Contents

Preamble III
Symbology XIII
Introduction XVII

CHAPTER 1

Where is Physics Today? – Synthetic Overview of the State of the Art of Physics Today 1
1.1 Introduction 1
1.2 Newton's Gravitation 2
1.3 Electromagnetism/GravitoElectroMagnetism 2
1.4 Special Relativity 5
1.5 General Relativity 8
1.6 Black Holes 10
1.7 Gravitational Waves 12
1.8 Quantum Mechanics 13
1.9 Highlighting the Differences between the Two Pillars of Physics 33
1.10 Nature Plays with Our Senses 35
1.11 How to Reconcile the Two Physics 37

CHAPTER 2

First Ask the Right Question 41
2.1 What is the State of the Art and the Issues that Arise from It? 41
2.2 What is the Nature of Space-Time? 42
2.3 Can Einstein's Equation be Reconstructed without Passing through Newton's Weak Field Limits? Without Using G? 42
2.4 What Brings Us Contemporary Data of the Vacuum? 44
2.5 Space-Time as a Physical Object an Elastic Medium 45

CHAPTER 3

A Strange Analogy between S. Timoshenko's Beam Theory and General Relativity 47
3.1 Introduction 47
3.2 Generalities on General Relativity 48
3.3 Analogy between Beam Theory and General Relativity from the Point of View of the General Principle Curvature = $K \times$ Energy Density 50
3.4 Analogy between the Definition of Curvature in Strength of Material and General Relativity 54
3.5 Extension of Curvature to Other Strength of Material Solicitations . . . 57
3.6 Analysis of Einstein's Equation Applied to the Entire Universe (Case of Cosmology) 59
3.7 Conclusions 63

CHAPTER 4

The Stress Energy Tensor in Theory of General Relativity and the Stress Tensor in Elasticity Theory are Similar 65
4.1 Definition of the Stress Energy Tensor in General Relativity 65
4.2 Definition of Stress Tensor in Elasticity Theory 66
4.3 Demonstration of the Correlation between the Stress Tensor and the Stress Energy Tensor 66

CHAPTER 5

Relationship between the Metric Tensor and the Strain Tensor in Low Gravitational Field 71
5.1 Introduction 71
5.2 Definition of Strain Tensor 71
5.3 Determination of the Link between the Metric and the Strain 73

CHAPTER 6

Relationship between the Stress Tensor and the Strain Tensor in Elasticity (K) and between the Curvature and the Stress Energy Tensor (κ) in General Relativity in Weak Gravitational Fields 79
6.1 Reminder of Results 80
6.2 Some Reminders about the Elasticity Theory 80
6.3 Highlighting the Parallelism between Elasticity Theory and General Relativity 81
6.4 Consequence of Parallelism and Transversalism between the Elasticity Theory and General Relativity 83

CHAPTER 7

Can Space-be Considered as an Elastic Medium? New Ether? 85
7.1 The Conclusions of Michelson and Morley's Experiment 85
7.2 Einstein's View of the Ether 86
7.3 Observations Made Demonstrate the Elastic Behaviour of Space-Time 86
7.4 Consequence of Measurements 91

CHAPTER 8

And if We Reconstructed the Formula of Einstein's Gravitational Field by No Longer Considering the Temporal Components of the Tensors, but the Spatial Components 93
8.1 Let Us Step Back from Gravitation According to Newton 93
8.2 The Strengths and Weaknesses of Newton's Gravitational Approach . . 94
8.3 G a Gravitational Constant of Strange Dimensions as a Combination of Underlying Parameters 95
8.4 How to Re-parameterize κ in Einstein's Gravitational Field Equation . . 96
8.5 The Strengths and Weaknesses of Gravitation According to Einstein . . . 97
8.6 Approach to Reconstructing General Relativity from the Elasticity Theory 98

CHAPTER 9

Re-interpretation of the Results of the Theoretical Calculation of General Relativity on Gravitational Waves in Weak Field from the Windows of Elasticity Theory 99
9.1 Introduction 101
9.2 Re-interpretation of the 2 Gravitational Wave Polarizations in Terms of Space Deformation Tensors in the Sense of Elasticity Theory 101
9.3 Consequence in Terms of Oscillating Waves in the Arms of Interferometers 107
9.4 Expression of Einstein's Linearized Gravitational Equation in the Form of Strains 110

CHAPTER 10

Determination of Poisson's Ratio of the Elastic Space Material 113
10.1 Introduction 113
10.2 First Approach: Analysis of the Movements of Particles Positioned in Space on a Circle Undergoing the Passage of a Gravitational Wave 114
10.3 Second Approach: In the z Direction, the Gravitational Wave is a Transverse Wave and is Not a Compression Wave 114
10.4 Third Approach: Based on Available Datas 115

CHAPTER 11

Dynamic Study of the Elastic Space Strains in an Arm of an Interferometer . . . 117
11.1 Study of an Interferometric Arm Subjected to Gravitational Waves Causing Compressions and Tractions of the Volume of Empty Space within It . . . 117
11.1.1 Assumptions . . . 117
11.1.2 Determination of Tensorial Equations Associated with Each Arm of the Interferometer . . . 119

CHAPTER 12

Dynamic Study of Simultaneous Elastic Space Strains in the 2 Arms of an Interferometer . . . 125
12.1 Study of Two Interferometric Arms Subjected to Gravitational Waves Resulting in Compression/Traction of the Volume of Space within Them . . . 126
12.1.1 Assumptions . . . 126
12.1.2 Determination of Tensorial Equation Associated with the Two Arms of the Interferometer . . . 127

CHAPTER 13

Study of an Elastic Space Cylinder Twisted by the Coalescence of Two Black Holes . . . 137
13.1 Study of a Vertical Space Cylinder in Pure Twisting – Use of Shear Speed of the Shear Wave Correlated with the Shear Strains . . . 138
13.1.1 Assumptions . . . 138
13.1.2 Determination of Tensorial Equation Associated with Twisting Space Tube . . . 139

CHAPTER 14

New Mechanical Expression of Einstein's Constant κ . . . 147
14.1 Steps to Obtain the Mechanical Conversion of κ . . . 148
14.2 Case where We Consider Only One Interferometer Arm . . . 148
14.3 Cases where the Two Arms of the Interferometer and Poisson's Ratio are Considered . . . 149
14.4 Case of a Pure Torsion of Space Tube . . . 149

CHAPTER 15

Vacuum Data . . . 151
15.1 Physical Approach or Mathematical Artifact? . . . 151
15.2 The Vacuum Energy . . . 152
15.3 Consistency of Results with Vacuum Data . . . 152

CHAPTER 16

Calibrating the New Mechanical Expression of κ with the Vacuum Data 155
16.1 Numerical Application to Vacuum Energy – Longitudinal Waves in Interferometric Tubes 156
16.1.1 Theoretical Development 156
16.1.2 Intensity Obtained for the New G Parameters Based on Vacuum Energy 159
16.2 Numerical Application to Vacuum Energy – Global Approach by Twist Wave 159
16.2.1 Theoretical Development 159
16.2.2 Intensities Obtained for New G Parameters Based on Vacuum Energy 162

CHAPTER 17

Let's Go Back to the Time Components Based on the New Results 165
17.1 Introduction 166
17.2 Impact on the Time of this Search 166
17.2.1 Time Behaviour as an Elastic Material 166
17.2.2 Relating the Time Intervals with the Thickness Fibers of Spatial Space Sheets 169

CHAPTER 18

Analogy of Mohr's Circle with Graviton Spin 175
18.1 Possible Constitution of Space Material 175
18.2 Analogy of Mohr's Circle with Graviton Spin 176

CHAPTER 19

What if We Gave Up the Constant Character of G? 179

CHAPTER 20

How to Test the New Theory? 181
20.1 Experimental Test of Young's Modulus of the Space Medium 181
20.2 Experimental Test of Pure Space Shear Behavior 182

CHAPTER 21

Other Points in Link with the Strength of Material 183
21.1 An Analysis of the Vibrations of the Space Medium at the Time of the Big Bang 183
21.2 The Plastic Behavior of the Space Medium in Strong Fields 183

CHAPTER 22

Conclusions 185

Appendix A – Chronological Order of Progress of the Author's Reflection and Related Discoveries 193
Appendix B – Measurements of Space-Time Material Deformations (Strains and Angles) 201
Appendix C – History of Physics and Related Formulas 205
Appendix D – Calculating the Scalar Curvature R of a Sphere 207
Appendix E – Application of Einstein's Equation in Cosmology – Demonstration of Friedmann–Lemaitre Equations 233
Appendix F – Can-We Understand a Black Hole from the Strength of the Materials? 279
Appendix G – Proof of the Relation between Speed c and the Shear Modulus μ of the Elastic Medium in the Case of Gravitational Wave 289
Appendix H – Proof of Curvature in Beam Theory 297
Appendix I – Proof of Quantum Value of Young's Modulus of Space Space-Time Obtained in Tables 16.1 and 16.2 305
Appendix J – Young's Modulus of the Space Time from the Energy Density of the Gravitational Wave 309

References 317
Terms and Definitions 331
About the Author 341
Summary 343