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Nota di contenuto	Contents; Foreword; 1. Basic Concepts and Historical Background; 1.1 Space and Astrophysics; 1.2 World War II, Teller 1952; 1.3 Controlled Nuclear Fusion; 1.4 Magnetic Confinement Conditions for Nuclear Fusion; 1.5 Nature of Plasma Turbulence; 1.6 Breakthrough with Tokamak Confinement; 1.7 Confinement Records Set in Early Tokamaks; 1.7.1 First generation tokamaks: Ormak, PLT, Alcator, ATC and TFR; 1.7.2 TFTR and the D-T fusion plasmas; 1.7.3 Third-generation tokamaks with international growth; 1.8 JET Record Fusion Power Experiments; References; 2. Alfvén and Drift Waves in Plasmas 2.1 Low-Frequency Wave Dispersion Relations 2.2 Reduction of the Kinetic Dispersion Relation; 2.3 Drift Waves; 2.4 Kinetic Alfvén Waves; 2.5 Coupling of the Drift Wave, Ion-Acoustic and Shear Alfvén Waves; 2.5.1 Electrostatic drift waves; 2.6 Drift Wave Eigenmodes in a Sheared Magnetic Field; 2.7 Symmetries of the Drift Wave Eigenmodes; 2.8 Outgoing Wave Boundary Conditions; 2.8.1 Localized ion drift modes; 2.9 Ion Acoustic Wave Turbulence; 2.9.1 Electromagnetic scattering measurements of ion acoustic waves; 2.9.2 Laser scattering experiment in Helium plasma 2.9.3 Probe measurements of the two-point correlation functions 2.9.4 Probe measurements of the spectrum and anomalous resistivity; 2.9.5 Drift wave spectral distributions; 2.9.6 Microwave scattering

experiments in PLT; 2.10 Drift Waves and Transport in the TEXT Tokamak; 2.11 Drift Waves in Stellarators; References; 3. Mechanisms for Drift Waves; 3.1 Drift Wave Turbulence; 3.2 Drift Wave Mechanism; 3.3 Energy Bounds for Turbulence Amplitudes; 3.3.1 Density gradients; 3.3.2 Temperature gradients; 3.3.3 Drift wave eigenmodes in toroidal geometry
3.3.4 The effect of magnetic and Er shear on drift waves
3.4 Weak Turbulence Theory for Drift Waves; 3.5 Ion Temperature Gradient Mode; 3.6 Drift Waves Paradigms: Hasegawa-Mima and Hasegawa-Wakatani Models; References; 4. Two-Component Magnetohydrodynamics; 4.1 Collisional Transport Equations; 4.2 Current, Density and Temperature Gradient Driven Drift Modes; 4.2.1 Ion acoustic waves and the thermal mode; 4.2.2 Ion temperature gradient instability; 4.3 Closure Models for Coupled Chain of Fluid Moments; 4.3.1 Closure models for the chain of the fluid moments
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4.4 Pressure Gradient Driven Instabilities; 4.4.1 Scale invariance properties arising from an Ohm's law with electron inertia; 4.4.2 Scaling of correlation length and time; 4.4.3 Magnetic flutter thermal transport; 4.4.4 Electron inertia Ohm's law; 4.5 Momentum Stress Tensor Stability Analysis; 4.6 Kinetic Ballooning Mode Instability; References; 5. Laboratory Experiments for Drift Waves; 5.1 Basic Laboratory Experiments for Drift Waves with Uniform Temperature Profiles; 5.2 Discovery of Drift Waves in Early Q-Machine Experiments
References

Sommario/riassunto

The book explains how magnetized plasmas self-organize in states of electromagnetic turbulence that transports particles and energy out of the core plasma faster than anticipated by the fusion scientists designing magnetic confinement systems in the 20th century. It describes theory, experiments and simulations in a unified and up-to-date presentation of the issues of achieving nuclear fusion power.
