TABLE OF CONTENTS

EDITORIAL INTRODUCTION	XIII
PREFACE TO THE FIRST EDITION	XV
PREFACE TO THE SECOND, ENLARGED EDITION	XVII
ACKNOWLEDGMENTS	XXI

PART I. PHILOSOPHICAL PROBLEMS OF THE METRIC OF SPACE AND TIME

Chapter 1.	Spatial and Temporal Congruence in Physics: A	
	Critical Comparison of the Conceptions of Newton,	
	Riemann, Poincaré, Eddington, Bridgman, Russell,	
	and Whitehead	3
	A. Newton	4
	B. Riemann	8
	C. Poincaré	18
	D. Eddington	24
	E. Bridgman	41
	F. Russell	44
	G. Whitehead	48
Chapter 2.	The Significance of Alternative Time Metrizations in	
	Newtonian Mechanics and in the General Theory of	
	Relativity	66
	A. Newtonian Mechanics	66
	B. The General Theory of Relativity	77
Chapter 3.	Critique of Reichenbach's and Carnap's Philosophy of	
	Geometry	81
	A. The Status of "Universal Forces"	81
	B. The "Relativity of Geometry"	98
Chapter 4.	Critique of Einstein's Philosophy of Geometry	106
-	A. An Appraisal of Duhem's Account of the Falsifi-	

PHILOSOPHICAL PROBLEMS OF SPACE AND TIME

	ability of Isolated Empirical Hypotheses in Its	
	Bearing on Einstein's Conception of the Inter-	100
	dependence of Geometry and Physics	100
	I. The I rivial validity of the D-Thesis	111
	B. The Interdependence of Geometry and Physics in	114
	Poincaré's Conventionalism	115
	C. Critical Evaluation of Einstein's Conception of the Interdependence of Geometry and Physics: Physi- cal Geometry as a Counter-Example to the Non-	
	Trivial D-Thesis	131
Chapter 5.	Empiricism and the Geometry of Visual Space	152
Chapter 6.	The Resolution of Zeno's Metrical Paradox of Exten- sion for the Mathematical Continua of Space and	
	Time	158
P	PART II, PHILOSOPHICAL PROBLEMS OF THE	•
	TOPOLOGY OF TIME AND SPACE	
Chapter 7	The Coursel Theorem of Theorem	1 50
Chapter 7.	The Causal Theory of Time	179
Chapter 7.	A. Closed Time	179 197
Chapter 7.	A. Closed Time B. Open Time	179 197 203
Chapter 8.	A. Closed Time B. Open Time The Anisotropy of Time	179 197 203 209
Chapter 8.	 A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Aniso- 	179 197 203 209
Chapter 8.	 A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? 	179 197 203 209 209
Chapter 8.	 A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? I. The Entropy Law of Classical Thermodynamics 	179 197 203 209 209 219
Chapter 8.	 A. Closed Time A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? I. The Entropy Law of Classical Thermodynamics II. The Statistical Analogue of the Entropy Law 	179 197 203 209 209 219 236
Chapter 8.	 A. Closed Time A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? I. The Entropy Law of Classical Thermodynamics II. The Statistical Analogue of the Entropy Law B. Are There Non-Thermodynamic Foundations for 	179 197 203 209 209 219 236
Chapter 8.	 A. Closed Time A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? I. The Entropy Law of Classical Thermodynamics II. The Statistical Analogue of the Entropy Law B. Are There Non-Thermodynamic Foundations for the Anisotropy of Time? 	179 197 203 209 209 219 236 264
Chapter 8. Chapter 9.	 A. Closed Time A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? I. The Entropy Law of Classical Thermodynamics II. The Statistical Analogue of the Entropy Law B. Are There Non-Thermodynamic Foundations for the Anisotropy of Time? The Asymmetry of Retrodictability and Predicta- 	179 197 203 209 209 219 236 264
Chapter 9.	 A. Closed Time A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? I. The Entropy Law of Classical Thermodynamics II. The Statistical Analogue of the Entropy Law B. Are There Non-Thermodynamic Foundations for the Anisotropy of Time? The Asymmetry of Retrodictability and Predictability, the Compossibility of Explanation of the Past 	179 197 203 209 209 219 236 264
Chapter 8. Chapter 9.	 A. Closed Time A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? I. The Entropy Law of Classical Thermodynamics II. The Statistical Analogue of the Entropy Law B. Are There Non-Thermodynamic Foundations for the Anisotropy of Time? The Asymmetry of Retrodictability and Predictability, the Compossibility of Explanation of the Past and Prediction of the Future, and Mechanism vs. 	179 197 203 209 219 236 264
Chapter 9.	 A. Closed Time A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? The Entropy Law of Classical Thermodynamics The Entropy Law of Classical Thermodynamics The Statistical Analogue of the Entropy Law B. Are There Non-Thermodynamic Foundations for the Anisotropy of Time? Analogue of the Entropy Law Are There Non-Thermodynamic Foundations for the Anisotropy of Time? The Asymmetry of Retrodictability and Predictability, the Compossibility of Explanation of the Past and Prediction of the Future, and Mechanism vs. Teleology 	179 197 203 209 219 236 264 281
Chapter 9.	 A. Closed Time A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? I. The Entropy Law of Classical Thermodynamics II. The Statistical Analogue of the Entropy Law B. Are There Non-Thermodynamic Foundations for the Anisotropy of Time? The Asymmetry of Retrodictability and Predictability, the Compossibility of Explanation of the Past and Prediction of the Future, and Mechanism vs. Teleology A. The Conditions of Retrodictability and Non- 	179 197 203 209 219 236 264 281
Chapter 8.	 A. Closed Time A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? I. The Entropy Law of Classical Thermodynamics II. The Statistical Analogue of the Entropy Law B. Are There Non-Thermodynamic Foundations for the Anisotropy of Time? The Asymmetry of Retrodictability and Predictability, the Compossibility of Explanation of the Past and Prediction of the Future, and Mechanism vs. Teleology A. The Conditions of Retrodictability and Non-Predictability 	179 197 203 209 219 236 264 281 281
Chapter 8.	 A. Closed Time A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? The Entropy Law of Classical Thermodynamics The Entropy Law of Classical Thermodynamics The Statistical Analogue of the Entropy Law B. Are There Non-Thermodynamic Foundations for the Anisotropy of Time? The Asymmetry of Retrodictability and Predictability, the Compossibility of Explanation of the Past and Prediction of the Future, and Mechanism vs. Teleology A. The Conditions of Retrodictability and Non-Predictability B. The Physical Basis for the Anisotropy of Psycho- 	179 197 203 209 219 236 264 281 281
Chapter 9.	 A. Closed Time A. Closed Time B. Open Time The Anisotropy of Time A. Is There a Thermodynamic Basis for the Anisotropy of Time? The Entropy Law of Classical Thermodynamics The Entropy Law of Classical Thermodynamics The Statistical Analogue of the Entropy Law B. Are There Non-Thermodynamic Foundations for the Anisotropy of Time? The Asymmetry of Retrodictability and Predictability, the Compossibility of Explanation of the Past and Prediction of the Future, and Mechanism vs. Teleology A. The Conditions of Retrodictability and Non-Predictability B. The Physical Basis for the Anisotropy of Psychological Time 	179 197 203 209 219 236 264 281 281 281

VIII

	C. The Bearing of Retrodictability and Non-Predict-	
	ability on the Compossibility of Explainability and	
	Predictability	290
	I. Evolutionary Theory	300
	II. The Paresis Case	303
	III. The Barometer Case	309
	D. The Controversy Between Mechanism and Tele-	
	ology	311
Chapter 10.	Is There a "Flow" of Time or Temporal "Becoming"?	314
Chapter 11.	Empiricism and the Three-Dimensionality of Space	330
	PART III. PHILOSOPHICAL ISSUES IN THE THEORY OF RELATIVITY	
Chapter 12.	Philosophical Foundations of the Special Theory of	
1	Relativity, and Their Bearing on Its History	341
	A. Introduction	341
	B. Einstein's Conception of Simultaneity, Its Preva-	
	lent Misrepresentations, and Its History	342
	C. History of Einstein's Enunciation of the Limiting	
	Character of the Velocity of Light in vacuo	369
	D. The Principle of the Constancy of the Speed of	
	Light, and the Falsity of the Aether-Theoretic	
	Lorentz-Fitzgerald Contraction Hypothesis	386
	E. The Experimental Confirmation of the Kinematics	
	of the STR	397
	F. The Philosophical Issue Between Einstein and His	
	Aether-Theoretic Precursors, and Its Bearing on	
	E. T. Whittaker's History of the STR	400
Chapter 13.	Philosophical Appraisal of E. A. Milne's Alternative	
	to Einstein's STR	410
Chapter 14.	Has the General Theory of Relativity Repudiated	
	Absolute Space?	418
Chapter 15.	Philosophical Critique of Whitehead's Theory of	40-
	Relativity	425
BIBLIOGRA	PHY FOR THE FIRST EDITION	429

IX

PART IV. SUPPLEMENTARY STUDIES 1964-1973

1. Supplement to Part I

Chapter 16.	Space, Time and Falsifiability (First Installment)	449
	Abstract	449
	Introduction	450
	Criteria for Intrinsicness vs. Extrinsicness of Metrics	
	and of Relations on Manifolds: Contents	457
	1. Singly and Multiply Extended Manifolds	458
	2. Intrinsicness vs. Extrinsicness of Metrics, Metrical	
	Equalities, and Congruences	468
	3. What are the Logical Connections, if any, between	
	Alternative Metrizability, Intrinsic Metric Amor-	
	phousness, and the Convention-ladenness of Metr-	
	ical Comparisons?	547
	4. Intrinsicness and Extrinsicness of a Relation on a	
	Manifold	563
Chapter 17.	Can We Ascertain the Falsity of a Scientific Hypoth-	
	esis?	569
	1. Introduction	569
	2. Purported Disproofs of Hypotheses in Biology and	
	Astronomy	572
	3. Is it NEVER Possible to Falsify a Hypothesis	
	Irrevocably?	585
Chapter 18.	Can an Infinitude of Operations Be Performed in a	
	Finite Time?	630
	2. Supplement to Part II	
Chapter 19.	Is the Coarse-Grained Entropy of Classical Statistical	
*	Mechanics an Anthropomorphism?	646
	1. Introduction	646

- 2. Entropy Change and Arbitrariness of the Partitioning of Phase Space 648
- 3. What is the Physical Significance of the Triple Role of the Entropy for the Entropy Statistics in the Class U?659

<i>Tuble of Contents</i>	T	able	of	Contents
--------------------------	---	------	----	----------

	4. Do the Roles of Human Decision and Ignorance Impugn the Physical Significance of the Entropy Statistics for the Class U?	663
	3. Supplement to Part III	
Chapter 20.	 Simultaneity by Slow Clock Transport in the Special Theory of Relativity Introduction (co-authored with Wesley C. Salmon) 1. Summary 2. Examination of Ellis and Bowman's Account of Nonstandard Signal Synchronizations 	666 666 670 671
	3. The Philosophical Status of Simultaneity by Slow Clock Transport in the Special Theory of Rela- tivity	683
Chapter 21.	 The Bearing of Philosophy on the History of the Special Theory of Relativity 1. History and Pedagogy of the Light Principle 2. Contraction and Time-Dilation Hypotheses 3. Summary General Relativity, Geometrodynamics and Ontology 1. Introduction 2. The Philosophical Status of the Metric of Space-Time in the General Theory of Relativity 3. The Ontology of Empty Curved Metric Space in the Geometrodynamics of Clifford and Wheeler 4. The Time-Orientability of Space-Time and the 'Arrow' of Time 	709 711 715 726 728 728 730 750 788
APPENDIX		804
INDEX OF I	PERSONAL NAMES – Compiled by Mr. Theodore C. Falk	857
INDEX OF S	SUBJECTS – Compiled by Mr. Theodore C. Falk	865