

LIST OF CONTENTS

ABSTRACT	
ACKNOWLEDGMENTS	
LIST OF CONTENTS	
LIST OF FIGURES AND TABLES	
CHAPTER 1 - INTRODUCTION	1
1.1 Motivation for Studying Turbulence in RFPs	1
1.2 Basic Principle of RFP	5
1.3 Experimental Studies of Turbulence in Tokamaks	7
1.3.1 Diagnostics of Plasma Turbulence	9
1.3.2 General Features of Turbulence	9
1.3.3 Fluctuation Induced Transport	10
REFERENCES	13
CHAPTER 2 - EXPERIMENTAL APPARATUS	17
2.1 REPUTE-1 Device	17
2.2 Plasma Diagnostic	19
2.2.1 Basic Magnetic Measurements	21
2.2.2 Other Diagnostics	21
2.3 Diagnostics of Edge Turbulence	23

2.3.1 Poloidal Magnetic Probe Array	23
2.3.2 Toroidal Magnetic Probe Array	24
2.3.3 Triple-Probe and Magnetic-Probe Array	27
2.3.4 Complex Probe	33
2.3.5 3 × 3 Magnetic Probe Matrix	38
REFERENCES	41

CHAPTER 3 - MEASUREMENT PRINCIPLES AND DATA ANALYSES

3.1 Principle of Langmuir Probe Measurement	43
3.1.1 Characteristic of Langmuir Probe	
without Magnetic Field	43
3.1.2 Effects of Magnetic Fields	46
3.1.3 Measurement of Electric Field Fluctuation	48
3.1.4 Triple-Probe Measurement	50
3.2 Estimation of Wavenumber Spectra of Turbulence	55
3.2.1 Description of the Method	57
3.2.2 Extension to Two Dimension Wavenumber Case	58
REFERENCES	61

CHAPTER 4 - EXPERIMENTAL RESULTS

4.1 Global Plasma Parameters	64
4.1.1 Operation and Global Plasma Parameters	64
4.1.2 Operation Limits for Probe Measurements	
of Turbulence	66
4.1.3 Global Parameters and Energy Balance	67

4.2 Edge Profiles of Mean Parameters	69
4.3 Edge Profiles of Fluctuation Levels	77
4.4 Fluctuation Spectra	85
4.4.1 Frequency Spectra	85
4.4.2 Wavenumber Spectra	87
4.5 Fluctuation Correlations and Transport	91
<i>REFERENCES</i>	103

CHAPTER 5 - DISCUSSIONS AND CONCLUSIONS 105

5.1 Discussions on Fluctuations and Transport	105
5.1.1 Electrostatic Fluctuations and Transport	105
5.1.2 Scaling Studies of Magnetic Fluctuations	108
5.1.3 Magnetic Fluctuations and Transport	113
5.1.3 Electron Heat Flux	121
5.2 Conclusions	124
<i>REFERENCES</i>	127

APPENDIX A - SEVERAL INTERESTING PHENOMENA IN RFP 131

A.1 Flux Generation and Relaxation Phenomena	131
A.2 Fluctuations, Helicity Transport and Ion Heating	133
<i>REFERENCES</i>	137

APPENDIX B - EDGE PARAMETER PROFILES 141