

# Contents

<b>Introduction</b> .....	<b>xv</b>
<b>Part I G as in Gaia, Galaxy, Galaxies</b>	
<b>1 Gaia in the Sky</b> .....	<b>3</b>
<b>2 The Milky Way: Our Galaxy and Its Components</b> .....	<b>7</b>
2.1 The Galaxy .....	7
2.2 The Stars .....	10
2.3 The H-R Diagram .....	15
2.4 Planets and Minor Bodies .....	19
<b>3 Galaxies Everywhere!</b> .....	<b>23</b>
3.1 From “Galaxy” to “Galaxies” .....	23
3.2 Galaxies Have a Dark Side. Or not? .....	25
3.3 Are We at the Center of a Ripping Universe?.....	31
<b>Part II A as in Astronomy and Astrometry</b>	
<b>4 History of Astronomy at a Glance</b> .....	<b>37</b>
4.1 Astronomy and Astrometry .....	37
4.2 Astrometry and Celestial Mechanics .....	39
4.3 Astrometry and Astrophysics .....	40
<b>5 Astrometry</b> .....	<b>43</b>
5.1 The What and the Why .....	43
5.2 Positions .....	43
5.3 Proper Motions .....	48
5.4 Parallaxes .....	50
5.5 Perspective Acceleration .....	57
5.6 High-Precision Astrometry .....	59

## xii Contents

<b>6</b>	<b>Global Astrometry and the Art of Celestial Map-Making</b> .....	<b>63</b>
6.1	Global Astrometry from the Ground .....	63
6.2	Global Astrometry from Space and Gaia .....	65
 <b>Part III I as in Instrumentation and Information Technology</b>		
<b>7</b>	<b>Building the Gaia Satellite</b> .....	<b>73</b>
7.1	The Spacecraft .....	73
7.2	The Service Module .....	75
7.3	The Payload Module .....	79
7.4	Astrometry Is Too Serious to Be Left (Only) to Astrometrists .....	85
<b>8</b>	<b>On the Trail of Gaia Data</b> .....	<b>91</b>
8.1	From Space to the Earth: Mission Control System .....	91
8.2	Raw, Intermediate, or Well Done: The Gaia Data Processing Consortium .....	93
8.3	The Endlessly Moving Data .....	97
8.4	Gaia Archive: The Final Destination .....	98
 <b>Part IV A as in Astronautics and Scientific Anticipation</b>		
<b>9</b>	<b>Astronautics</b> .....	<b>105</b>
9.1	Astronautics 101 .....	105
9.2	Gaia in Space .....	108
9.3	Gaia and the Astronautics of the Future .....	113
<b>10</b>	<b>The Science of Gaia: A Walkthrough</b> .....	<b>117</b>
10.1	A Satellite Filled with Promise .....	117
10.2	The Solar System .....	117
10.3	Exoplanets .....	120
10.4	Stellar Evolution .....	125
10.5	Evolution of the Milky Way .....	126
10.6	Beyond the Milky Way .....	129
10.7	Fundamental Physics .....	132
10.8	Recapping .....	135
 <b>Part V Gaia's Latest News</b>		
<b>11</b>	<b>Gaia Data Releases</b> .....	<b>139</b>
11.1	Gaia Data Made Public .....	139
11.2	Data Release 1 .....	140
11.3	Data Release 2 .....	144
<b>12</b>	<b>Selected Results</b> .....	<b>147</b>
12.1	Hunting for Science .....	147
12.2	Stellar NICUs Are Less Exclusive Than Expected .....	148

12.3	Secrets of Stellar Structures Revealed by a Tiny Gap .....	149
12.4	Shedding Light on the Milky Way's Turbulent Rendezvous .....	152
12.5	Tinkering with the Cosmic Distance Ladder .....	153
<b>References</b>	.....	<b>157</b>