Advanced Series on Theoretical Physical Science

Volume



## LORENTZ AND POINCARÉ INVARIANCE

**100 YEARS OF RELATIVITY** 

Jong-Ping Hsu Yuan-Zhong Zhang

**World Scientific** 

## **CONTENTS**

Preface Acknowledgements		
Remarks on the Development of the Lorentz and Poincaré Invariance	xvii xxi	
Part I. Theoretical Implications of Lorentz and Poincaré Invariance	1	
1. The Dawn of Lorentz and Poincaré Invariance (1887-1905)	3	
First Proposal of the Universal Speed of Light by Voigt in 1887 A. Ernst and JP. Hsu	4	
The Ether and the Earth's Atmosphere G. F. FitzGerald	25	
General Problem of Moving Matter Treated in Relation to the Individual Molecules J. Larmor	27	
Moving Material System: Approximation Carried to the Second Order (Extract)  J. Larmor	39	
In Pursuit of the Electrodynamics for Moving Bodies JP. Hsu and T. Kleinschmidt	43	
2. Special Relativity and its 4-Dimensional Symmetry (1904-1908)	55	
Electromagnetic Phenomena in a System Moving with any Velocity less than that of Light (Extract)  H. A. Lorentz	56	
Poincaré's Rendiconti Paper on Relativity. Part I H. M. Schwartz	76	
On the Electrodynamics of Moving Bodies A. Einstein	116	
The Principle of Relativity and the Fundamental Equations of Mechanics	143	
M. Planck Space and Time H. Minkowski	147	
The Theory of Relativity and Science (Extract)  W Pauli	162	

Einstein's First Paper on Relativity H. M. Schwartz	164	
	On the Origins of the Special Theory of Relativity (Extract) G. Holton	183
3.	Inquiries Regarding the Constancy of the Speed of Light (1908-1910)	193
	The Postulate of the Constancy of the Speed of Light. Ritz's and Related Theories (Extract) W. Pauli	194
	Critical Researches on General Electrodynamics (Extract) W. Ritz	196
4.	Extended Relativity and its 4-Dimensional Symmetry (1928-1997)	217
	The Philosophy of Space and Time: Simultaneity (Extract) H. Reichenbach	218
	Special Relativity in Anisotropic Space W. F. Edwards	226
	Four-Dimensional Symmetry of Taiji Relativity and Coordinate Transformation Based on a Weaker Postulate for the Speed of Light I  L. Hsu, JP. Hsu and D. A. Schneble Four-Dimensional Symmetry of Taiji Relativity and Coordinate Transformation Based on a Weaker Postulate for the Speed of Light II	243 258
	JP. Hsu and L. Hsu	256
5.	The Splendid Union of Special Relativity and Quantum Mechanics (1927-1949)	273
	The Quantum Theory of the Emission and Absorption of Radiation P. A. M. Dirac	274
	The Quantum Theory of the Electron P. A. M. Dirac	297
	The Radiation Theories of Tomonaga, Schwinger, and Feynman (with commentary)  F. J. Dyson	316

6.	The Lorentz and Poincaré Groups and Their Implications (1939)	337
	Symmetries, Quantum Lorentz Transformation and the Poincaré Algebra S. Weinberg	338
	Lorentz Group in Feynman's World  Wigner's Little Groups and Their Applications Y. S. Kim and M. E. Noz	351
7.	The Isotropy of the Speed of Light c: A Convenient Assumption (1963-1995)	377
	Test Theories of Special Relativity Y. Z. Zhang	378
8.	Common Relativity and its 4-Dimensional Symmetry (1976-1983)	397
	Common Time in a Four-Dimensional Symmetry Framework JP. Hsu and T. N. Sherry	398
	Questions on Universal Constants and Four-Dimensional Symmetry from a Broad Viewpoint - I JP. Hsu	418
	News and Views (Extract) (On Common Time and Common Relativity) Nature Editorial	434
9.	The Aether and Relativistic Quantum Fields (~1970)	437
	Is There an Aether? P. A. M. Dirac	438
	Vacuum as the Source of Asymmetry T. D. Lee	441
	The New Ether J. D. Bjorken	453
10	The Logically Simplest Theory of Relativity and its 4-Dimensional Symmetry (1990-1994)	469
	Can One Derive the Lorentz Transformation from Precision Experiments?  L. Hsu	470
	A Physical Theory Based Solely on the First Postulate of Relativity	494

## xvi Lorentz and Poincaré Invariance

Par	II. Experiments for Lorentz and Poincaré Invariance	507
11.	The Fizeau Experiment	509
12.	The Michelson-Morley Experiment	513
13.	The Wilson-Wilson Experiment	521
14.	The Kennedy-Thorndike Experiment	527
15.	The Ives-Stilwell Experiment	531
16.	The Observation of the Muon Lifetime Dilation	537
17.	"Experimental Tests" of the Second Postulate of Special Relativity	541
18.	The Mass-Velocity Relation Experiment	549
19.	The Mass-Energy Relation Experiment	555
20.	The Thomas Precession Experiment	561
<b>A</b> p	endices	567
A.	Woldemar Voigt (1850-1919) Von C. Runge	568
B.	George Francis FitzGerald (1851-1901) JP. Hsu	570
<b>C</b> .	Abbreviated Biographical Sketch of Walter Ritz (1878-1909)  R. S. Fritzius	572
D.	Hans Reichenbach (1891-1953): Principal Dates M. Reichenbach	574
E.	The Most General Linear-Acceleration Transformation of Spacetime Based on Limiting 4-Dimensional Symmetry JP. Hsu	575