
Contents

Part I Mathematical Prerequisite

1	Basic Geometrical Concepts	3
1.1	Basic Definitions	3
1.2	The Metric Tensor In General Relativity	6
1.3	Rotating Metric Vector	8
1.4	Rotating Metric Vector	12
1.5	Summary	18
A	The Rank-Three And Rank-Four Totally Antisymmetric Unit Tensor	21
2	Duality and the Antisymmetric Metric	23
2.1	Euclidean Spacetime. Special Relativity	23
2.2	Non-Minkowski Spacetime. General Relativity	26
2.3	Field Equation For Gravitation And Electromagnetism	33
2.4	Parity Violating Fields: Comparison With The Sachs Theory ..	38
2.5	The Field Equation (2.70) As An Eigenequation Or Wave Equation	42
	References	49

Part II Developed Theory

3	A Generally Covariant Field Equation For Gravitation And Electromagnetism	53
3.1	Introduction	53
3.2	Fundamental Geometrical Concepts	54
3.3	The Generally Covariant Field Equation	56
3.4	Discussion	58

References	61
4 A Generally Covariant Wave Equation For Grand Unified Field Theory	63
4.1 Introduction	64
4.2 Derivation Of The Generally Covariant Wave Equation	67
4.3 Fundamental Equations In Terms Of The Metric Vector	70
4.4 Derivation Of The Poisson And Newton Equations	72
4.5 Some Fundamental Equations Of Physics Derived From The Wave Equation	78
4.6 Discussion	88
References	95
5 The Equations of Grand Unified Field Theory In Terms Of the Maurer-Cartan Structure Relations of Differential Geometry	97
5.1 Introduction	97
5.2 The Tetrad In Generally Covariant (O(3)) Electrodynamics ...	99
5.3 GUFT As Differential Geometry: Evans Equations And The Maurer-Cartan Structure Relations	103
5.4 Inter-Relation Of Fields: The Poisson Equation And Other Results	107
5.5 Discussion	115
References	117
6 Derivation Of Dirac's Equation From The Evans Wave Equation	119
6.1 Introduction	119
6.2 Derivation of the Dirac Equation of General Relativity	121
6.3 Derivation Of The Dirac Equation of Special Relativity	127
6.4 The Dirac Matrices as Eigenfunctions	129
6.5 A Fundamental Paradox In Clifford Algebra	131
6.6 Discussion	133
References	135
7 Unification Of Gravitational And Strong Nuclear Fields ...	137
7.1 Introduction	137
7.2 Derivation Of The Quark Color Triplet	140
References	145

8	Derivation Of The Evans Wave Equation <i>From</i> The Lagrangian And Action: Origin Of The Planck Constant In General Relativity	147
8.1	Introduction	147
8.2	The Lagrangian Density And Action Of The Evans Wave Equation	148
8.3	Phase Factor, Topological Effects, And Origin Of The Planck Constant In General Relativity	150
8.4	Unification Of The Fermat And Hamilton Principles In The Principle of Least Curvature, Derivation Of Wave Particle Duality And Quantum Mechanics From General Relativity	166
	References	169
9	The Evans Lemma Of Differential Geometry	171
9.1	Introduction	171
9.2	Proof Of the Evans Lemma	173
9.3	Gauge Invariant Fields, Duality Equations, Inhomogeneous Field Equation, And The Class Of Evans Equations For All Differential Forms	180
	References	193
10	Physical Optics, The Sagnac Effect, And The Aharonov-Bohm Effect In The Evans Unified Field Theory	195
10.1	Introduction	195
10.2	Shortcomings Of The Maxwell-Heaviside Field Theory In Physical Optics	196
10.3	Generally Covariant Phase Factor From The Evans Unified Field Theory	199
10.4	Reflection And Michelson Interferometry	205
10.5	The Sagnac Effect	206
10.6	The Aharonov-Bohm Effect	209
10.7	Gauge Invariance Of The Phase Law (10.32)	211
A	The Sagnac Effect As A Change In Tetrad	215
	References	217
11	Derivation Of The Geometrical Phase From The Evans Phase Law Of Generally Covariant Unified Field Theory	219
11.1	Introduction	219
11.2	Derivation Of The Tomita-Chiao Effect From The Evans Phase Law	220
11.3	Derivation Of The Berry Phase From The Evans Phase	223

References	227
------------------	-----

12 Derivation Of The Lorentz Boost From The Evans Wave Equation	229
12.1 Introduction	229
12.2 Derivation Of The Dirac Spinor And The Dirac Wave Equation From Evans' Theory	232
12.3 Derivation Of The Dirac Equation As A First-Order Differential Equation	236
12.4 Derivation Of The Lorentz Boost	238

References	241
------------------	-----

13 The Electromagnetic Sector Of The Evans Field Theory ...	243
13.1 Introduction	243
13.2 Equations Of The Electromagnetic Sector Of Evans' Field Theory	243
13.3 Experimental Tests Of The Evans Theory	252

References	257
------------------	-----

14 New Concepts From The Evans Unified Field Theory. Part One: The Evolution Of Curvature, Oscillatory Universe Without Singularity, Causal Quantum Mechanics, And General Force And Field Equations	259
14.1 Introduction	259
14.2 The Evolution Equations Of R And T	261
14.3 General Wave, Field And Force Equations Of The Evans Theory	267

References	273
------------------	-----

15 New Concepts From The Evans Unified Field Theory, Part Two: Derivation Of The Heisenberg Equation and Replacement Of The Heisenberg Uncertainty Principle ...	275
15.1 Introduction	275
15.2 Derivation of the Heisenberg Equation	278
15.3 Replacement of the Heisenberg Uncertainty Principle	289

References	293
------------------	-----

16 Development Of The Evans Wave Equations In The Weak-Field Limit: The Electrogravitic Equation	295
16.1 Introduction	295
16.2 Derivation of the Electrogravitic Equation	296
16.3 Discussion	297

References	299
17 The Spinning and Curving of Spacetime: The Electromagnetic and Gravitational Fields In The Evans Unified Field Theory	301
17.1 Introduction	301
17.2 The Fundamental Equations	304
17.3 Limiting Forms of the Evans Field	305
17.4 Consequences for Evolutionary Theory and New Technology ..	311
A The First Maurer-Cartan Structure Relation	315
B The Second Maurer-Cartan Structure Relation	317
C The First Bianchi Identity	321
D The Second Bianchi Identity	325
References	327
18 Derivation of O(3) Electrodynamics from Generally Covariant Unified Field Theory	329
18.1 Introduction	329
18.2 The Fundamental Geometrical Equations of the Unified Field Matter Theory	330
18.3 The Equations of O(3) Electrodynamics	332
References	343
19 The Derivation of O(3) Electrodynamics from The Evans Unified Field Theory	345
19.1 Introduction	345
19.2 The Limit of O(3) Electrodynamics	346
19.3 Discussion	348
References	353
20 Calculation of the Anomalous Magnetic Moment of the Electron from the Evans-Unified Field Theory	355
20.1 Introduction	355
20.2 Vacuum or Zero-point Energy in the Evans Theory	356
20.3 Criticisms of Quantum Electrodynamics	361
20.4 Discussion	362
References	365

21	Generally Covariant Electro-Weak Theory	367
	21.1 Introduction	367
	21.2 The Evans Electro-Weak Theory	370
	21.3 Discussion	382
	References	387
22	Evans Field Theory of Neutrino Oscillations	389
	22.1 Introduction	389
	22.2 The Mixing of Neutrino Wavefunctions Due to the Evans Phase	390
	22.3 Origin of the Evans Phase in General Relativity	393
	References	395
23	The Interaction of Gravitation and Electromagnetism	397
	23.1 Introduction	397
	23.2 The First Bianchi Identity of Differential Geometry and the Homogeneous Evans Field Equation	398
	23.3 Discussion	401
	References	405
24	The Fundamental Invariants of the Evans Field Theory	407
	24.1 Introduction	407
	24.2 The Structure and Identity Invariants of Differential Geometry	408
	24.3 The Inverse Structure Theorem	412
	24.4 The Aharonov Bohm Effects	413
	24.5 Derivation of the Heisenberg Equation of Motion and Origin of the Planck Constant	417
	References	423
25	Electromagnetic Energy from Gravitation	425
	25.1 Introduction	425
	25.2 Development of the Hodge Dual of the Homogeneous Equation of Evans Field Theory	426
	25.3 Eddington Type Experiment	431
	References	433
26	The Homogeneous and Inhomogeneous Evans Field Equations	435
	26.1 Introduction	435
	26.2 Development Of The Current Terms j and J	437
	26.3 Discussion Of The Interaction Of Electromagnetism and Gravitation	441

References	443
27 Derivation of the Gauss Law of Magnetism, The Faraday Law of Induction, and O(3) Electrodynamics from The Evans Field Theory	445
27.1 Introduction	445
27.2 Geometrical Condition Needed for the Gauss Law of Magnetism and the Faraday Law of Induction and Derivation of O(3) Electrodynamics	446
27.3 Numerical Methods of Solutions	451
References	459

Part III Technical References

A Evans Reference Charts	463
A.1 Evans Unified Field Theory	463
A.2 Evans Unified Field Theory	464
A.3 Evans Unified Field Theory	465
A.4 Table: Field Theories of General Relativity	466
A.5 Development of Maxwell-Heaviside Field Theory Into Generally Covariant Electrodynamics	467
A.6 Evans Unified Field Theory	468
B Standard Tensor Formulation of the Inhomogeneous and Homogeneous Maxwell-Heaviside Field Equations	469
B.1 Inhomogeneous Field Equation	469
B.1.1 Coulomb's Law ($\nu = 0$)	469
B.1.2 Ampère-Maxwell Law ($\nu = 1, 2, 3$)	469
B.1.3 Coulomb Law	469
B.1.4 Ampère-Maxwell Law	470
B.2 Homogeneous Field Equation	470
B.2.1 The Gauss Law ($\nu = 0$)	471
B.2.2 The Faraday Law of Induction ($\nu = 1, 2, 3$)	471
B.3 Overall Result	471
B.3.1 Differential Form Notation	472
B.3.2 Evans Unified Field Theory	472
B.4 Units and Constants	472
B.5 Notes	472
C The Complex Circular Basis	475
C.1 O(3) Electrodynamics	476
C.2 Notes and References	477
D The AntiSymmetric Metric	479

E	Tensorial Structure of the Inhomogeneous Field Equations (IE)	483
	E.1 Introduction (HE & IE)	483
	E.2 The Coulomb Law ($\nu = 0$)	484
	E.2.1 Notes on the Coulomb Law	485
	E.3 The Ampère Maxwell Law ($\nu = 1,2,3$)	486
	E.3.1 Notes on the Ampère Maxwell Law	486
F	Some Notes On The I.E. (Inhomogeneous Evans Field Equation)	487
	F.1 Introduction	487
	F.2 The Coulomb Law in the Evans field Theory	493
	F.3 Discussion	494
G	O(3) Electrodynamics From General Relativity and Unified Field Theory	495
	G.1 Introduction	495
	G.1.1 Homogeneous Field Equation (HE)	495
	G.1.2 Inhomogeneous Field Equation (IE)	495
H	Illustration That The Evans Field Theory is Completely Determined Mathematically	501
I	A Summary of the Evans Field Theory	505
	I.1 The Homogeneous Field Equation	505
	I.2 Hodge Dual of the Homogeneous Field Equation	506
	I.3 The Inhomogeneous Field Equation	507
	I.3.1 The Standard Model	507
	I.4 Summary of the Unified Field Theory	508
	I.5 Einstein Field Theory of Gravitation	509
	I.6 Maxwell-Heaviside Field Theory of Electromagnetism	510
J	Mathematical Proofs	511
	J.1 The Free Space Condition	511
	J.2 The Tetrad Postulate	512
	J.3 The Evans Lemma	514
K	The Four Fundamental Laws of Electrodynamics In The Unified Field Theory: Vector Notation	515
	K.1 The Inhomogeneous Laws	515
	K.2 Coulomb Law ($\nu = 0, \mu = 1, 2, 3$)	515
	K.3 Ampère Maxwell law ($\nu = 1, 2, 3$)	515
	K.4 The Gauss Law of Magnetism	516
	K.5 The Faraday Law of Induction	516
	K.6 Simplification Of The IE	517

K.7 Derivation of The Coulomb Law From The Evans Unified Field Theory.....	518
K.7.1 Tensor Notation.....	518
K.7.2 Vector Notation.....	519
Index	521