
Contents

Kuiper Belt and Comets: An Observational Perspective

<i>D. Jewitt</i>	1
1 Preamble	1
1.1 The Conduct of Research into the Subject	2
2 The Modern Solar System	5
2.1 Protoplanetary Disk	5
2.2 The Three Domains	9
3 Cometary Nuclei	26
3.1 Mantles	38
4 Kuiper Belt	47
4.1 Kuiper Belt Physical Properties: Colors and Albedos	47
4.2 Kuiper Belt Physical Properties: Spectra	53
4.3 Kuiper Belt Physical Properties: Shapes, Spins	56
4.4 Kuiper Belt Physical Properties: Multiple Objects	57
4.5 Kuiper Belt Physical Properties: Densities	59
4.6 Centaurs	62
4.7 Irregular Satellites	63
4.8 Trojans	68
References	72

Comets and Their Reservoirs: Current Dynamics and Primordial Evolution

<i>A. Morbidelli</i>	79
1 The Trans-Neptunian Population	80
1.1 Brief Tutorial on Orbital Dynamics	80
1.2 The Structure of the <i>Trans</i> -Neptunian Population	84
1.3 Dynamics in the Kuiper Belt	93
1.4 Note on the Scattered Disk	100
2 The Dynamics of Comets	101
2.1 Origin and Evolution of Jupiter Family Comets	104
2.2 Origin and Evolution of Long-Period Comets	108

2.3	Note on Halley-Type Comets	113
2.4	The Fate of Faded Comets	115
3	The Formation of the Oort Cloud	117
3.1	Problems with the Classical Scenario	122
3.2	Oort Cloud Formation in a Dense Galactic Environment	124
4	The Primordial Sculpting of the Kuiper Belt	127
4.1	The Origin of the Resonant Populations	128
4.2	The Origin of the Hot Population	130
4.3	The Origin of the Outer Edge of the Kuiper Belt	132
4.4	The Mass Deficit of the Cold Population	134
4.5	Pushing out the Kuiper Belt	138
5	Origin of the Late Heavy Bombardment of the Terrestrial Planets	139
6	Building a Coherent View of Solar System History: Perspectives for Future Work	151
	References	154

Comets

<i>H. Rauer</i>	165
1 Introduction	165
2 Sublimation Processes	168
2.1 General Overview	168
2.2 Gas Sublimation and Nucleus Differentiation	170
2.3 Observations of Gas Activity Evolution	175
3 Coma and Tail Dynamics	182
3.1 Dynamics of the Neutral Coma	182
3.2 Dynamics in the Outer Coma and Neutral Gas Tails	200
3.3 Dynamics of Dust Tails	201
3.4 Dynamics of Ion Tails	204
4 Emission Excitation in the Gas Coma	208
4.1 Resonance Fluorescence	212
4.2 Prompt Emission	213
4.3 Optical Depth Effects	214
4.4 Excitation of Rotational and Vibrational Transitions	214
4.5 OH Maser Emission	216
4.6 X-ray Emission	216
5 Chemical Processes in the Coma	216
5.1 Chemistry of Some Frequently Observed Species	219
6 Gas Production Rates	224
6.1 Simple Coma Models	224
6.2 Abundance Ratios and Compositional Differences among Comets	226
6.3 Compositional Differences Among Comets	230
6.4 Isotopic Ratios	231

7	Dust Particles	233
7.1	Composition	234
7.2	Size Distribution.....	236
7.3	The Dust Production Rate.....	238
8	Outlook	240
	References	242
	Acknowledgments	255
	Index	257