

CONTENTS

PART I. THE PROPAGATION AND ABSORPTION OF ELECTROMAGNETIC WAVES IN PLASMAS

1. GENERAL INFORMATION ABOUT PLASMAS	
1.1 Properties of plasmas	3
1.2 Natural plasmas and laboratory plasmas	12
2. OSCILLATIONS AND WAVES IN ISOTROPIC PLASMAS	
2.1 Oscillations and waves in homogeneous isotropic plasmas	15
2.2 High-frequency conductivity of homogeneous isotropic plasmas	25
2.3 Electromagnetic wave propagation in homogeneous and inhomogeneous isotropic plasmas	27
3. OSCILLATIONS AND WAVES IN MAGNETOACTIVE PLASMAS	
3.1 Oscillations and waves in homogeneous magnetoactive plasmas	33
3.2 High-frequency conductivity of homogeneous magnetoactive plasmas	47
3.3 Electromagnetic wave propagation in homogeneous magnetoactive plasmas	49
4. LINEAR TRANSFORMATION AND ABSORPTION OF WAVES IN INHOMOGENEOUS PLASMAS	
4.1 Coupling between electromagnetic and plasma waves. Transformation efficiency	53
4.2 Resonances in a bounded plasma of small size	57
4.3 Electromagnetic wave absorption in inhomogeneous bounded plasmas	62

PART II. NON-LINEAR PHENOMENA IN THE
PROPAGATION AND ABSORPTION OF ELECTRO-
MAGNETIC WAVES IN PLASMAS

5. NON-LINEAR PHENOMENA IN PLASMAS IN STRONG ELECTROMAGNETIC FIELDS	
5.1 Properties of non-linear phenomena	71
5.2 Conditions for strong action of electromagnetic fields on plasmas	74
6. INTERACTION OF INDIVIDUAL CHARGED PARTICLES AND RAREFIED PLASMAS WITH SLIGHTLY NON-UNIFORM HIGH-FREQUENCY FIELDS	
6.1 Averaged equations of motion	77
6.2 High-frequency potential forms	80
6.3 Acceleration and confinement of individual charged particles and plasmas	81
6.4 Generation and acceleration of electromagnetic waves	84
6.5 Experiments on the reflection and focusing of electron streams by high-frequency quasi-potential barriers	85
6.6 Experiments on the reflection and acceleration of rarefied plasma streams by high-frequency quasi-potential barriers	95
6.7 Experiments on the focusing and three-dimensional confinement of rarefied plasmas in high-frequency quasi-potential wells	108
7. INTERACTION OF INDIVIDUAL CHARGED PARTICLES AND RAREFIED PLASMAS WITH SLIGHTLY NON-UNIFORM HIGH-FREQUENCY FIELDS IN THE PRESENCE OF A STATIC MAGNETIC FIELD	
7.1 High-frequency potential forms	121
7.2 Experiments on the reflection of electron streams by a high-frequency quasi-potential barrier in the presence of a static magnetic field	122
7.3 Acceleration and reflection of plasmas in systems having gradients of the electromagnetic and static magnetic fields	124
7.4 Accumulation of plasma in systems with gradients of the electromagnetic and static magnetic fields	130

8. INTERACTION OF STRONG ELECTROMAGNETIC FIELDS WITH DENSE PLASMAS	
8.1 Confinement of dense plasmas	134
8.2 Acceleration of dense plasma blobs	135
8.3 Coherent acceleration of plasma blobs	136
8.4 Acceleration of a plasma piston	137
8.5 Experiments on radiative acceleration of plasmas	138
8.6 Experiments to observe instability of plasmas in a strong microwave field	142
9. ANOMALOUS ABSORPTION OF ELECTRO- MAGNETIC WAVES. HEATING OF COLLISIONLESS ISOTROPIC PLASMAS	
9.1 Non-linear interaction of electromagnetic waves with plasmas	153
9.2 Parametric instability of isotropic plasmas in high- frequency fields	160
9.3 Computer experiments	176
9.4 Experiments on the interaction of microwave and high- frequency fields with gas-discharge plasmas	180
9.5 Experiments on the absorption of microwaves and par- ticle heating in waveguides	186
9.6 Experiments on the interaction of microwaves with slight- ly inhomogeneous extensive plasmas	221
9.7 Experiments on the interaction of electromagnetic waves with plasmas in the optical (laser) range	239
10. ANOMALOUS ABSORPTION OF ELECTRO- MAGNETIC WAVES. HEATING OF COLLISIONLESS MAGNETOACTIVE PLASMAS	
10.1 Parametric instability of magnetoactive plasmas in high-frequency fields	248
10.2 Experiments on the absorption of microwaves and par- ticle heating in magnetoactive plasmas with $E \parallel B_0$	250
10.3 Experiments on the absorption of microwaves and par- ticle heating in magnetoactive plasmas with $E \perp B_0$	266
10.4 Ionosphere experiments	281
CONCLUSION	290
REFERENCES	291
ADDITIONAL REFERENCES	310
INDEX	323