

Paul S Wesson.

Five-Dimensional Physics

Classical and Quantum Consequences of Kaluza-Klein Cosmology

CONTENTS

	Preface	V
1.	HIGHER-DIMENSIONAL PHYSICS	1
1.1	Introduction	1
	Dimensions Then and Now	2
_	Higher-Dimensional Theories	6
	Field Equations in $N \ge 4$ Dimensions	10
	A Primer on Campbell's Theorem	24
1.6	Conclusion	28
2.	THE BIG BANG REVISITED	34
2.1	Introduction	34
2.2	Flat 5D Universes	35
2.3	The Singularity as a Shock Wave	43
	A Bounce Instead of a Bang	47
	The Universe as a 5D Black Hole	54
2.6	Conclusion	60
3.	PATHS IN HYPERSPACE	64
3.1	Introduction	64
3.2	Dynamics in Spacetime	65
	Fifth Force from Fifth Dimension	70
3.4	Null Paths and Two Times	77
3.5	The Equivalence Principle as a Symmetry	81
3.6	Particle Masses and Vacua	90
3.7	Conclusion	95
4.	QUANTUM CONSEQUENCES	100
4.1	Introduction	100
4.2	4D Uncertainty from 5D Determinism	102
	Is Mass Quantized?	107
	The Klein-Gordon and Dirac Equations	112

x Five-Dimensional Physics

4.5	Gauges and Spins	119
4.6	Particles and Waves: A Rapprochement	124
4.7	Conclusion	129
5.	THE COSMOLOGICAL "CONSTANT" AND VACUUM	134
5.1	Introduction	134
	The 5D Cosmological "Constant"	138
	Astrophysical Consequences	150
5.4	Vacuum Instability	158
5.5	Mach's Principle Anew	162
5.6	Conclusion	165
6.	EMBEDDINGS IN $N \ge 5$ DIMENSIONS	170
6.1	Introduction	170
6.2	Embeddings and Physics	171
6.3	The Algebra of Embeddings	174
	The Campbell-Magaard Theorem	182
	Induced-Matter Theory	187
	Membrane Theory	191
	Conclusion	198
7.	PERSPECTIVES IN PHYSICS	202
	Index	221