Contents

PREFACE

PART I

KINETIC THEORY OF NONIDEAL GASES

INTRODU	JCTI	ON	1
CHAPTER	1	THE METHOD OF DISTRIBUTION FUNCTIONS AND THE METHOD OF MOMENTS	5
Section	I	Equations for the position and momentum distribution functions in a gas of monatomic particles	5
	2	The approximation of binary collisions	10
	3	The weak coupling approximation. The polarization approximation	15
	4	The equation for the phase space density in the six-dimensional position and momentum space	16
	5	The method of moments	18
	6	The approximations of the first and second moments. The polarization approximation	21
	7	Transport equations for the mass density, momentum density and kinetic energy density	27
CHAPTER	2	THE BOLTZMANN KINETIC EQUATION FOR NONIDEAL GASES	31
Section	8	Some results of the equilibrium statistical theory of nonideal gases	31
	9	Nonlinear integral equations for the two-particle correlation function	35
	10	The Boltzmann kinetic equation for the spatially homogeneous ideal gas	37
	11	Properties of the Boltzmann collision integral for the ideal gas	42
	12	The Boltzmann kinetic equation for a spatially homogeneous nonideal gas	46
	13	The collision integral in the weak coupling approximation. The Landau kinetic equation	49
	14	Boltzmann's H-theory for the nonideal gas	51
	15	The Boltzmann equation for a spatially inhomogeneous nonideal gas	56

v

Page ix

vi	Сом	TENTS	CONTENTS		vii
		Page			Page
CHAPTER 3	KINETIC EQUATIONS FOR DENSE GASES	63	CHAPTER 8	EFFECT OF AN EXTERNAL FIELD ON THE KINETIC PROPERTIES OF PLASMAS	169
Section 16	Problems of the kinetic theory of dense gases	63	Section 41	Equations for the functions f_{lpha} , $\delta {\it N}_{\it A}$ in the	169
17	Kinetic equations for nonideal gases taking into account triple collisions	67	42	presence of an external field Spectral density of the source fluctuations in the	170
18	Kinetic equations for the smoothed density of a gas	74		presence of a high-frequency electric field	170
19	On the statistical description of non-equilibrium	82	43	Spectral density of the electric field fluctuations	173
20	Generalized kinetic equation	84	44	Conductivity of a plasma in a high-frequency electric field	178
		97	46	Low frequencies	181
CHAPIER 4	KINEIIC THEORY OF FLUCIUATIONS IN GASES	07	47	The effective potential originating from the average	184
Section 21	Equation for the smoothed distribution functions	87	48	dynamical polarization	186
22	Equation for the smoothed phase density. The method of moments	89	48	Fluctuations in the presence of a magnetic field	189
23	Random sources in the Boltzmann kinetic equation and in the hydrodynamical equations	101	50	Kinetic equation for a plasma in the presence of an external magnetic field	196
	PART II		CHAPTER 9	THE SPATIALLY HOMOGENEOUS NONIDEAL PLASMA	199
3	KINETIC THEORY OF NONIDEAL FULLY TONIZED DLASMAS		Section 51	Spectral densities of non-stationary processes	199
INTRODUCTI		107	52	Spectral densities of the source fluctuations	203
INTRODUCTI	LON	107	53	in a nonideal plasma The Landau kinetic equation for a nonideal plasma	207
CHAPTER 5	THE MICROSCOPIC EQUATIONS FOR A FULLY IONIZED	111	54	The Balescu-Lenard equation for a nonideal plasma	210
	PLASMA AND THEIR AVERAGE		55	The collision integral of the nonideal plasma, taking	215
Section 24	Microscopic equations for a fully ionized plasma	111		into account the averaged dynamical polarization	218
. 25	Microscopic equations for a Coulomb plasma	114	56 57	Boltzmann kinetic equation for a nonideal plasma	223
20	Approximation of binary collisions and polarization	118			220
	approximation for plasmas		CHAPTER 10	THE SPATIALLY INHOMOGENEOUS NONIDEAL PLASMA	229
28	Transport equations for the density, the momentum density	120	Section 58	Relation between collision integral and spectral	229
	and the energy density of the particles. Transport equa-		59	The collision integral	230
	the electromagnetic field		60	Properties of the collision integral	232
CHAPTER 6	KINETIC EQUATIONS FOR THE PLASMA IN THE FIRST MOMENT	125	CHAPTER 11	KINETIC THEORY OF FLUCTUATIONS IN A PLASMA	237
	APPROXIMATION. THE VLASOV EQUATION		Section 61	Equations for the smoothed phase-space density and field	237
Section 29	Kinetic description of the processes in a collisionless plasma	125	62	The method of moments. The polarization approximation	239
30	The linear approximation	127	63	The spectral densities of the long-range fluctuations	242
31	Electrical conductivity and dielectric constant	129	64	Kinetic equations for plasmas with account of the	240
32	Wave properties of a collisionless plasma	134	65	Hydrodynamical equations with account of the	248
CHAPTER 7	KINETIC EQUATIONS FOR THE IDEAL FULLY IONIZED PLASMA	139		long-range fluctuations	
Section 33	Limitations necessary for the derivation of kinetic equations	139		PART III	
34	Spectral densities of the source fluctuations in the	143		QUANTUM KINETIC EQUATIONS FOR NONIDEAL GASES	251
35	ideal plasma Spectral densition of fluctuations in the ideal plasma	144		AND NONIDEAL PLASMAS	
36	Spectral densities of the fluctuations in the equilibrium plasma	144	TNEDODUCE		251
37	The Balescu-Lenard kinetic equation	151	INTRODUCT.	ION	
38	The Landau kinetic equation	154	CHAPTER 12	QUANTUM KINETIC EQUATIONS FOR NONIDEAL GASES	255
39 40	Spectral densities of fluctuations in a relativistic plasma Kinetic equation for a relativistic plasma	164	Section 66	Hierarchy of equations for the quantum distribution functions.	253
			67	Macroscopic equations and thermodynamic functions	257
			68	Two forms of the quantum collision integral	259
					260

 69 The weak coupling approximation
70 Quantum Boltzmann collision integral for nonideal gases,
with account of the exchange effects 260 263

~	~ ~ ~ ×	~~~~	3.70	2
	/ 16/	· · · · ·	AU.1	· • •
	UNN	1 P.	IN I	•••
~	~			-

			Page	
CHAPTER	13.	QUANTUM KINETIC EQUATIONS FOR PLASMAS	267	
Section	71 72 73 74 75 76 77 78	The phase-space density operator The equations for the moments The polarization approximation The quantum collision integral in the polarization approximation The effective potential. The pseudopotential The quantum Boltzmann equation for a nonideal plasma Thermodynamic functions of the nonideal plasma Exchange effects	267 270 271 272 275 277 278 281	
CHAPTER	14	KINETIC EQUATIONS FOR PARTIALLY IONIZED PLASMAS AND FOR CHEMICALLY REACTING GASES	2 8 5	
Section	79 80	Partially ionized plasmas. Initial model Kinetic equations for the distribution functions of electrons, jons and atoms	285 288	
	81	Chemically reacting gases. Initial model	295	
	82	Kinetic equations for chemically reacting gases	296	
	83	Equations for the concentrations of free and bound charged particles. Ionization and recombination coefficients	298	
	84	Effect of the electromagnetic field fluctuations on the kinetic processes in a partially ionized plasma	299	
	85	Kinetic theory of fluctuations in chemically reacting gases and in partially ionized plasmas	301	
REFERE	REFERENCES			
INDEX			315	
OTHER TITLES IN THE SERIES				

viii