

# CONTENTS

<b>Foreword</b>	1
-----------------	---

<b>EXPERIMENTS ON THE L-2 STELLARATOR</b> I. S. Shpigel'	5
---	---

<b>INVESTIGATION OF THE ENERGY SPECTRA AND FLUXES OF CHARGE-EXCHANGE ATOMS ON THE L-2 STELLARATOR</b> S. E. Grebenshchikov, I. S. Sbitnikova V. N. Sukhodol'skiy, A. V. Khudoleev, I. S. Shpigel'	11
---	----

<b>INVESTIGATION OF PLASMA RADIATION ON THE L-2 STELLARATOR</b> E. D. Andryukhina, K. S. Dyabilin, O. I. Fedyanin	
--	--

1. Measurement Technique	21
2. Ohmic Plasma Heating and the Role of Radiation Losses	23
3. The Role of Radiation Losses in Discharge Formation By Means of RF Plasma Heating	27
4. Radial Radiation Profiles	28
5. Radiation Losses and Electron Energy Balance	30
Conclusion	31
References	31

<b>SUBMILLIMETER-INTERFEROMETER-BASED SYSTEM FOR RADIAL PLASMA DENSITY PROFILE MEASUREMENTS IN THE L-2 STELLARATOR</b> S. V. Kladov, A. D. Smirnova	33
--	----

<b>NEW DEVELOPMENTS IN THOMSON SCATTERING DIAGNOSTICS ON THE L-2 STELLARATOR</b>		
M. A. Blokh, N. F. Larionova		41
<b>THE POSSIBILITY FOR APPLICATION OF THE FOIL TECHNIQUE TO PLASMA DIAGNOSTICS ON THE L-2 STELLARATOR</b>		
S. E. Grebenshchikov, B. I. Kornev, N. F. Larionova, A. V. Novikova		45
<b>PLASMA RADIATION AT THE ELECTRON-CYCLOTRON SECOND HARMONIC AND PLASMA OPTICAL THICKNESS</b>		
D. K. Akulina, O. I. Fedyanin, Yu. V. Khol'nov		51
Introduction		51
1. Transmission of Linearly-Polarized Radiation Through a Stellarator Plasma Column Near the Electron-Cyclotron Second Harmonic		52
2. Investigation of ECR Second-Harmonic Radiation on the L-2 Stellarator and the Possibility of Electron Temperature Measurement		61
3. Runaway Electrons on the L-2 Machine and Their Role in Radiation in the $2\omega_{He}$ Range		67
References		71
<b>INVESTIGATION OF PERIPHERAL PLASMA ON THE L-2 STELLARATOR</b>		
S. N. Popov		73
1. Probe Thermal Operating Conditions		73
2. The Probe Voltage-Time Characteristic Technique		74
3. Experiment		77
References		78

<b>MHD-ASPECTS OF STELLARATOR PLASMA CONFINEMENT</b>		
L. M. Kovrizhnykh, S. V. Shchepetov		81
<b>Chapter 1: Averaged MHD-Equations</b>		82
1.1. Description of Stellarator Plasma by Means of Averaged Equations		82
1.2. Select Examples		93
<b>Chapter 2: Stellarator Plasma Equilibrium</b>		98
2.1. Initial Equations		98
2.2. Derivation of Equations for the Center Shear of Magnetic Surfaces and their Ellipticity		101
2.3. Low-Pressure Plasma Equilibrium		104
2.4. High-Pressure Plasma Equilibrium in a Stellarator		108
<b>Chapter 3: Stellarator Plasma Stability</b>		
3.1. Equation of Minor Oscillations		110
3.2. Plasma Stability Criteria With Respect to Perturbations With $n \gg 1$		113
3.3. Dissipative Flute-Type Instability Criterion in a Stellarator		119
Conclusion		121
Appendix 1: Derivation of Averaged Ohm's Law		123
Appendix 2: Flute Modes in a Racetrack Stellarator		124
References		126
<b>FORMATION, EVOLUTION AND EXPLOSIVE DISRUPTION OF CURRENT SHEETS IN PLASMA</b>		
A. G. Frank		131
Current Sheets in $\Theta$ -Pinch Systems		133
Current Sheets in Multipole Magnetic Fields		134
Experiments on the "Current Sheet" Devices at the Plasma Physics Laboratory of the Lebedev Physics Institute		138
Laboratory Experiments and Solar Flares		158
Conclusion		161
References		162

<b>INVESTIGATION OF INDUCED <math>ls</math>-SCATTERING NEAR LOWER HYBRID RESONANCE</b>	
G. M. Batanov, L. M. Kovrizhnykh, L. V. Kolik, A. E. Petrov, A. V. Sapozhnikov, K. A. Sarksyant, A. S. Sakharov, N. N. Skvortsova	
	171
1. Change in Electron Energy and Momentum from Induced $ls$ -Scattering in a Magnetized Plasma	172
2. Experimental Technique and Initial Plasma Characteristics	175
3. Nonlinear Excitation of Ion-Acoustic Waves by RF Field	178
4. Electron Heating by Low-Hybrid Pump Wave Action on a Nonequilibrium Magnetically- Activated Plasma	183
5. Developmental Dynamics of Ion-Acoustic Turbulence From $ls$ -Scattering near Lower Hybrid Resonance	191
6. Dynamics of Electron Heating in a Skew Langmuir Wave Field	201
Conclusion	203
References	203
<b>ELECTRON ACCELERATION BY ELECTROMAGNETIC IRRADIATION OF A WEAKLY-COLLISIONAL PLASMA</b>	
D. M. Karfidov, N. A. Lukina, K. F. Sergeychev	
	205
Introduction	205
1. Experimental Setup and Measurement Technique	209
2. Electron Acceleration by Parametric Plasma in an $s$ -Polarized Electromagnetic Wave Field	213
3. Electron Acceleration by Microwave Interaction With a Strongly-Inhomogeneous Plasma	222
4. Interaction of Microwave Radiation With the Plasma Corona From Inhomogeneous Gas Target Breakdown	226
Conclusion	236
References	237

<b>HIGH-PRESSURE MICROWAVE DISCHARGES</b>	
G. M. Batanov, S. I. Gritsinin, I. A. Kossyy, A. N. Magunov, V. P. Silakov, N. M. Tarasova	
	241
<b>Chapter 1: Possible Engineering Applications of High-Pressure Microwave Discharge</b>	
1. Non-Self-Sustained Microwave Discharge in High-Power Laser Engineering	242
2. Non-Self-Sustained Discharge and the Microwave Rocket Concept	246
<b>Chapter 2: Experimental Investigation of High-Pressure Microwave Discharge</b>	250
1. Experimental Setup	251
2. Spatial Structure and the Dynamics of Microwave-Stimulated Discharge	252
3. Dynamics of Nitrogen Molecule Vibrational Excitation in Microwave-Stimulated Discharge. Heating of the Gas Medium	256
4. Demonstration of Possible Applications of High- Pressure Microwave Discharge to Direct Microwave- to-Mechanical Energy Conversion	263
<b>Chapter 3: Discussion of Experimental Results on High-Pressure Microwave Discharge</b>	267
1. Initial Microwave Discharge Stage. Role of the Stimulator	268
2. Ionization Wave in High-Pressure Stimulated Microwave Discharge	268
3. Plasma Parameters in Channels and in Interchannel Space	272
4. Gas Heating. The Dynamics of Vibrational State Excitation and Relaxation for Nitrogen Molecules	274
Conclusion	278
References	278

<b>SCATTERING OF ATOMS BY A STANDING LIGHT WAVE</b>	
V. A. Grinchuk, A. P. Kazantsev, E. F. Kuzin, M. L. Nagaeva, G. A. Ryabenko, G. I. Surdutovich, V. P. Yakovlev	
	283
Introduction	
1. Potential of an Atom in an Inhomogeneous Field	285
2. Classical Scattering Picture	286
3. Quantum Effects	288
4. Bipotential Scattering	289
5. The Case $\gamma r \gg 1$	291

x    *Contents*

6.	Experimental Investigation of Stimulated Radiation	
	Pressure	293
	Conclusion	303
	References	303

	SUBJECT INDEX	307
--	---------------	-----