

# Contents

List of Main Symbols . . . . .	xiii
Chapter I. PLASMA IN SEMICONDUCTORS . . . . .	1
1. Main Definitions . . . . .	1
2. The Dispersion Equation . . . . .	6
3. Drift Currents of Charged Particles and Electric Conductivity of a Semiconductor in Electric and Magnetic Fields . . . . .	11
4. The Boltzmann Kinetic Equation . . . . .	19
5. The Effective Mass and the Band Structure . . . . .	26
6. Scattering Mechanisms and Relaxation Times . . . . .	37
Chapter II. WAVES IN PLASMA . . . . .	46
1. Waves in a Cold Plasma in the Absence of Magnetic Field . . . . .	49
2. Waves in a Single-Component Plasma Placed in Magnetic Field . . . . .	53
3. The Multi-Component Plasma. Magnetohydrodynamic and Magnetosonic Waves . . . . .	67
4. The Effect on Waves of Thermal Motion of Particles. Electrosonic Waves. Landau Attenuation . . . . .	75
5. Helicon Waves in Metals . . . . .	80
6. Waves in a Semiconductor with Anisotropic Valleys . . . . .	81
7. Experimental Observation of Magnetoplasma Waves in Semiconductors . . . . .	86
8. Helicon Spectroscopy . . . . .	96
Chapter III. WAVE INSTABILITIES IN PLASMA . . . . .	107
1. Criteria of Instability . . . . .	107
2. Practical Methods of Determining Instability Criteria . . . . .	115
3. The Negative Differential Conductivity . . . . .	120
4. Energy Transfer to Waves in Plasma . . . . .	124
Chapter IV. DRIFT INSTABILITIES . . . . .	128
1. The Interaction of the Charge Carrier Flux and Waves in the Plasma with the Acoustical Waves in the Lattice . . . . .	129
2. Interaction of the Drift Current of Charge Carriers with Waves in an Unbounded Plasma . . . . .	140

3. Interaction of Streams of Charge Carriers and Waves in a Bounded Plasma . . . . .	146
Chapter V. HOT ELECTRONS . . . . .	154
1. The Mean Energy and the Drift Velocity of Hot Electrons. Thermal Instability . . . . .	155
2. The Energy Distribution Function of Hot Electrons . . . . .	161
3. Heating of Electrons in Many-Valley Semiconductors of the Type $A^{III}B^V$ and $A^{II}B^{VI}$ . . . . .	163
4. The Heating of Electrons in Germanium and Silicon . . . . .	171
5. The Monte Carlo Method . . . . .	181
Chapter VI. INSTABILITIES DUE TO INTER-VALLEY ELECTRON TRANSFER . . . . .	193
1. Electric Domains. Gunn Effect . . . . .	193
2. Operation Modes of Diodes with Negative Bulk Conductivity . . . . .	202
3. Absolute Negative Resistance . . . . .	207
Chapter VII. AVALANCHE INSTABILITIES . . . . .	209
1. Avalanche Instability . . . . .	209
2. Mechanisms of Charge Carrier Generation by the Electric Field . . . . .	212
3. Avalanche Structures . . . . .	217
Chapter VIII. RECOMBINATION INSTABILITIES . . . . .	229
1. Recombination of Hot Electrons . . . . .	230
2. Recombination Waves . . . . .	238
3. Injection Instabilities . . . . .	241
Chapter IX. PLASMA STREAMS . . . . .	245
1. Plasma Streams through a Semiconductor with Variable Cross-section . . . . .	246
2. Pinch-effect . . . . .	252
3. Kink and Gradient Instabilities . . . . .	259
Appendix . . . . .	267
References . . . . .	278
Index . . . . .	295