Contents

1 From Protoplanetary Disks to Planetary Disks: Gas Dispersal and Dust Growth	
<i>T. Takeuchi</i>	1
1.1 Introduction	1
1.2 A Simple Model of Protoplanetary Disks	3
1.3 Disappearance of the Gas Disks	6
1.4 Dust Motion in the Gas Disk	12
1.5 Dust Growth	19
1.6 Conclusions	27
Appendix: List of Symbols	28
References	30
2 Dynamics of Small Bodies in Planetary Systems	
<i>M.C. Wyatt</i>	37
2.1 Introduction	37
2.2 Observed Debris Disk Structures	39
2.3 Debris Disk Models	44
2.4 Interaction Between Planets and Planetesimal Belt	51
2.5 Interaction Between Planets and Dust	61
2.6 Conclusions	65
References	68
3 Asteroids and Their Collisional Disruption	
<i>A.M. Nakamura, and P. Michel</i>	71
3.1 Introduction	72
3.2 Asteroids	73
3.3 Disruption by Hypervelocity Impact	80
3.4 Impact Process on Asteroid 25413 Itokawa	89
3.5 Summary and Perspectives	92
References	93

4 On the Strength and Disruption Mechanisms of Small Bodies in the Solar System

<i>P. Michel</i>	99
4.1 Introduction	99
4.2 The Strength of Materials	101
4.3 Rotation Rates and Implications on the Strength of Small Bodies ..	108
4.4 Tidal Disruption of Small Bodies	112
4.5 Collisional Disruption of Small Bodies	118
4.6 Conclusion	125
References	126

5 Meteoroids and Meteors – Observations and Connection to Parent Bodies

<i>S. Abe</i>	129
5.1 Introduction of Meteoroids and Meteors	129
5.2 Classifications	132
5.3 Observational Techniques	137
5.4 Meteoroids to Zodiacal Clouds	141
5.5 Origin of Meteoroids	142
5.6 Meteorites' Orbits and Meteor Observation Networks	144
5.7 Meteoroid Impacts on Other Planets	148
5.8 Meteoroids Influx on the Earth	148
5.9 Spectrum and Composition of Meteoroids	150
5.10 Differential Ablation, Density, and Strength of Meteoroids	152
5.11 Organics and Water in Meteoroids	155
5.12 Association Between Comets and Asteroids Through Meteoroids ..	159
Acknowledgments	160
References	160

6 Optical Properties of Dust

<i>A. Li</i>	167
6.1 Introduction	167
6.2 Scattering of Light by Dust: A Conceptual Overview	169
6.3 Scattering of Light by Dust: Definitions	170
6.4 Scattering of Light by Dust: Dielectric Functions	174
6.5 Scattering of Light by Dust: Analytic Solutions	178
6.6 Scattering of Light by Dust: Numerical Techniques	183
References	184

7 Evolution of Dust and Small Bodies: Physical Processes

<i>I. Mann</i>	189
7.1 Introduction	189
7.2 The Stellar Environments	192
7.3 Physical Processes	198
7.4 Entry of Interstellar Matter	206
7.5 Collisional evolution	208

7.6	Second Generation Gas Components	212
7.7	Dust Lifetimes	213
7.8	Dust Rings – Rings Caused by Dust Sublimation	215
7.9	Dust Material Composition and Dust Alteration	217
7.10	Summary	223
	Acknowledgment	225
	References	225
8 Observational Studies of Interplanetary Dust		
	<i>M. Ishiguro and M. Ueno</i>	231
8.1	Introduction of Zodiacal Light	231
8.2	Dust Sources and Sinks	233
8.3	Smooth Zodiacal Cloud Components	241
8.4	Wavelength Dependency and Albedo	247
8.5	Ongoing and Future Projects	249
	References	252
9 Six Hot Topics in Planetary Astronomy		
	<i>D. Jewitt</i>	259
9.1	Introduction	259
9.2	Lightcurves and Densities	262
9.3	Color Distributions	270
9.4	Spectroscopy of Primitive Matter	272
9.5	Irregular Satellites	278
9.6	Main-Belt Comets	281
9.7	Comets and Their Debris	286
9.8	Epilogue	291
	Acknowledgments	291
	References	291
10 Detection of Extrasolar Planets and Circumstellar Disks		
	<i>Y. Itoh</i>	297
10.1	Introduction	297
10.2	Summary of Objects	297
10.3	Indirect Detection	299
10.4	Direct Detection	311
10.5	Future Prospects	319
	References	320
Index		325