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شبكة المعلومات الجامعية

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شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



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شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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MOTION IN NON-LINEAR THEORIES OF GRAVITY

By

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*I dedicate this thesis to the soul of the father of General Relativity in
Egypt,*

Professor Fahmy Ibrahim MIKHAIL

(1921-1998)

who introduced many generations to the subject.

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SUMMARY

The thesis deals with the problem of motion in non-linear gravity theories which are constructed using the geometrization philosophy. It contains four chapters each has its conclusion and list of references. The thesis contains twelve comparison tables to enable the reader to arrive quickly to conclusions. Some of the results of chapters 2 and 3, jointly by the author and his supervisors, are published in four papers and the results of chapter 4 are in preparation for publication.

Chapter 1:

This chapter reviews briefly, in a unified way, two different philosophies used to tackle the problem of motion. The first is the geometrization scheme and the second is quantization scheme. In the first, it is shown how different properties of the moving body, e.g. rotation, charge, are taken into account in the equations of motion. The same is considered in the second philosophy, but the properties of the moving particle are of quantum nature, especially spin. Two bridges between the two different treatments are given. The first bridge is the **Path Integral Formalism** which enables to get the quantum equation of motion starting from a classical (geometric) Lagrangian. The second bridge is **WKB-approximation** using which one can get the classical (geometric) equation of motion starting with the corresponding quantum equation of motion. Discussion and criticism of the two treatments are given at the end of this chapter together with a list of references to the literature.

Chapter 2:

In this chapter, two non-symmetric geometries, more wider than the Riemannian one, are examined for new path equations that can be used as trajectories of test particles. The first is the **Absolute Parallelism geometry**. The new path equations derived in this geometry possess some quantum properties ! The equations contain a torsion term which is naturally quantized, without applying any quantization scheme.

The second is **Einstein's non-symmetric geometry**. The same quantum features are found in the new path equations of this geometry. The quantum features discovered are also connected to the torsion term of the equations. The absolute parallelism geometry is parameterized in order to get a general path equation, having the same quantum features, in place of individual path equations of this geometry. At the end of this chapter, the results obtained are discussed. The main results of this chapter are published in two papers underlined in the list of given at the end of this chapter.

Chapter 3:

In this chapter, a physical meaning is attributed to the torsion term, with its quantum features., appeared on the R.H.S. of the new general path equation. This term is suggested to represent **spin-gravity interaction**. To confirm this suggestion, two evidences are considered, one on the laboratory scale and the other on the galactic scale. The first evidence is the discrepancy between the theoretical calculations and the observed results of the **COW-experiment**. An overview of this experiment, its history and possible interpretations of its discrepancy are given. It is shown that if we use the new path equation in place of Newton's equation in the theoretical calculations, the discrepancy could be minimized or removed completely. It is shown also that the suggested interaction between the spin of neutrons used and the Earth's gravitational field is the factor responsible both qualitatively and quantitatively for this discrepancy.

The second evidence is the disagreement between the arrival times of massless particles, coming from **SN1987A**, and the supernovae mechanism. It is shown that using the new path equation, taking into account the spin of massless particles one could construct a temporal model for this supernova, which agrees completely with the supernovae mechanism. The results of this chapter are discussed at its end. The main results obtained are published in two papers which are underlined in the list given at the end of the chapter.

Chapter 4:

In this chapter two further equations are constructed in the absolute parallelism geometry. One is for the motion of the charged particle in a combined gravitational and electromagnetic field. This equation is shown to be more acceptable than that accounting for Lorentz force, given in chapter 1. The second derived equation is more general and could be used to study the motion of charged spinning particles in a combined gravitational and electromagnetic field. It is shown that this equation could be reduced to some special cases upon inserting certain values into its parameters. The results of this chapter are discussed at the end of it. The main results obtained are now in preparation for publication. The chapter contains a list of references.

Contents

1 THE PROBLEM OF MOTION:

GEOMETRIC AND QUANTUM TREATMENTS.	4
1 INTRODUCTION	5
2 GEOMETRIC DESCRIPTION OF MOTION	6
2.1 The Geodesic Equation:	7
2.2 Equation of Null-Geodesic	7
2.3 Covariant Lorentz Equations of Motion (Charged particle)	8
2.4 Papapetrou Equation (Rotating Particle)	9
2.5 Dixon Equation (Rotating Charged Particle)	10
3 QUANTUM DESCRIPTION OF MOTION	11
3.1 Schrödinger Equation	11
3.2 Pauli Equation	12
3.3 Klein-Gordon Equation	12
3.4 Dirac Equation	13
4 FROM GEOMETRIC TO QUANTUM DESCRIPTION OF MOTION	14
5 FROM QUANTUM TO GEOMETRIC DESCRIPTION OF MOTION	18
6 NOTES AND AIM OF THE PRESENT WORK	22

7	REFERENCES	24
2	QUANTUM FEATURES OF PATHS IN NON-SYMMETRIC GEOMETRIES	26
1	INTRODUCTION	27
2	CONVENTIONAL ABSOLUTE PARALLELISM-GEOMETRY .	28
2.1	Bases of Absolute Parallelism-Geometry	28
2.2	Path Equation in AP-Geometry	31
2.3	New Path Equations in AP-Geometry	32
3	EINSTEIN NON-SYMMETRIC GEOMETRY	33
3.1	Bases Of Einstein Non-Symmetric Geometry	33
3.2	Paths in ENS-Geometry	37
3.3	New Paths in ENS-Geometry	38
4	QUANTUM FEATURES OF NON-SYMMETRIC GEOMETRIES	42
4.1	Quantum Features in AP-Geometry	43
4.2	Quantum Features of Einstein Non-Symmetric Geometry	50
5	PARAMETERIZED AP-GEOMETRY	51
6	DISCUSSION	56
7	REFERENCES	59
3	MOTION OF SPINNING PARTICLES: PHYSICAL AND ASTRO-PHYSICAL CONFIRMATION.	61
1	INTRODUCTION	62
2	PHYSICAL MEANING OF THE TORSION TERM	62
3	EXPERIMENTAL CONFIRMATION OF THE NEW SUGGESTED INTERACTION	65
3.1	The COW-Experiment	66

3.2	Interpretation Using Spin-Gravity Interaction	70
3.3	Comments On Different Interpretations	71
4	CONFIRMATION AND APPLICATION ON THE GALACTIC SCALE	73
4.1	Motion of The Carriers of Astrophysical Information	73
4.2	SN Mechanism	75
4.3	Observation of SN1987A	76
4.4	Temporal Models	77
5	DISCUSSION AND CONCLUDING REMARKS	81
6	REFERENCES	83
4	MOTION OF CHARGED SPINNING PARTICLES	85
1	INTRODUCTION	86
2	GEOMETRIC PATHS FOR THE MOTION OF CHARGED PARTICLE	86
3	GEOMETRIC PATHS FOR THE MOTION OF CHARGED SPINNING PARTICLES	88
4	GENERAL CONCLUDING REMARKS	90
5	REFERENCES	91