

CONTENTS

Preface	iii
Taro KIHARA	
Relaxations in Quiescent Plasmas	
1. Fluctuation of the Charge Density	1
2. Fluctuations of the Longitudinal Electric Field	2
3. Brownian Motion of a Heavy Ion	4
4. Connection Formulas	6
5. Examples	8
6. Quantum Effects	10
7. Effects of a Magnetic Field	11
References	12
V. P. SILIN	
Relaxation and Transport Theory for Plasmas in Strong Magnetic Field	
1. Introduction	13
2. The Derivation of Generalized Collision Integral of Charged Particles in Strong Fields	16
3. The Theory of Temperature Relaxation	23
4. Two-Fluids Hydrodynamics in Strong Magnetic Field	30
5. The Theory of the High-Frequency Dielectric Tensor	32
6. Resume	39
References	39
R. BALESCU	
Statistical Mechanics of Unstable and Turbulent Plasmas	
1. Introduction	42
2. General Formalism of Non-Equilibrium Statistical Mechanics	44
3. Derivation of the Master Equation and of the Kinetic Equation . . .	46
4. Kinetic Equations for Stable and for Weakly Turbulent Plasmas . .	50
4.1 Stable plasma	52
4.1.a Strongly stable plasma	52
4.1.b Weakly stable plasma	53
4.2 Unstable plasma	53
4.2.a Strongly unstable plasma	54
4.2.b Weakly unstable plasma	54
4.2.c "Quasi-linear" approximation for weakly stable plasmas . . .	55
5. Statistical Mechanics of the Fully Developed Turbulence	57
6. Kinetic Equations for Strong Turbulence	61
Acknowledgements	67
References	67
Setsuo ICHIMARU	
Theory of Fluctuations in Turbulent Plasmas	
1. Introduction	69
2. Self-Consistent Approach	71

3. Dielectric Superposition Principle	73
4. Turbulence Spectrum Associated with the Ion-Acoustic Wave Instability	76
5. Kinetic-Theoretical Developments	79
5.1 Quasilinear theory	80
5.2 Spectrum of weak turbulence	81
Acknowledgement	85
References	85
D. F. DUBOIS	
Nonlinear Parametric Excitation of Plasma Fluctuations	
1. Introduction	87
2. Formal Theory of Parametric Coupling in Plasmas	90
2.1 Phenomenological nonlinear electrodynamics	90
2.2 Effect of a strong monochromatic pump field	94
2.3 Coupled mode equations for longitudinal fields	98
2.4 Three mode coupling	100
2.5 Coupled modes in inhomogeneous plasmas	107
2.6 Some remarks on convergence	114
2.7 Parametric amplification of signal and noise	115
3. Applications and Comparison with Experiments	118
3.1 General results for a collisionless plasma and spatially uniform pump	118
3.2 Langmuir wave-ion wave coupling with application to anisotropic semiconductors	121
3.3 Plasmon-optical phonon coupling in semiconductors	126
3.4 Effects of finite pump wavelength	128
3.5 Three mode parametric amplification of fluctuations	131
3.6 Experiments on parametric amplification of drift wave fluctuations	133
3.7 Four mode parametric coupling and experiments	138
4. Nonlinear Saturation Effects	146
4.1 Pump saturation	147
4.2 Nonlinear mode-mode coupling	151
4.3 Reaction of the fluctuation spectrum back onto the particle distribution function	153
Acknowledgement	154
References	154
David MONTGOMERY	
Nonlinear Vlasov Plasmas: Initial Value Problem and Response to an External Field	
Abstract	156
1. Introduction	156
2. Numerical Methods	157
3. The Initial Value Problem	160
3.1 Stable case; non-linear Landau damping	160

3.2 Unstable case; development of inhomogeneous equilibria	164
4. The Case of External Fields	166
4.1 $\omega \cong O(\omega_{pe})$	167
4.2 $\omega \ll \omega_{pe}$	169
4.3 Landau damping of perturbations on inhomogeneous equilibria	170
4.4 Response to a static test charge	174
5. Suggestions and Predictions	175
5.1 Two-stream instability, Many linearly unstable wave numbers	175
5.2 Generalization to two dimensions	175
5.3 Inclusion of magnetic fields	176
Acknowledgements	176
References	177
Kyoji NISHIKAWA	
Landau Damping and Plasma Wave Echo	
1. Introduction	178
2. Landau Damping	180
3. Plasma Wave Echo	183
4. Collisional Effects on the Plasma Wave Echo	186
References	189