

Contents

1	Introduction	1
1.1	Magnetic Reconnection	1
1.1.1	Sweet-Parker Reconnection	2
1.1.2	Hall Reconnection.	3
1.1.3	Petschek Reconnection.	5
1.1.4	Open Questions	5
1.2	Particle Acceleration in Magnetic Reconnection	6
1.2.1	Acceleration Region and Acceleration Process	7
1.2.2	Acceleration Mechanism	7
1.2.3	Open Questions	11
1.3	Magnetic Cloud Boundary Layer	11
1.3.1	The Identification of MC Boundary.	12
1.3.2	Properties of the BL	12
1.3.3	Open Questions	14
1.4	Magnetic Reconnection in the Solar Wind	16
1.4.1	Structure of the Reconnection Exhaust.	16
1.4.2	Physical Properties of Magnetic Reconnections in the Solar Wind	16
1.4.3	Open Questions	17
	References	18
2	Magnetic Reconnection and the Associated Energetic Particles in the Boundary Layer.	23
2.1	Introduction	23
2.2	Analyzing Methods	23
2.2.1	LMN Coordinate.	24
2.2.2	Walen Relation.	25
2.3	Magnetic Reconnection in the BL	26
2.4	Energetic Particles Associated with Magnetic Reconnection	29
2.5	Discussion and Conclusion.	31
	References	32

3	The Acceleration of Energetic Particles in Magnetic Reconnection	35
3.1	Introduction	35
3.2	Background Description of Numerical Simulations	36
3.2.1	Different Methods of Numerical Simulations	36
3.2.2	GEM Magnetic Reconnection Challenge	37
3.3	Simulation Results	38
3.3.1	Interplanetary Magnetic Reconnection Driven by MC	38
3.3.2	Acceleration of Energetic Electrons	39
3.4	Discussion and Summary	41
	References	43
4	Proton and Electron Flux Variations in the Magnetic Cloud Boundary Layers	45
4.1	Introduction	45
4.2	The Velocity Distribution Function	45
4.2.1	Definition of the Velocity Distribution Function	45
4.2.2	The Moments of the Velocity Distribution Function	46
4.2.3	Electron Velocity Distribution Function in Solar Wind	47
4.3	Data Set Description	48
4.3.1	Instruments and Data	48
4.3.2	Event Selection	49
4.4	Statistical Results	49
4.5	Explanations for the Flux Variations at Different Energy Bands	52
4.5.1	The Core Electrons	52
4.5.2	The Suprathermal Electrons	53
4.5.3	Energetic Electrons	54
4.5.4	Protons	54
4.6	Discussion and Summary	55
	References	57
5	The Criterion of Magnetic Reconnection in the Solar Wind	59
5.1	Introduction	59
5.2	Event Selection	60
5.2.1	The Reconnection Exhaust	60
5.2.2	The MC-Driven Shock	61
5.3	Statistical Results	63
5.4	Explanations for the Flux Variations in Different Events	65
5.4.1	The Magnetic Cloud Boundary Layer and Reconnection Exhaust	65
5.4.2	The MC-Driven Shock	66

5.5 Discussion and Summary	67
References	69
6 Summary and Outlook	71
References	72