## **CONTENTS**

Foreword		xiii
Pref	Preface	
	Acknowledgements	
Abbreviations used in this book		xvii xix
Introduction. Why observe the planets?		1
1	The Solar System	4
	General	4
	A scale model of the Solar System	9
	Bode's Law	10
	Kepler's Laws of Planetary Motion	11
	Elements of planetary orbits. Perturbations	12
	Planetary conjunctions, oppositions, phases and transits	12
	The sidereal and synodic orbital periods of the planets	15
	The brightness of the planets	17
	Further reading	19
2	The celestial sphere	20
	General	20
	Positions on the celestial sphere	21
	The ecliptic and the Zodiac	21
	Celestial latitude and longitude	25
	The precession of the equinoxes. Nutation	26
	Sidereal time (star time)	27
	The apparent motions of the planets on the celestial sphere	27
	Further reading	30
3	Telescopes and accessories	31
	Types of telescopes	31
	The choice of telescope	40
	Protecting the telescope from dust and atmospheric pollution	65
	Cleaning the mirror of a Newtonian reflector	66
	Housing and care of your telescope	66
	Further reading	68

## Contents

4	The atmosphere and seeing	69
	General	69
	Assessing atmospheric seeing conditions	70
	The effect of telescope aperture	70
	Local effects on seeing	71
	Further Reading	72
5	Mercury	73
	General	73
	History of observation	75
	Visibility of Mercury	82
	The axial rotation of Mercury	87
	Observing Mercury	88
	Transits of Mercury	93
	Further reading	98
6	Venus	99
	General	99
	History of observation	102
	Space probe exploration of Venus	117
	Observing Venus	120
	Transits of Venus	129
	Further reading	129
7	Mars	131
	General	131
	Orbital characteristics	132
	Predicting oppositions	134
	The retrograde motion of Mars	135
	Martian seasons	137
	Surface features	139
	Atmospheric phenomena	142
	History of observation	144
	Observing Mars	163
	Features for observation	171
	Longitude determination of Martian features	177
	Further reading	178
8	The minor planets (asteroids)	181
	General	181
	Discovery and history of observation of the minor planets	183
	Visibility of the minor planets	189
	Observing the minor planets	191
	Further reading	200
9	Jupiter	202
	General	202
	History of observation	206
	Variations in the cloud belts	216

		Contents
	Surface markings of the satellites	221
	Spacecraft observation of Jupiter	222
	Visibility of Jupiter	225
	Observing Jupiter	226
	Determination of the longitudes of Jovian features by central	
	meridian transit timings	228
	Classification and description of Jovian disc features	232
	Determination of latitudes of Jovian features	235
	Disc drawings, strip and sectional sketches	239
	Determination of rotational periods of Jovian features from	
	longitudinal drift	241
	Observations of the Great Red Spot	243
	Colour changes and intensity estimates of Jovian features	246
	General observing notes	247
	Further reading	259
10	Saturn	260
	General	260
	History of observation	264
	Spacecraft exploration of Saturn	292
	The satellites of Saturn	296
	Visibility of Saturn	298
	Observing Saturn	298
	Forthcoming oppositions of Saturn	311
	Further reading	312
11	Uranus	314
	General	314
	The discovery of Uranus	320
	Prediscovery sightings of Uranus	321
	History of observation	321
	Spacecraft exploration of Uranus	330
	Visibility of Uranus	332
	Observing Uranus	332
	Further reading	335
12	Neptune	337
	General	337
	The discovery of Neptune	337
	Prediscovery sightings of Neptune	343
	History of observation	344
	Spacecraft exploration of Neptune	348
	Visibility of Neptune	352
	Observing Neptune	352
	Further reading	353
13	Pluto	355
	General	355
	The search for a trans-Neptunian planet	355
		xi

## Contents

	The discovery of Pluto	357
	History of observation	358
	Visibility of Pluto	361
	Observing Pluto	362
	Further reading	363
14	Constructing maps and planispheres	364
	General	364
	The horizontal orthographic projection	364
	Cylindrical projections	366
	The polar projection	369
	Further reading	369
15	Planetary photography and videography	370
	General	370
	The planetary photographer's camera	370
	Choice of film	374
	Characteristics of some films	375
	Black and white film processing	375
	Photography of individual planets	375
	Exposure times	377
	Video and CCD photography (videography) of the planets	379
	Using a CCD camera	382
	Suppliers of CCD cameras	386
	Video-assisted drawing (VAD) of the planets	386
	Further reading	388
16	Photoelectric photometry of the minor planets, planets and	
	their satellites	389
	General	389
	The photoelectric photometer and its components	390
	Telescopes for photoelectric photometry	392
	Photoelectric photometric procedure	393
	Photoelectric photometry of the minor planets	393
	Colorimetric photoelectric photometry	396
	Photoelectric photometry of the planets and their satellites	396
	Further reading	398
	Name index	399
	Subject index	403