research started over half a century ago. Although the task remains unfinished, the end of the road could be in sight if society makes the right decisions. Nuclear Fusion: Half a Century of Magnetic Confinement Fusion Research is a careful, scholarly account of the course of fusion energy research over the past fifty years. The authors outline the different paths followed by fusion research from initial ignorance to present understanding. They explore why a particular scheme would not work and why it was more profitable to concentrate on the mainstream tokamak development. The book features descriptive sections, in-depth explanations of certain physical and technical issues, scientific terms, and an extensive glossary that explains relevant abbreviations and acronyms.

EINSTEIN'S REVOLUTIONARY WISDOM (Seven Last Days in the Life of Albert Einstein) A Novel

The Fourth State of Matter

The EINSTEIN-STEFAN ENCOUNTERS:Time Hopping Travel—Transcending the Barriers of Time

Self-Organization of Hot Plasmas

Scientific and Technical Aerospace Reports

Nuclear Fusion

Nonlinear Space Plasma Physics

THUS SPOKE EINSTEIN on LIFE and LIVING Wisdom of Albert Einstein in the Context Selected, Edited, and Commented by V. Alexander STEFAN

Institute for Advanced Physics Studies Stefan University

this part is supported by two useful appendices on some of the mathematical tools used and the physical units of plasma physics. State-space models, state observers, H control, and process simulations are some of the familiar techniques used by ? the authors to meet the demanding spatial control specifications for these processes; however, the research reported in the monograph is more that just simulation studies and proposals for possible future hypothetical controllers, for the authors have worked with some of the world's leading existing tokamak facilities. Chapter 5, 8, and 9 respectively, give practical results of implementations of their control schemes on the FTU Tokamak (Italy), the TCV Tokamak (Switzerland), and the JET Tokamak (United Kingdom). Additionally, the authors present simulation results of their ideas for the control of the new tokamak proposed for the ITER project. In conclusion, being very aware that most control engineers will not be conversant with the complexities of tokamak nuclear fusion reactor control, the authors have taken special care to give a useful introduction to the background of nuclear fusion, the science of plasma physics and appropriate models in the first part of the monograph (Chapters 1 to 3). This introduction is followed by six chapters (4 to 9) of control studies. In Chapter 4, the generic control problem is established and then five case study chapters follow.

"The essays in this book are by some of the world's leading physicists, including seven Nobel Prize winners. The essays address topics ranging from Weisskopf's contributions to theoretical physics to more intimate views of his role as a teacher, friend, and humanist."--BOOK JACKET.

Hearings Before the Subcommittee of the Committee on Appropriations, United States Senate, Ninety-ninth Congress, Second Session

Fusion Technology 1990

Department of Energy Authorization for Fiscal Years 1982, 1983, and 1984

Energy and Water Development Appropriations for 1982

Fusion Nucléaire. □I□Adernyĭ Sintez. Fusión Nuclear

Congressional Budget Request

The aim of the biennial series of symposia on Fusion Technology, organized by the European Fusion Laboratories, is the exchange of information on the design, construction and operation of fusion experiments. The coverage of the volume includes the technology aspects of fusion reactors to provide a link to the technology of new developments and form a guideline for the definition of future work. These proceedings comprise two volumes and contain both the invited lectures and contributed papers presented at the Symposium, which was attended by 556 participants from around the globe. The 312 papers in this volume, including 17 invited papers, give a broad and current overview of the progress and trends fusion technology is experiencing now, and the future for fusion devices.

In Against the Tide: An Autobiographical Account of a Professional Outsider, Leslie Woods relates the fascinating story of his life from fisherman's son in New Zealand to head of the Mathematical Institute at the University of Oxford. After starting at a trade school, he won a scholarship to a university, then joined the RNZAF, and later became a fighter pilot in the Pacific. Woods then won a Rhodes scholarship to Merton College in Oxford after WWII. Following several years of research in aerodynamics, he became a professor of engineering at the University of New South Wales. He also had a fellowship with Oxford's Balliol College and had a consultancy at Culham Laboratory where he researched the theory of

magnetically confined hot plasmas. In 1970, Woods became a professor of plasma theory yet became disillusioned with the fusion energy project, which he believes survived on exaggerated claims of progress. Besides recounting his history, Woods explains why magnetic fusion has failed to succeed and outlines the philosophy of science to which he subscribes. He writes frankly about both his successes and failures and finishes with an account of his taking up gliding at the age of 74.

Plasma physics may hold the key to a virtually inexhaustible future energy source through the control of thermonuclear reactions. The complexity of plasma physics makes it a difficult subject to write about in popular terms, but the authors of The Fourth State of Matter: An Introduction to Plasma Science, Second Edition treat plasma in a comprehens

EINSTEIN'S REVOLUTIONARY WISDOM (Seven Last Days in the Life of Albert Einstein) A Novel

Energy and Water Development Appropriations for 1983

Stefan University Press Series on Thus Spoke Einstein; ISSN: 1550-4115

Fusion Policy

Against the Tide

Volume 1: Plasma Physics

The World Year of Physics 2005 honors the achievements in physics research of Albert Einstein, the worldwide known sad— eyed genius. In 1905 Albert Einstein had completed his doctoral thesis and published 4 physics papers, including his "Special Relativity paper." The world of physics, and the world, in general, has been since changed forever. As the human race is stepping into the 3rd Millennium of the Common Era, the influence of Albert Einstein is ever stronger—the works of Einstein still play the major role in the further development of physics, and science and technology.

Stefan University Press Series on Thus Spoke Einstein; ISSN: 1550-4115 Einstein's opinions on science, art, and society. Time-Hopping Travel—Transcending the Barriers of Time The imaginary conversations (encounters) between Albert Einstein and Vladislav Alexander Stefan. The topics discussed include, among others, the Nature of She-Time, the Time-Travel-Modes, the Human-Immortality-Codes, and the World Government, as found in Stefan's Faustef Trilogy, SURSORSAR (Secret Pure Wisdom), and the Open World Manifesto.

This book provides an excellent introduction to the fundamental physics of plasmas, which comprise most of the matter in the universe. It is based on lectures that were used for an introductory plasma course at the graduate level.

Half a Century of Magnetic Confinement Fusion Research

Albert Einstein: The Son-in-law of the Serbs (the Yugoslavs)

Hearings Before a Subcommittee of the Committee on Appropriations, House of Representatives, Ninety-ninth Congress, First Session

Magnetic Control of Tokamak Plasmas

Hearings Before the Subcommittee on Energy Research and Development of the Committee on Science, Space, and Technology, House of Representatives, One Hundredth Congress, Second Session

Albert Einstein: The Son-in-law of the Serbs (the Yugoslavs)

Market: Students and researchers in chaos, plasma physics, and fluid transport. This superb collection of invited papers offers an excellent overview of the current status and future trends in chaotic dynamics, plasma and fluid physics, nonlinear phenomena and chaos, and transport and turbulence studies.

Recent advances in the development of lasers with more energy, power, and brightness have opened up new possibilities for exciting applications. Applications

of Laser-Plasma Interactions reviews the current status of high power laser applications. The book first explores the science and technology behind the ignition and burn of imploded fusion fue

The Department of Energy's Restructured Fusion Energy Sciences Program

An Autobiographical Account of a Professional Outsider

The Canonical Profile Transport Model

Hearings Before a Subcommittee of the Committee on Appropriations, House of Representatives, Ninety-seventh Congress, First Session

Energy Research Abstracts

Albert and Mileva Einstein, World Year of Physics 2005, and More