Introduction to Plasma Physics is the standard text for an introductory lecture course on plasma physics. The text’s six sections lead readers systematically and comprehensively through the fundamentals of modern plasma physics. Sections on single-particle motion, plasmas as fluids, and collisional processes in plasmas lay the groundwork for a thorough understanding of the subject. The authors take care to place the material in its historical context for a rich understanding of the ideas presented. They also emphasize the importance of medical imaging in radiotherapy, providing a logical link to more advanced works in the area. The text includes problems, tables, and illustrations as well as a thorough index and a complete list of references.

An Introduction to Plasma Physics and Its Space Applications, Volume 1

A historic snapshot of the field of plasma physics, this fifty-year-old volume offers an edited collection of papers by pioneering experts in the field. In addition to assisting students in their understanding of the foundations of classical plasma physics, it provides a source of historic context for modern physicists. Highly successful upon its initial publication, this book was the standard text on plasma physics throughout the 1960s and '70s. Hailed by Science magazine as a "well executed venture," the three-part treatment ranges from basic plasma theory to magnetohydrodynamics and microwave plasma physics. Highlights include Klimontovich's article on quantum plasmas, Buneman's writings on how to distinguish between attenuating and amplifying waves, and Yoler's clear and cogent review of magnetohydrodynamics. Professional atomic and plasma physicists and all students of plasma physics will appreciate this historic resource.

Basic Data of Plasma Physics

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 of a Lawson number $nT_e$ of $2 \times 10^13$ cm$^{-3}$ sec in the Alcator tokamaks at MIT; neutral-beam heating of the PL T tokamak at Princeton to $K_Ti = 6.5$ keV; increase of average $\beta$ 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 heating 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 VII VIII islands, and disruptions.

**Plasma Physics**

Advanced undergraduate/beginning graduate text on space and laboratory plasma physics.

**Theory of Low-Temperature Plasma Physics**

The book describes a statistical approach to the basics of plasma physics.

**Introduction to Plasma Theory**

This book offers the reader an overview of the basic approaches to the theoretical description of low-temperature plasmas, covering numerical methods, mathematical models and modeling techniques. The main methods of calculating the cross sections of plasma particle interaction and the solution of the kinetic Boltzmann equation for determining the transport coefficients of the plasma are also presented. The results of calculations of thermodynamic properties, transport coefficients, the equilibrium particle-interaction cross sections and two-temperature plasmas are also discussed. Later chapters consider applications, and the results of simulation and calculation of plasma parameters in induction and arc plasma torches are presented. The complex physical processes in high-frequency plasmas and arc plasmas, the internal and external parameters of plasma torches, near-electrode processes, heat transfer, the flow of solid particles in plasmas and other phenomena are considered. The book is intended for professionals involved in the theoretical study of low-temperature plasmas and the design of plasma torches, and will be useful for advanced students in related areas.

**Magnetically Confined Fusion Plasma Physics**

This book grew out of lecture notes for an undergraduate course in plasma physics that has been offered for a number of years at UCLA. With the current increase in interest in controlled fusion and the wide spread use of plasma physics in space research and relativistic astrophysics, it makes sense for the study of plasmas to become a part of an undergraduate student's basic experience, along with subjects like thermodynamics or quantum mechanics. Although the primary purpose of this book was to fulfill a need for a text that seniors or juniors can really understand, I hope it can also serve as a painless way for scientists in other fields-solid state or laser physics, for instance to become acquainted with plasmas. Two guiding principles were followed: Do not leave algebraic steps as an exercise for the reader, and do not let the algebra obscure the physics. The extent to which these opposing aims could be met is largely due to the treatment of a plasma as two interpenetrating fluids. The two-fluid picture is both easier to understand and more accurate than the single-fluid approach, at least for low-density plasma phenomena.
Introduction to Plasma Physics

Plasma Physics - Basic Theory with Fusion Applications presents a thorough treatment of plasma physics, beginning at an introductory level and including an extensive discussion of its applications in thermonuclear fusion research. The physics of fusion plasmas is explained mainly in relation to recent progress in tokamak research, but other plasma confinement schemes, such as stellarators and inertial confinement, are also described. The unique and systematic presentation will help readers to understand the overall structure of plasma theory and will facilitate access to more advanced literature on specialist topics. Numerous problems will assist the students in mastering the text.

Plasma Physics Theory

This book is an introduction to the field of modern plasma physics theory. The topics have been carefully chosen by the authors after many years teaching a graduate course in this subject. The book contains a comprehensive description of three widely used models in plasma physics: one-particle, hydro-dynamic and kinetic. The original results concerning fluctuation theory, nonlinear wave interaction and plasma turbulence have been obtained within the framework of the kinetic approach. This volume will be of particular interest to graduate students and researchers studying plasma physics as well as statistical physics and magnetohydrodynamics. It will also be of use to students and researchers in physical astronomy, particularly in other space plasma physics such as solar physics and stellar structure. The elements of the kinetic theory of gases.

Handbook on Plasma Instabilities

A coherent, self-contained account of the fundamental theories in plasma physics, now updated and corrected throughout.

Plasma Physics

This acts as a reference work for the field of high intensity and/or high plasma density laser-plasma interactions for years to come. It covers everything from single particles to dense fluids, from computational physics to the practical results in fusion. In addition, it contains treatments of the theory of electrodynamics, laser-driven hydrodynamics, the Lorentz force, complex refractive index and relativistic effects in plasmas. Although ""the swamp of plasma physics"" is mostly a classical place, the author indicates where quantum and classical calculations converge.

Introduction to Plasma Physics

This book provides the ideal introduction to this complex and fascinating field of research, balancing the theoretical and practical and preparing the student for further study.

Introduction to Plasma Physics and Controlled Fusion

An Introduction to Plasma Physics, Second Edition focuses on the processes, reactions, properties, and approaches involved in plasma physics, including kinetic theory, radiation, particle motions, and oscillations. The publication first offers information on the introduction to plasma physics and basic properties of the equilibrium plasma. Discussions focus on the occurrence of plasma in nature, technological aspects of plasma physics, quasi-neutrality and plasma oscillations, transmission of electromagnetic radiation through plasma, production of plasma by shock waves, and degree of
ionization in a thermal plasma. The text then ponders on arc plasma, magnetohydrodynamics, and magnetohydrodynamic stability. The manuscript takes a look at plasma dynamics and particle motions and kinetic theory of the plasma. Topics include dielectric behavior of a magnetized plasma, approximate treatment of particle orbits, formal derivation of the drifts, macroscopic effects of particle motion, consequences of the magnetic moment, and transport equations and hydrodynamics. Low-frequency oscillations of a uniform magnetized plasma, stability and perturbation theories, and approximate procedure for solving the transport equations are also discussed. The publication is a highly recommended source material for readers interested in plasma physics.

**Introduction to Plasma Physics**

The primary objectives of this book are, firstly, to present the essential theoretical background needed to understand recent fusion research and, secondly, to describe the current status of fusion research for graduate students and senior undergraduates. It will also serve as a useful reference for scientists and engineers working in the related fields. In Part I, Plasma Physics, the author explains the basics of magneto-hydrodynamics and kinetic theory in a simple and compact way and, at the same time, covers important new topics for fusion studies such as the ballooning representation, instabilities driven by energetic particles, and various plasma models for computer simulations. Part II, Controlled Nuclear Fusion, attempts to review the "big picture" in fusion research. Mathematical derivations are comprehensively explained to better enable readers to later concentrate on the physics. All important phenomena and technologies are addressed, with a particular emphasis on the topics of most concern in current research.

**Basic Principles Of Plasma Physics**

Encompasses the Lectured Works of a Renowned Expert in the Field Plasma Physics: An Introduction is based on a series of university course lectures by a leading name in the field, and thoroughly covers the physics of the fourth state of matter. This book looks at non-relativistic, fully ionized, nondegenerate, quasi-neutral, and weakly coupled plasma.

**Introduction to Plasma Physics**

Provides a complete introduction to plasma physics as taught in a 1-year graduate course. Covers all important topics of plasma theory, omitting no mathematical steps in derivations. Covers solitons, parametric instabilities, weak turbulence theory, and more. Includes exercises and problems which apply theories to practical examples. 4 of the 10 chapters do not include complex variables and can be used for a 1-semester senior level undergraduate course.

**Plasma Physics**

Encompasses the Lectured Works of a Renowned Expert in the Field Plasma Physics: An Introduction is based on a series of university course lectures by a leading name in the field, and thoroughly covers the physics of the fourth state of matter. This book looks at non-relativistic, fully ionized, nondegenerate, quasi-neutral, and weakly coupled plasma. Intended for the student market, the text provides a concise and cohesive introduction to plasma physics theory, and offers a solid foundation for students wishing to take higher level courses in plasma physics. Mathematically Rigorous, but Driven by Physics This work contains over 80 exercises—carefully selected for their pedagogical value—with fully worked out solutions available in a separate solutions manual for professors. The author provides an in-depth discussion of the various fluid theories typically used in plasma physics. The material presents a number of applications, and works through specific topics including basic
plasma parameters, the theory of charged particle motion in inhomogeneous electromagnetic fields, plasma fluid theory, electromagnetic waves in cold plasmas, electromagnetic wave propagation through inhomogeneous plasmas, magnetohydrodynamical fluid theory, and kinetic theory. Discusses fluid theory illustrated by the investigation of Langmuir sheaths Explores charged particle motion illustrated by the investigation of charged particle trapping in the earth’s magnetosphere Examines the WKB theory illustrated by the investigation of radio wave propagation in the earth’s ionosphere Studies the MHD theory illustrated by the investigation of solar wind, dynamo theory, magnetic reconnection, and MHD shocks Plasma Physics: An Introduction addresses applied areas and advanced topics in the study of plasma physics, and specifically demonstrates the behavior of ionized gas.

**Fundamentals of Plasma Physics**

Introducing basic principles of plasma physics and their applications to space, laboratory and astrophysical plasmas, this new edition provides updated material throughout. Topics covered include single-particle motions, kinetic theory, magnetohydrodynamics, small amplitude waves in hot and cold plasmas, and collisional effects. New additions include the ponderomotive force, tearing instabilities in resistive plasmas and the magnetorotational instability in accretion disks, charged particle acceleration by shocks, and a more in-depth look at nonlinear phenomena. A broad range of applications are explored: planetary magnetospheres and radiation belts, the confinement and stability of plasmas in fusion devices, the propagation of discontinuities and shock waves in the solar wind, and analysis of various types of plasma waves and instabilities that can occur in planetary magnetospheres and laboratory plasma devices. With step-by-step derivations and self-contained introductions to mathematical methods, this book is ideal as an advanced undergraduate to graduate-level textbook, or as a reference for researchers.

**Plasma Physics**

A family, a civil war and the adventures of Cooper Trawlaine.

**Plasma Kinetic Theory**

Fundamentals of Plasma Physics is a general introduction designed to present a comprehensive, logical and unified treatment of the fundamentals of plasma physics based on statistical kinetic theory, with applications to a variety of important plasma phenomena. Its clarity and completeness makes the text suitable for self-learning and for self-paced courses. Throughout the text the emphasis is on clarity, rather than formality, the various derivations are explained in detail and, wherever possible, the physical interpretations are emphasized. The mathematical treatment is set out in great detail, carrying out the steps which are usually left to the reader. The problems form an integral part of the text and most of them were designed in such a way as to provide a guideline, stating intermediate steps with answers.

**Principles of Plasma Physics for Engineers and Scientists**

Beginning at an introductory level, this text presents a thorough treatment of plasma physics, including an extensive discussion of its applications in thermonuclear fusion research. A novel feature of this book is its comprehensive description of the various concepts and formulas widely used in fusion theory based on the fundamental equations of the plasma fluid. The physics of fusion plasmas is explained mainly in relation to recent progress in tokamak research, but other plasma confinement schemes, such as stellarators and inertial confinement, are also described. The unique and systematic
Cemetery Ridge

This complete introduction to plasma physics and controlled fusion by one of the pioneering scientists in this expanding field offers both a simple and intuitive discussion of the basic concepts of this subject and an insight into the challenging problems of current research. In a wholly lucid manner the work covers single-particle motions, fluid equations for plasmas, wave motions, diffusion and resistivity, Landau damping, plasma instabilities and nonlinear problems. For students, this outstanding text offers a painless introduction to this important field; for teachers, a large collection of problems; and for researchers, a concise review of the fundamentals as well as original treatments of a number of topics never before explained so clearly. This revised edition contains new material on kinetic effects, including Bernstein waves and the plasma dispersion function, and on nonlinear wave equations and solitons. For the third edition, updates was made throughout each existing chapter, and two new chapters were added: Ch 9 on “Special Plasmas” and Ch 10 on Plasma Applications (including Atmospheric Plasmas).

Plasma Physics

Handbook on Plasma Instabilities, Volume 1 serves as an introduction to the field of plasma physics and plasma instabilities. Topics covered include basic plasma physics, statistical plasma theory, and magnetohydrodynamics (MHD), as well as the many-species theory and plasma containment. The motion of individual particles, oscillations and waves, and MHD instabilities of a real and an ideal plasma are also discussed. This volume is comprised of 13 chapters and begins with a survey of the various applications of plasma sciences and an overview of the fundamental concepts of plasma physics. Basic plasma physics, the physics of instabilities, orbit theory, kinetic theory, MHD, and the many-fluid theory are then presented. The following chapters focus on the principles of plasma containment and waves in plasmas, together with the basic features of plasma instabilities and their classification. The classical MHD stability theory of an ideal and of a real plasma is also described. The final chapter is devoted to drift waves and drift instabilities in inhomogeneous plasmas, paying particular attention to the theory of gradient instabilities and the microscopic theory of waves in non-homogeneous collisionless plasmas. This handbook is intended for beginners in plasma physics and plasma instabilities and for physicists and engineers working actively in the field.

Plasma Physics

Beginning at an introductory level, this text presents a thorough treatment of plasma physics, including an extensive discussion of its applications in thermonuclear fusion research. A novel feature of this book is its comprehensive description of the various concepts and formulas widely used in fusion theory based on the fundamental equations of the plasma fluid. The physics of fusion plasmas is explained mainly in relation to recent progress in tokamak research, but other plasma confinement schemes, such as stellarators and inertial confinement, are also described. The unique and systematic presentation will help readers to understand the overall structure of plasma theory and will facilitate access to more advanced literature on special topics.

Plasma Physics

Covers the basic concepts of plasma physics
Basic Space Plasma Physics (Revised Edition)

This unified introduction provides the tools and techniques needed to analyze plasmas and connects plasma phenomena to other fields of study. Combining mathematical rigor with qualitative explanations, and linking theory to practice with example problems, this is a perfect textbook for senior undergraduate and graduate students taking one-semester introductory plasma physics courses. For the first time, material is presented in the context of unifying principles, illustrated using organizational charts, and structured in a successive progression from single particle motion, to kinetic theory and average values, through to collective phenomena of waves in plasma. This provides students with a stronger understanding of the topics covered, their interconnections, and when different types of plasma models are applicable. Furthermore, mathematical derivations are rigorous, yet concise, so physical understanding is not lost in lengthy mathematical treatments. Worked examples illustrate practical applications of theory and students can test their new knowledge with 90 end-of-chapter problems.

Laser Plasma Physics

This book presents a thorough treatment of plasma physics, beginning at an introductory level and proceeding to an extensive discussion of its applications in thermonuclear fusion research. The physics of fusion plasmas is explained mainly in relation to recent progress in tokamak research, but other plasma confinement schemes, such as stellarators and inertial confinement, are also described. The unique and systematic presentation will help readers to understand the overall structure of plasma theory.

Plasma Physics

Introduction to Plasma Physics presents the latest on plasma physics. Although plasmas are not very present in our immediate environment, there are still universal phenomena that we encounter, i.e., electric shocks and galactic jets. This book presents, in parallel, the basics of plasma theory and a number of applications to laboratory plasmas or natural plasmas. It provides a fresh look at concepts already addressed in other disciplines, such as pressure and temperature. In addition, the information provided helps us understand the links between fluid theories, such as MHD and the kinetic theory of these media, especially in wave propagation. Presents the different phenomena that make up plasma physics Explains the basics of plasma theory Helps readers comprehend the various concepts related to plasmas

Statistical Plasma Physics, Volume I

A Thorough Update of the Industry Classic on Principles of Plasma Processing The first edition of Principles of Plasma Discharges and Materials Processing, published over a decade ago, was lauded for its complete treatment of both basic plasma physics and industrial plasma processing, quickly becoming the primary reference for students and professionals. The Second Edition has been carefully updated and revised to reflect recent developments in the field and to further clarify the presentation of
basic principles. Along with in-depth coverage of the fundamentals of plasma physics and chemistry, the authors apply basic theory to plasma discharges, including calculations of plasma parameters and the scaling of plasma parameters with control parameters. New and expanded topics include: * Updated cross sections * Diffusion and diffusion solutions * Generalized Bohm criteria * Expanded treatment of dc sheaths * Langmuir probes in time-varying fields * Electronegative discharges * Pulsed power discharges * Dual frequency discharges * High-density rf sheaths and ion energy distributions * Hysteresis and instabilities * Helicon discharges * Hollow cathode discharges * Ionized physical vapor deposition * Differential substrate charging With new chapters on dusty plasmas and the kinetic theory of discharges, graduate students and researchers in the field of plasma processing should find this new edition more valuable than ever.

**Plasma Physics**

Market: Scientists, engineers, and graduate students involved in the phenomenon of plasma physics. This 1966 reference work is a compilation of some of the most important plasma physics measurements published during the late 1950s and the early 1960s. It offers a wealth of useful information on elastic-collision and charge-transfer cross sections, mobility and diffusion, electron attachment and detachment, and recombination. Numerous fundamental principles make this a much-consulted handbook on the physical phenomena, measurements, and properties of plasma physics.

**Principles of Plasma Discharges and Materials Processing**

Developed from the lectures of a leading expert in plasma wave research, Plasma Kinetic Theory provides the essential material for an introductory course on plasma physics as well as the basis for a more advanced course on kinetic theory. Exploring various wave phenomena in plasmas, it offers wide-ranging coverage of the field. After introducing basic kinetic equations and the Lenard–Balescu equation, the book covers the important Vlasov–Maxwell equations. The solutions of these equations in linear and quasilinear approximations comprise the majority of kinetic theory. Another main topic in kinetic theory is to assess the effects of collisions or correlations in waves. The author discusses the effects of collisions in magnetized plasma and calculates the different transport coefficients, such as pressure tensor, viscosity, and thermal diffusion, that depend on collisions. With worked examples and problem sets that enable sound comprehension, this text presents a detailed, mathematical approach to applying plasma kinetic theory to diffusion processes in plasmas.

**Plasma Physics**

Beginning at an introductory level, this text presents a thorough treatment of plasma physics, including an extensive discussion of its applications in thermonuclear fusion research. A novel feature of this book is its comprehensive description of the various concepts and formulas widely used in fusion theory based on the fundamental equations of the plasma fluid. The physics of fusion plasmas is explained mainly in relation to recent progress in tokamak research, but other plasma confinement schemes, such as stellarators and inertial confinement, are also described. The unique and systematic presentation will help readers to understand the overall structure of plasma theory and will facilitate access to more advanced literature on special topics.

**Plasma Physics and Controlled Nuclear Fusion**

A general introduction designed to present a comprehensive, logical and unified treatment of the fundamentals of plasma physics based on statistical kinetic theory. Its clarity and completeness make it suitable for self-learning and self-paced courses. Problems are included.
Introduction to Plasma Physics and Controlled Fusion

A Nobel Foundation Symposium on the subject: "Nonlinear Effects In Plasmas", was held at Aspenasgarden, Lerum, in the Goteborg area of Sweden from June 11-17, 1976. The Symposium was the 36th in the series of Nobel Foundation Symposia, which have been held mainly within the areas of physics, chemistry, medicine, literature and peace prizes. Some 30 leading experts from the United States, Soviet Union, Japan and Western Europe attended the Symposium. The purpose of the Symposium was to discuss various topics in the field of modern plasma physics. We had to select from this vast area of active research a suitable common theme with a great number of new and interesting contributions. We decided to devote our Symposium in particular to nonlinear effects in plasmas and to emphasize some areas where important developments seemed to be taking place. In recent years basic theory and experiments in nonlinear plasma physics have been stimulated largely by the need for an energy source based on fusion of light nuclei. In many laboratories all over the world attempts are being made to come closer to the final goal by studying magnetically confined plasmas and systems of inertial confinement. Heating of plasmas to fusion temperatures remains a key problem. There are good reasons to believe that the nonlinear effects in plasmas will play an important role for fusion, a long-range program which is still largely in its basic research phase.

Plasma Physics

The growing number of scientific and technological applications of plasma physics in the field of Aerospace Engineering requires that graduate students and professionals understand their principles. This introductory book is the expanded version of class notes of lectures I taught for several years to students of Aerospace Engineering and Physics. It is intended as a reading guide, addressed to students and non-specialists to tackle later with more advanced texts. To make the subject more accessible the book does not follow the usual organization of standard textbooks in this field and is divided in two parts. The first introduces the basic kinetic theory (molecular collisions, mean free path, etc.) of neutral gases in equilibrium in connection to the undergraduate physics courses. The basic properties of ionized gases and plasmas (Debye length, plasma frequencies, etc.) are addressed in relation to their equilibrium states and the collisional processes at the microscopic level. The physical description of short and long-range (Coulomb) collisions and the more relevant collisions (elementary processes) between electrons’ ions and neutral atoms or molecules are discussed. The second part introduces the physical description of plasmas as a statistical system of interacting particles introducing advanced concepts of kinetic theory, (non-equilibrium distribution functions, Boltzmann collision operator, etc). The fluid transport equations for plasmas of electron ions and neutral atoms and the hydrodynamic models of interest in space science and plasma technology are derived. The plasma production in the laboratory in the context of the physics of electric breakdown is also discussed. Finally, among the myriad of aerospace applications of plasma physics, the low pressure microwave electron multipactor breakdown and plasma thrusters for space propulsion are presented in two separate chapters.

An Introduction to Plasma Physics

The enlarged new edition of this textbook provides a comprehensive introduction to the basic processes in plasmas and demonstrates that the same fundamental concepts describe cold gas-discharge plasmas, space plasmas, and hot fusion plasmas. Starting from particle drifts in magnetic fields, the principles of magnetic confinement fusion are explained and compared with laser fusion. Collective processes are discussed in terms of plasma waves and instabilities. The concepts of plasma description by magnetohydrodynamics, kinetic theory, and particle simulation are stepwise introduced. Space charge effects in sheath regions, double layers and plasma diodes are given the
necessary attention. The novel fundamental mechanisms of dusty plasmas are explored and integrated into the framework of conventional plasmas. The book concludes with a concise description of modern plasma discharges. Written by an internationally renowned researcher in experimental plasma physics, the text keeps the mathematical apparatus simple and emphasizes the underlying concepts. The guidelines of plasma physics are illustrated by a host of practical examples, preferentially from plasma diagnostics. There, Langmuir probe methods, laser interferometry, ionospheric sounding, Faraday rotation, and diagnostics of dusty plasmas are discussed. Though primarily addressing students in plasma physics, the book is easily accessible for researchers in neighboring disciplines, such as space science, astrophysics, material science, applied physics, and electrical engineering. This second edition has been thoroughly revised and contains substantially enlarged chapters on plasma diagnostics, dusty plasmas and plasma discharges. Probe techniques have been rearranged into basic theory and a host of practical examples for probe techniques in dc, rf, and space plasmas. New topics in dusty plasmas, such as plasma crystals, Yukawa balls, phase transitions and attractive forces have been adopted. The chapter on plasma discharges now contains a new section on conventional and high-power impulse magnetron sputtering. The recently discovered electrical asymmetry effect in capacitive rf-discharges is described. The text is based on an introductory course to plasma physics and advanced courses in plasma diagnostics, dusty plasmas, and plasma waves, which the author has taught at Kiel University for three decades. The pedagogical approach combines detailed explanations, a large number of illustrative figures, short summaries of the basics at the end of each chapter, and a selection of problems with detailed solutions.

**Plasma Physics**

This textbook begins with a description of the Earth's plasma environment, followed by the derivation of single particle motions in electromagnetic fields, with applications to the Earth's magnetosphere. Also discussed are the origin and effects of collisions and conductivities, formation of the ionosphere, magnetospheric convection and dynamics, and solar wind-magnetosphere coupling. The second half of the book presents a more theoretical foundation of plasma physics, starting with kinetic theory. Introducing moments of distribution function permits the derivation of the fluid equations, followed by an analysis of fluid boundaries, with the Earth's magnetopause and bow shock as examples, and finally, fluid and kinetic theory are applied to derive the relevant wave modes in a plasma. This revised edition seamlessly integrates new sections on magnetopause reconstruction, as well as instability theory and thermal fluctuations based on new developments in space physics. Applications such as the important problems of collisionless reconnection and collisionless shocks are covered, and some problems have also been included at the end of each chapter.

**Introduction to Plasma Physics**

This book describes the ideal magnetohydrodynamic theory for magnetically conned fusion plasmas. Advanced topics are presented in attempting to fill the gap between the up-to-date research developments and plasma physics textbooks. Nevertheless, they are self contained and trackable with the mathematical treatments detailed and underlying physics explained. Both analytical theories and numerical schemes are given. Besides the current research developments in this field, the future prospects are also discussed. Nowadays, it is believed that, if the ideal MHD theory predicts major instabilities, none of the magnetic confinements of fusion plasmas can survive. The author has also written the book Advanced Tokamak Stability Theory. In view of its importance, the MHD theory is further systematically elaborated in this book. The conventional ideal MHD framework is reviewed together with the newly developed multi-parallel-fluid MHD theory. The MHD equilibrium theory and code are described with the non-letter-'X' separatrix feature pointed out. The continuum modes, quasi-modes, phase mixing, and Alfvén resonance heating are analysed. The analytical theories for
MHD stability in tokamak configurations are systematically presented, such as the interchange, peeling, ballooning, toroidal Alfvén modes, and kink type of modes. The global stability computations are also addressed, including resistive wall modes, error-field amplifications, and Alfvén modes, etc.

**Fundamentals of Plasma Physics**

The enlarged new edition of this textbook provides a comprehensive introduction to the basic processes in plasmas and demonstrates that the same fundamental concepts describe cold gas-discharge plasmas, space plasmas, and hot fusion plasmas. Starting from particle drifts in magnetic fields, the principles of magnetic confinement fusion are explained and compared with laser fusion. Collective processes are discussed in terms of plasma waves and instabilities. The concepts of plasma description by magnetohydrodynamics, kinetic theory, and particle simulation are stepwise introduced. Space charge effects in sheath regions, double layers and plasma diodes are given the necessary attention. The novel fundamental mechanisms of dusty plasmas are explored and integrated into the framework of conventional plasmas. The book concludes with a concise description of modern plasma discharges. Written by an internationally renowned researcher in experimental plasma physics, the text keeps the mathematical apparatus simple and emphasizes the underlying concepts. The guidelines of plasma physics are illustrated by a host of practical examples, preferentially from plasma diagnostics. There, Langmuir probe methods, laser interferometry, ionospheric sounding, Faraday rotation, and diagnostics of dusty plasmas are discussed. Though primarily addressing students in plasma physics, the book is easily accessible for researchers in neighboring disciplines, such as space science, astrophysics, material science, applied physics, and electrical engineering. This second edition has been thoroughly revised and contains substantially enlarged chapters on plasma diagnostics, dusty plasmas and plasma discharges. Probe techniques have been rearranged into basic theory and a host of practical examples for probe techniques in dc, rf, and space plasmas. New topics in dusty plasmas, such as plasma crystals, Yukawa balls, phase transitions and attractive forces have been adopted. The chapter on plasma discharges now contains a new section on conventional and high-power impulse magnetron sputtering. The recently discovered electrical asymmetry effect in capacitive rf-discharges is described. The text is based on an introductory course to plasma physics and advanced courses in plasma diagnostics, dusty plasmas, and plasma waves, which the author has taught at Kiel University for three decades. The pedagogical approach combines detailed explanations, a large number of illustrative figures, short summaries of the basics at the end of each chapter, and a selection of problems with detailed solutions.