

Contents

1	The Elements of a Cosmological Model	1
	References	4
2	Copernicus' Astronomical Revolution	5
2.1	<i>De Revolutionibus Orbium Coelestium</i> : A Text that Changed the Image of the Universe	7
2.1.1	Copernicus' System of the World	8
2.1.2	Copernicus' Theory of Planetary Motions	18
2.2	Epistemological and Philosophical Implications of Copernicus' Thought	21
	References	28
3	Kepler: The Cosmographer <i>Par Excellence</i>	31
3.1	Kepler and the Unity of Science: His Attempt to Unify All the Aspects of Cosmology	32
3.1.1	The Structure of the World in <i>Mysterium Cosmographicum</i>	32
3.1.2	Kinematical Aspects of Kepler's Cosmology in Connection with His Dynamical Ideas	39
3.1.3	Kepler's Concept of Force	42
3.1.4	<i>Virtus Motrix</i> and Light in Kepler's Theory: A Comparison	57
3.2	Kepler: The Role of the A Priori and the A Posteriori in the Making of Science	60
	References	69
4	Galileo and the Spread of the Copernican System	73
4.1	Galileo's Contributions to Cosmology	74
4.1.1	Discoveries in the <i>Sidereus Nuncius</i> , Sunspots, Phases of Venus	75
4.1.2	Galileo's Tides Theory	81
4.1.3	Galileo's Concept of Inertia	87

4.2	Galileo's Epistemological and Philosophical Ideas	99
	References	113
5	Descartes and the New Mechanistic Paradigm	117
5.1	Descartes: A Mechanical Model of Universe Devised Without Mathematics	118
	5.1.1 Fundamental Principles of Descartes' Physics	119
	5.1.2 The Structure of Descartes' Universe	120
	5.1.3 Commentaries	126
5.2	Philosophical Issues of Descartes' Cosmology	132
	References	145
6	Huygens: The Greatest Cartesian Scientist	147
6.1	Huygens' New Physics: Centrifugal Forces, Gravity, Nature of Motion	149
	6.1.1 <i>De Vi Centrifuga</i>	149
	6.1.2 Gravity and Centrifugal Forces	153
	6.1.3 Inertia and the Nature of Motion	162
6.2	Epistemological and Philosophical Implications of Huygens' Physics	177
	6.2.1 The Philosophy of the <i>Treatise of Light</i>	178
	6.2.2 An Overview of the Structure of Huygens' Cosmos	181
	6.2.3 The <i>Cosmotheoros</i> : The Place of Man and Earth in Huygens' Cosmos	186
	References	190
7	Newton and His System of the World	193
7.1	The Successful Synthesis of Newton's Dynamics	194
	7.1.1 Newton's Concept of Force and Mass	195
	7.1.2 The Problem of Inertia	203
	7.1.3 Newton's Experimental Philosophy and the Deduction of the Law of Universal Gravitation	235
7.2	Newton's Idea of the Universe	239
	References	247
8	Leibniz: The Philosopher-Scientist	253
8.1	Leibniz's Cosmological Ideas	254
	8.1.1 Mechanism and Gravity	254
	8.1.2 Beyond Mechanism: The Concept of <i>Vis</i>	258
	8.1.3 Leibniz's Model of the Solar System	266
8.2	The Attempt to Unify Mathematics, Metaphysics and Science in Leibniz's Cosmology	276
	References	288

Conclusion	293
Bibliography	303
Index of Names	323