<<等离子体物理学和受控聚变>>

图书基本信息

书名：<<等离子体物理学和受控聚变>>

13位ISBN编号：9787510005725

10位ISBN编号：7510005728

出版时间：2010-4

出版时间：世界图书出版公司

作者：陈

页数：421

前言

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]upiter 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 of a Lawson number nTE of 2×1013 cm-3 sec in the A!cator tokamaks at MIT; neutral-beam heating of the PLT tokamak at Princeton to KTi=6.5 keV; increase of average 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 2XIIB 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 EBT 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 islands, and disruptions. Concurrently, the problems of reactor design,fusion technology, and fission-fusion hybrids have received serious atten-tion for the first time. Inertial confinement fusion has grown from infancy to a research effort one-fourth as large as magnetic fusion. With the 25-TW Shiva laser at Livermore, 3lear neutrons have been produced in a single pellet implosion, and fuel compressions to one hundred times liquid hydrogen density have been achieved. The nonlinear plasma processes involved in the coupling of laser radiation to matter have received meticulous attention, and the important phenomena of resonance absorption, stimulated Brillouin and Raman scattering, and spontaneous magnetic field generation are well on the way to being understood. Particle drivers-electron beams, light-ion beams, and heavy-ion beams——have emerged as potential alternates to lasers, and these have brought their own set of plasma problems. In space plasma physics, the concept of a magnetosphere has become well developed, as evidenced by the prediction and observation of whistler waves in the Jovian magnetosphere. The structure of the solar corona and its relation to sunspot magnetic fields and solar wind generation have become well understood, and the theoretical description of how the aurora borealis arises appears to be in good shape. Because of the broadening interest in fusion, Chapter 9 of the first edition has been expanded into a comprehensive text on the physics of fusion and will be published as Volume 2. The material originated from my lecture notes for a graduate course on magnetic fusion but has been simplified by replacing long mathematical calculations with short ones based on a physical picture of what the plasma is doing. It is this task which delayed the completion of the second edition by about three years. Volume 1, which incorporates the first eight chapters of the first edition, retains its original simplicity but has been corrected and expanded. A number of subtle errors pointed out by students and professors have been rectified. In response to their requests, the system of units has been changed, reluctantly, to inks (Sl). To physicists of my own generation, my apologies; but take comfort in the thought that the first edition has become a collector's item. The dielectric tensor for cold plasmas has now been included; it was placed in Appendix B to avoid complicating an already long and difficult chapter for the beginner, but it is there for ready reference.The chapter on kinetic theory has been expanded to indude ion Landau damping of acoustic waves, the plasma dispersion function, and Bern-stein waves. The chapter on nonlinear effects now incorporates a treat-ment of solitons via the Korteweg-deVries and nonlinear Schrodinger equations. This section contains more detail than the rest of Volume 1,but purposely so, to whet the appetite of the advanced student. Helpful hints from G. Morales and K. Nishikawa are hereby acknowledged. For the benefit of teachers, new problems from a decade of exams have been added, and the solutions to the old problems are given. A sample three-hour final exam for undergraduates will be found in Appendix C. The problem answers have been checked by David Brower;any errors are his, not mine. Finally, in regard to my cryptic dedication, I have good news and bad news. The bad news is that the poet (my father) has moved on to the land of eternal song. The good news is that the eternal scholar (my mother) has finally achieved her goal, a Ph.D. at 72. The educational process is unending. Francis F. Chen Los Angeles, 1983

内容概要

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 of a Lawson number nTE of 2×1013 cm-3 sec in the A!cator tokamaks at MIT; neutral-beam heating of the PLT tokamak at Princeton to KTi=6.5 keV; increase of average 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 2XIIB 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 EBT 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 islands, and disruptions. Concurrently, the problems of reactor design, fusion technology, and fission-fusion hybrids have received serious attention for the first time.

作者简介

作者：（美国）陈（Francis F. Chen）

书籍目录

章节摘录

插图：What makes plasmas particularly difficult to analyze is the fact that the densities fall in an intermediate range. Fluids like water are so dense that the motions of individual molecules do not have to be considered. Collisions dominate, and the simple equations of ordinary fluid dynamics suffice. At the other extreme in very low-density devices like the alternating-gradient synchrotron, only single-particle trajectories need be considered; collective effects are often unimportant. Plasmas behave sometimes like fluids, and sometimes like a collection of individual particles. The first step in learning how to deal with this schizophrenic personality is to understand how single particles behave in electric and magnetic fields. This chapter differs from succeeding ones in that the E and B fields are assumed to be Prescribed and not affected by the charged particles.

编辑推荐

《等离子体物理学和受控聚变:第1卷(第2版)》是由世界图书出版公司出版的。

<<等离子体物理学和受控聚变>>