NIKIFOROS A. SIDERIS

THE MACHINERY OF NEWTONIAN GRAVITATION

AND

THE FALLACIES OF GENERAL RELATIVITY

A THEORETICAL DEDUCTION OF NEWTON'S LAW OF GRAVITATION

SECOND EDITION

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This Book
is dedicated to the Memory of

my Parents Antony and Katina Sideris,

my cousin Nikiforos Mandilaras victim of the Greek Junta
and

Richard Feynman

who gave me the motivation to write this book.

Preface
by Prof. Andreas Theofilou
Director of Research, National Center of Research in Physics Science and Post-Graduate professor of the National University of Athens

This preface was for the Greek Edition of this Book and here is a translation by me.

In this book the author Mr. Nikiforos Sideris, makes a general consideration of the principles of Physics in a comprehensible manner for the readers who have not dealt particularly with this subject. At the same time, he questions various points of view, which stand for axioms, trying his own foundation. Of course nothing is self evident in physics and the contest constitutes the motive power for its progress. The power of these axioms is decided by the physical results they imply. One such example is the Einstein's axiom according to which the velocity of light and generally of the electromagnetic waves is the same with respect to any reference system. So if we measure it from the land or from a traveling ship we shall find that it is the same. This of course looks paradoxical because for all the other material subjects or waves, the velocity depends on the frame of reference. Nevertheless, all these, by using this axiom along with other that look less strange, it became possible many laws of physics to be derived that were verified experimentally and in fact with enough accuracy.

One of the achievements of the present basic principles of physics is the derivation of the gravitational Newton's law that is achieved in fact with very simple mathematics. It would be a great achievement if these simple thoughts could be used for a generalized theory that would lead to Mr. Sideris results, but this is not an easy issue. Let us think that Einstein with the cooperation of other eminent scientists was trying in all his life to formulate such a theory, but without success.

I recommend warmly the reading of this book.

Andreas Theofilou

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PREFACE

I started writing this book as an attempt to derive Newton's Law of Gravitation (NLG) theoretically, since as it is known, this famous law has been derived from observation of the motion of either celestial bodies (planets around the Sun - Kepler's laws) or objects on Earth (and why not the famous Newton's apple, if it really happened). Basically, however, this law stems from the ingenious manipulations of the existing knowledge at that time by Newton.

In physics, when we want to introduce new ideas, we start by developing in our mind a certain model and then we follow the next two stages: First we dress our model with the appropriate mathematics (since without mathematics we do philosophy at best or even science fiction rather than physics) and second we prove that our mathematics lead to experimental verification of our model.

The idea to deal with the problem of gravitation has occupied my mind for many years. However the motive to start thinking more seriously on this subject was given by a quotation in one of Richard Feynman's books[(1)]. I will present this quotation in the main body of this work. So I developed a model that finally led to Newton's Law of Universal Attraction, and I published it in Greek in a small booklet. Now I present it in English, not only in a revised version, but as a complete theory that is not a THEORY OF EVERYTHING (TOE), in the same manner as the NLG would do but with the new expression of the gravitational force law, as it resulted from the model for the gravitational interactions I developed in this book. I must declare from this very moment that the theory I am going to present can deal with any problem of gravitation. People for about two and a half centuries believed that Newton's Law of Universal Attraction could solve any problem of gravitation either on earth or in our celestial neighborhood. But the appearance of the theory of relativity both in its Special and General form changed things. These two theories showed that Newton's idea about the instantaneous action at a distance was wrong since from the Special Theory the maximum velocity in the universe is that of light in free space (or vacuum or at infinity etc.) and also that gravitation was due to the curvature of "spacetime" (General Theory) and not to the application of forces from one

body to another. This last theory is still the cornerstone of gravitation and of all next theories that try to reconcile it with the other great theory of the 20th century, the Quantum Mechanics. What I can only say in advance for my theory is that it is susceptible to alterations that will improve its validity, if more accurate experimental results can be obtained for the four famous tests of General Relativity.

The reader may reasonably question why I added to the title of this book the Fallacies of General Relativity (GR). For nearly a century since this celebrated theory was presented by Albert Einstein, it has been regarded by almost the totality of the physics community as the best theory of gravitation and most people believe that the NLG is nothing more than a partial solution of the so "elegant" equations of GR when the fields are weak and the velocities of the interacting bodies are low compared with the velocity of light in vacuum. I really do not know what the word vacuum may mean. If by that we mean empty space we have to ask whether such a thing may exist somewhere in (at least) the observable universe. I think that complete emptiness does not exist wherever we look at. Some people talking about the velocity of light use the term: "at infinity". This expression too is misleading since infinity is never reached. So although I may use sometimes the above terms I mean that the velocity of light is approximately constant as we measure it on Earth and this will be used as a standard meter for comparison with other circumstances. Apart from that, in GR prevailed the idea that Newton's Law applies in the case of weak gravitational fields whereas in the case of strong fields only the application of the equations of GR gives reliable results. Nowhere, however, I found a sharp distinction about when a field is weak or strong. Of course the people who wanted to support the new theory of gravitation, the GR, turned their attention to the subtle departures of Newton's Law in observations within our solar system. So the Sun gravitational field is strong in this sense, compared with the Earth (and other minor planets) field. But the Sun field must be considered weak compared with the field of a neutron star or a black hole. Quite incidentally I had red a paper by S.L. Bażański[(2)], where the author concludes that in certain circumstances the solutions either by the equations of GR or by the Newtonian law, are identical. So the distinction between weak and strong fields is only relative. When I acquired enough certainty that my theory (I will call it from now on the New Newtonian Law (NNL)), was capable to give answers to the

famous four tests of GR, I could not ignore the GR theory and for this reason I made some important comments not only on the way the supporters of GR predicted the results of the above tests, but also on the way this theory was engaged with gravitation. The reader is left to decide, after reading this book, which theory is nearer to the nature of what we call GRAVITATION. **To my opinion no physical theory (mine included) may be considered as a final one (as a TOE) in the realm of gravitation.**

The basic idea in my model was based on the necessity to find a way that will permit the transmission of the gravitational interactions in space among the material bodies. As it is known, this is imposed on physics by quantum mechanics, since for any interaction there must be a messenger or carrier that transports information accordingly to the force field it refers to. Have you ever thought why in Newton's law in the nominator appears the product of the masses M_1M_2 and not their sum M_1+M_2, even squared for conservation of dimensionality?
(The same holds for Coulomb's Law between two electric charges). I am not absolutely sure but I have the impression that this fact is not accidental. It rather is the manifestation that there are two entities that have to **communicate** with each other, whereas in the case of addition of the two masses or charges would be one and only one entity, their sum, so no communication would be necessary, so no force, no motion, nothing but a static, dead universe. I suppose that the above reason did not lead Newton or Coulomb to develop their laws. As this point of view will be discussed again in the ensuing development, the communication among the various parts of the universe with each other through the various force fields preserves causality in the universe. Without causality the universe would be an erratic and lawless medley of unconnected entities. Among the various forces that satisfy the above necessity the most general force is gravity. Nothing in nature, matter or energy, as far as we know, escapes from the gravitational interaction. The mechanism of the gravitational interactions will be the subject of the present work. At this point **I will state once and for all, to avoid any misunderstanding from any one who reads these lines, that I am on the side of those who do not consider themselves satisfied to simply use either Coulomb's or Newton's Law (of electricity or gravitation) as these Laws have been derived by experiment or observation, without any knowledge of their "Machinery" (In Feynman's words). These laws have been**

found correct in most cases of their application and for this reason I (and everybody else I suppose) must try to understand why such well established Laws of physics is expressed by the experimentally or observationally established relations and not by some different ones.

As it is known, one of the major problems of physics today, is the unification of GR with the other great theory of the 20th century, i.e. with Quantum Mechanics (QM). Thus many names have been given to the attempts for a solution, as Supersymmetry, Supergravity, Superstrings, Branes et al, about which I have but a slight idea. The integration however of GR and QM has not yet been achieved. The reason is that QM has been developed in a flat space and time whereas GR is based on the idea of the model of **curved spacetime**. I think that the person that would discover the **instrument** for a straightforward (and simultaneous) measurement of SPACETIME and its CURVATURE should be awarded with many Nobel Prizes. (And really in what units this concept is measured?)

This little book is addressed to all physicists, either they teach in high schools, or they teach in any higher level to undergraduate or postgraduate students and also to any physicist who works in research centers, independently of the subject of his/her research. In brief, this book is addressed to all Physicists. At the same time, however, this book is addressed to other scientists and particularly to civil engineers, to mechanical engineers, to ship-builders, to aircraft-builders and why not to space-ships builders. Of course you may ask yourselves why I mention with such detail almost all branches of physicists or technical scientists. The answer is simple. The up to this moment impregnable fortress of physics is **Gravitation.** But not only of physics. The technologies that are dealing with the above branches of science willy-nilly are subject to the effect of the gravitational forces, either due to the charges of technical terrestrial constructions, or as charges of moving constructions of any kind, on the ground, in the water or in air and even in space. So if the gravitational force could be tamed even partially, one could expect a protection from earthquakes and any research that aims at a better understanding of gravitation, may at some moment come to the point to permit the manipulation of the gravitational forces at will, by man.

Although this problem looks for the time being a utopia, the development of the present theory, offers certainly a new deeper meaning to the causes that generate the existence of the

gravitational forces. For this reason this theory may constitute the initiation for a new consideration of the problem for the causes of the appearance of these forces as well as for a possible elimination of them, if necessary and possible (in a far enough future).

When the physicists of the beginning of the 20th century, realized that the undeniable acceptance of Newton's theory for about 250 years, started presenting some cracks, they started searching for new solutions, because either the Special Theory of Relativity (STR) prohibited the instantaneous action at a distance by the maximum velocity in the universe, i.e. the velocity of light in "vacuum", or some astronomical observations (measurements) presented some small deviations from the predictions of the NLG. So the people started searching for something else that would make gravitation trustworthy. And in fact, the moment came when the appearance of the theory of GR restated the problem of gravitation on a new basis. From then on, all considered that the subject "Gravitation" was closed (at least in macrocosmos). But it seems that in nature there is no limit for its secrets.

If someone asks himself what GR offered to the comprehension of the phenomenon of existence of gravitation, will see that the only observational support of this theory comes from its famous four tests (the reliability of which has been questioned by many people). Furthermore the only solutions of its equations were achieved for symmetric systems (Schwarzschild solution, Robertson-Walker equation (metric) in cosmology and some other cases, which do not however give one sole answer to the problems they concern). So GR during the 95 years of its existence has not achieved many things, besides all the efforts of the hard working scientists called "relativists". The big thorn for this theory as mentioned above appeared when the other great theory of the 20th century, the QM was developed for a better comprehension of the happenings in microcosmos. Will the Superstrings succeed to fulfil this task? I really do not think so. I will explain in Appendix A why I have this opinion. I wish that the superstrings would tell us sometimes what gravitation is, and how it works from the smallest to the biggest dimension in the universe. From a recent paper of mine[3] it is inferred, that GR is not a genuine theory of gravitation, so all its results are questionable .See also Appendix A.

Without the pre-existence of the Newtonian theory, GR would be, even today, a theory of the (incomprehensible) curved spacetime, a theory for the expression of the physical laws of nature in the non-inertial systems as well as in the inertial systems,

but not a theory of gravitation. By no way GR could derive Kepler's laws by itself i.e. without Newton. For this reason, the theory I will present here acquires an even greater importance as a realistic theory of gravitation, than it had before the publication of my work[3] mentioned above*.

The present work will be presented in the style of a rather extended paper that is hardly possible to be published in a scientific journal. I will close this preface with a question to the teachers or professors of any level of education:

If a student of yours put the question: "Sir, could Newton's Law of gravitation be derived theoretically with no reference to Kepler's Laws of planetary motion, or to its experimental verification by Cavendish types experiments, or even to the famous Newton's apple", what could the teacher give as an answer? I suppose that there would be no answer. I think that after reading Appendix A nobody can claim that Newton's Law is a special case of GR. On the contrary, without Newton, GR could never be a theory of gravitation by itself.

A last thing must be said: I will give myself a characterisation of this work: It is "classical physics including the use of Special Relativity in certain cases" in which however, some quantum mechanical concepts enter, as the Planck units (especially length) and the "mysterious" motion of almost all elementary particles, called by Schrödinger, Zitterbewegung. The main job is the finding of a model that will be supported by some (simple) mathematics that will lead straight to Newton's Law. In fact this theory leads to an advanced Newton's Law, the classical expression of which may be derived in the case where the velocity at which the gravitational interactions (**not of the gravitational waves**) propagate in space is considered constant. In this case this velocity inevitably comes to be equal to the velocity of light c. So the classical Newton's Law is derived theoretically **without the handicap of the instantaneous action at a distance.** Somebody could say that I should be satisfied by only the fact of the theoretical derivation of Newton's Law. But of course this is not enough.

Apart from the derivation of the advanced (as I believe) Newton's Law, and apart from its predictions in the cases of the famous four tests of GR, I considered it necessary to present some criticism on the fallacies and the misconceptions of the those who

* I advise the reader to read first this paper of mine, presented in brief in APPENDIX A before proceeding in the reading of this book.

have attempted to support the validity of the equations of GR in applications. This criticism will be given after the development of the first (and main) part of my theory, since this is one of the reasons I decided to investigate the problem of gravitation from the Newtonian point of view.

I cannot say something else but I think that some details concerning the applications of this theory in the cases of the four tests of it, escaped from Einstein's attention. Einstein, apart from the interpretation of the photoelectric effect (for which he was awarded the Nobel Prize) and apart from many more contributions to physics in general (the Bose-Einstein statistics, the Einstein's A and B coefficients and many others), enriched physics with one of the most basic (and popular) equation: $\mathbf{E = m.c^2}$. Additionally I also believe that his points of view in his juxtaposition with the Copenhagen School are the correct ones. However for his theories of Relativity (Special and General) there are still (after about 100 years) objections and doubts by many people. I cannot omit a by-product of this work. As I will explain in what follows, one of the requirements that must be satisfied for any theory of gravitation, is that the gravitational interactions (**I repeat not the gravitational waves**) must propagate at superluminal velocity. This requirement places the carriers of the gravitational interactions in the realm of tachyonic objects. Many people that will be mentioned later[4,5,6 et al)] . tried to solve the problem of particles that travel faster than light (tachyons) using the mass transformation of STR by making some minor corrections to the corresponding equations to conform to the $v > c$ velocity. Since I had to deal with the same problem in the case of the gravitational carriers I spent a long time to use the above equations for them, but finally I realised that the equations of STR do not give acceptable results for these carriers. This means that the Einstein's equations for mass are only valid when $v \leq c$. So I hope that I found some new transformations that cover at least the case of the carriers of gravitational interactions.

Post Script: Some friends suggested that it might be more conventional if I presented this theory as a paper in a scientific journal. The reader will soon realize that this work is not a little part of a much greater and already existing theory. It is a New Theory of GRAVITATION that comes as a serious third proposition after the NLG and Einstein's GR.

The whole text has been divided into two major parts. Part I has been devoted to the development of the theoretical model I used for the derivation of the New Law of Gravitation (**NLG**, whose a

special case is the Gravitational Newton's Law (**GNL**). In this Part have been attached Four Appendices (A,B,C,D) which give a deeper insight to the problem of gravitation.

In Part II are solved the problems of the four tests of the GR by the use of the NNL and the appropriate computer programs. An extended reference is done to the solutions of the same problems by various authors with the unavoidable sincere criticism wherever the solutions presented serious errors or at least discrepancies among each other. In this part are also presented some more or less inexplicable results or coincidences that probably require further investigation, because if these results are finally explained, new horizons may open for the understanding of the relation between Earth and Moon. The part II ends with a brief conclusion of the whole work. A brief Addendum however, in which some cosmological ideas of mine are included as well some ideas on elementary particles are also presented since I thought that these ideas would be useful for the reader to understand that gravitation, elementary particle physics and cosmology are inseparable.

For the convenience of the reader I summarize below the most frequent abbreviations used in this book:

NNL = New Newtonian Law
NLG = Newton's Law of Gravitation
TOE = Theory Of Everything
GR = General Relativity
STR = Special Theory of Relativity
SPS = Sub Planckian Space
SQR = Sub Quantum Regime
MWH = Mini White Hole
MTW = Misner-Thorne-Wheeler
ABS = Adler-Basin-Schiffer

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As I said, this book was published in Geek on 2010 and its ISBN is 978-960-8160-49-1

PART I

THE MACHINERY OF NEWTONIAN GRAVITATION

Abstract

In this First Part of the present work, a model is presented for an analytical derivation of the Law of Gravitational Attraction that was first introduced by Newton. The model will be based on a "Machinery" of exchange of some "mediators" which from now on will be called "**Barytons**" not to be confused with the gravitons used in the quantum mechanical versions of gravitation. The expression of the NLG is a special case of a more general one for the gravitational interactions between two elementary particles (the New Newtonian Law or NNL for brevity). This general expression turns to the NLG when the velocity v=v(r) at which the gravitational interactions propagate in space, is constant, in which case comes out to be equal to the velocity of light in vacuum c. The general expression of this law requires a velocity v=v(r) that depends on the distance from the source of emission of the barytons, which source coincides (to a very good approximation) with the mass centre of the interacting particles. The variation of this velocity will be determined in Part II.

INTRODUCTION

The fundamental law of gravitational attraction between two masses M_1 and M_2, first discovered by Newton and contained in his monumental work "Philosophiae Naturalis Principia Mathematica" (1687), is an empirically derived, simple but very important law, that explains most of the gravitational phenomena, when the gravitational field is not particularly strong and the velocities of the involved bodies are much smaller than the velocity of light, at least as the followers of GR assert. In what follows I will show that something like this, very probably does not hold, and that Newton's law and particularly with its modification that will be derived in the present work, will be valid equally well in the case of strong fields and great velocities

between the interacting particles. I will also show that the NLG is the best law when the distance of the interacting bodies is shorter than a certain distance that will be determined in the course. I characterized this law as empirical in the sense that, when Newton came to its formulation, made use of Kepler's laws for the motion of the planets around the sun, laws that had resulted from observation (and perhaps of his famous falling apple). Newton never tried to find how the gravitational force is generated and how it is transported through empty space and he spent a long time to persuade his contemporaries that he was satisfied from the fact alone that his law was working perfectly in both the celestial and terrestrial mechanics. He simply proposed the so-called "action at a distance" (an action instantaneously transmitted through space) without any further proof. This point of view remained valid for about 2 ½ centuries and finally was rejected when the theory of STR introduced the velocity of light as the maximum velocity for the transmission of any kind of information. As we will show further on, even Newton could have discarded, at least the *instantaneous*, had he thought in terms of information* exchange between the interacting bodies.

According to R. Feynman(1): "...But is this a simple law? What about the machinery of it? All we have done is to describe *how* the earth moves around the sun, but we have not said *what makes it go.* Newton made no hypotheses about this; he was satisfied to find *what* it did without getting into the machinery of it. *No one has since given any machinery…"* And further on he describes one of the many proposed machineries for an explanation of this law, which finally were proved wrong. Milo Wolff(7) in a recent paper asserts that: "…*For the time being the mechanisms of the forces are unknown*…." .

It is known that the problem of gravitation has been already confronted fairly satisfactorily by GR (at least according to its supporters) but the development of Quantum Mechanics has proved that GR is not sufficient when the quantisation of the gravitational field is sought. The Super-gravity and Super-strings

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* By the compact word "information" I mean transmission of any kind of "knowledge" and particularly in the present case of gravitation, I mean the "knowledge" of mass, velocity, energy, and separation distance between two interacting particles (or bodies in general), from one particle by the other. The word "knowledge" is obviously in a metaphorical sense.

have been involved in this subject, but the final solution of the problem for the quantum gravity has not yet been found, in spite all new concepts introduced to promote these theories (such as gravitons and gravitinos). What made to me a particular impression is that although Feynman would certainly had a good knowledge of the equations of GR for gravitation, (since he was a student but also a collaborator of Wheeler) he insisted saying that: "*…No machinery has ever been invented that 'explains' gravity without also predicting some other phenomenon that does not exist…".* I suppose that this is a clear statement about his reservations on the validity of GR.

For the time being it seems that no analytical derivation of this "simple" law has been found. The reference of this law may be found in any textbook of mechanics, but a theoretical derivation of this law can be found nowhere. The theory that will be presented in this work aims at covering this absence, since from what I know no other effort is done towards this direction. (And in any case some solutions proposed by other people were found wrong or insufficient). This investigation, however, will reveal many more things that have not been found or discussed earlier.

So I will present a model on how the gravitational interactions may take place. This model does not lead to the Newtonian expression only, but basically to an expression of the gravitational force from which Newton's law emerges in the limit if the speed of the interactions is considered constant and in this case, is proved that it is necessarily equal to c. This expression may be used for the verification of the four tests of GR, something that the NLG cannot achieve. This part of my work will be presented in Part II. So in what follows our attention will be concentrated to the derivation of the NLG with the use of the proposed model for the case where the interacting bodies are two almost point-like entities with almost static masses (the point-like is a convenient approximation in the first degree, and the static masses will be proved unnecessary when the speed at which the gravitational interactions propagate will be determined). More specifically, we will consider two elementary particles with masses M_1 and M_2 that interact gravitationally with each other. The interaction of big gravitating masses may result from a superposition of the interactions of the elementary particles that constitute the big masses with each other plus the masses that correspond to the incidentally existing energy sources (from heat, electric fields etc.) but we shall not deal here with this subject.

The derivation of the NLG will be based on certain "First Principles" that will be used to the ensuing calculations, which are summarized as follows:

1) The existence of some magnitudes that are certainly original and at the same time fundamental is accepted, like the Planck units of length, time and mass or any (small) multiple of these units but of the same order of magnitude. The acceptance of such units is **one "first principle"**. More about the reason I have called the existence of these magnitudes a principle of physics will be said in APPENDIX B.

2) The various parts of the universe do communicate and their communication is satisfied in the megacosmos by the gravitational interaction that acts upon the whole of the known matter. If gravitation did not exist, causality would be violated, as I have already mentioned and the various parts of the universe would follow their own way of existence so no stars, no planets no galaxies etc. could be organized by smaller material objects, like quarks, nucleons, electrons, atoms, molecules and so on. The other known dynamical fields would be insufficient for the existence of a universe, as we know it. So the need for communication is a **second "first principle"**. Without it we could not talk about a universe as a whole. This need of communication is perhaps the basic feature of the most primitive law to which all other laws are humble servants. A question however may be put: Who or what imposed the law of communication not only for gravitation but for the other dynamical fields too? Although this question is a rather philosophical one, I shall try to give an answer in APPENDIX B along with the answer to the First Principle

3) **Another "first principle"** is the existence of a Sub-Quantum Regime (SQR), as it has been named by Atmanspacher[8], as well by David Bohm[9], and by me in three other works of mine[10,11,12] Sub Planckian Space (SPS) or Probability Space. This space has some unknown properties that have been investigated by me so that I believe that I have discovered most of the basic features of it. I suppose that nobody denies the existence of an unknown (for the time being) region of the 3+1 space into which we are embedded, with dimensions from zero up to ~1.6 10^{-35} m (Planck Length). To this region various characterizations have been attached by the author of ref. (8) as "dimensionless", "timeless", "non local" et al. It is a region where all known laws of physics cease to exist (where gravitation too is not excluded), or break down as many people say. For this region will be said more, further on. Besides

however the absence of complete knowledge of this region, its undeniable existence may be characterized as a **third** "**first principle**". It is anyway more than certain that our 3+1 space has an interior lower limit as we approach the Planck Region and for this reason we used the characterization "undeniable" for the existence of this subspace. As a mater of fact if there were no limit downwards for our 3+1 space then this space would be an infinite collection of dimensionless points that cannot give dimensions for any kind of space. The reason, on the other hand, I said that even gravitation does not work in this space, comes from three works of mine[10,11,12] where I studied this region and characterized it as an abstract space where the concept of **Probability** for the emergence of an amount of mass develops in imaginary time. I called this emergence of mass a Mini White Hole (MWH) so that in this space cannot act gravitation that would oppose the emergence of the mass.

4) The existence of Zitterbewegung that is displayed by the electrons (and perhaps by all elementary particles) in their uniform rectilinear motion as an additional rapidly oscillatory motion whose amplitude and period are of the order of $\hbar/2mc$ and $\hbar/2mc^2$ respectively (c.f. ref. (13) Messiah) and which in fact acts as a standard clock for the particles since it depends on the mass of each particle, is a fourth "first principle". More about the above principles will be said in the ensuing development and in APPENDIX B.

The theory I will present is based on the above 4 "first principles" and on a suitable model that expresses the way the gravitational interactions take place. What is left now is the detailed exposition of the concept of Barytons. To my opinion, this concept is not more hypothetical than the up to now not yet caught gravitons, introduced by the theories of quantum gravity and of course than the concept of spacetime, (not space and time) introduced in GR. Especially for gravitons I can present the following four reasons for which their existence as carriers of the gravitational interactions is unacceptable. So:

A) Because they are supposed to interact gravitationally with each other, new carriers are needed that will mediate among the gravitons, and if these carriers (which are gravitons too) interact with any other particle, they require new gravitons as carriers and so on ad infinitum. B) If the gravitons interact with all elementary particles, they will be unable to get out of a black hole, since, as

the photons they are transmitted with the velocity of light c according to the theories of quantum gravity, of the STR and of GR. So the black holes will not interact gravitationally with the matter that exists outside the event horizon and for this reason their existence would be not detectable even indirectly (e.g. through their gravitational influence to the motions of nearby stars). This would make the black holes really coal-black.

C) If the gravitons are moving with velocity c, then a photon that recedes from a big stellar mass, will cease interacting with the star since the gravitons transmitted from the photon, will never reach the star and those transmitted by the star will be unable to catch the photon that moves with the same velocity with them. So neither gravitational red-shift, nor bending of rays coming from a distant star that just graze the nearby star surface (e.g. the Sun), no radar signals delay, would be observed.

D) All the efforts for the development of a consistent theory of Quantum Gravity (Supersymmetry, Supergravity, Superstrings), have failed to satisfy this aim up to now. Why I say this? Green and Schwarz, in 1984 showed that the Superstring theory is the only reliable theory of quantum gravity. This however means that it includes as a partial solution of its equations the equations of GR. If this was not so, the physics community would have rejected this theory of the above researchers, since almost all this community believes that GR is the best and most "elegant" theory of gravitation (at least to a macroscopic level). If however the reader read the Appendix A will realize that GR is not a **genuine theory of gravitation**, as I have shown in another work of mine[(3)], which is given in a brief exposition in Appendix A. So any theory that claims that has quantized gravitation as it is developed by GR, will inevitably discover that it has not quantised gravitation but only (perhaps) the (unneeded) curved spacetime. But then Superstring theory will not be a Theory of Everything (a TOE).

The question is: Are all above four simple thoughts wrong? Has anybody commented upon the (wrong) strict application of the speed of transmission of the gravitons that has to be of order c to comply with the rules of STR and GR? Quite accidentally, I found a paper by G.D.Ransford[(14)] in which the author expresses the same, as above, point of view by saying: "…*A final argument of a superluminal speed for gravity may be found in the hypothesized behavior of black holes. If light cannot escape from a black hole, then gravity-if traveling at the speed of light- cannot do so either. In effect the matter swallowed up by the black hole could then no*

longer influence the outside world (and create a gravitational field there). It is to wonder somebody, why my four reasons presented above along the Ransford's belief that the gravitons must travel at superluminal velocity has not been mentioned by the so many Great minds who work hard to built up theories of quantum gravity? The only reason that I can think of for this omission is that it is possible that the authority of the theory of Relativity either Special or General, prevented the thought for superluminal velocity[1].

Since I gave the reasons for which, to my opinion, the gravitational interactions must be transmitted faster than light, I think that it is the appropriate time to show that the great mind of Newton could have avoided the instantaneous action at a distance by simple thoughts again as the ones I present immediately below.

I will show that if Newton, had regarded the gravitational interactions as the inevitable need of the material components of the universe to exchange information among each other so that the universe would work as a whole, he would have with certainty excluded the instantaneous action at a distance. This principle prevailed upon the scientific thought till the appearance of Einstein's STR.

The development of the Newtonian force between two masses M_1 and M_2 being at a distance r from each other, requires the transmission of information from one mass to the other, which information will activate the law of universal attraction. From the point of view of the mass M_1, it demands the knowledge of the value of the mass M_2, the direction at which the force from M_2 upon M_1 acts and the distance r. For the same reason from the point of view of M_2, it demands the knowledge of the magnitude of M_1, the direction of the force on M_2 from M_1 and the distance r

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[1] As a matter of fact in a paper by Clifford M. Will[(15)] under the title "Propagation Speed of Gravity and the Relativistic Time Delay" submitted to the Astrophysical Journal (6.Mar.2003), I found for the first time a discussion about the possibility that the speed of propagation of the gravitational interaction c_g may differ from that of light. The author does not give even a simple indication whether c_g is greater or smaller than c and he only concludes that "…*in a theory with either integrating dynamical fields or with non-dynamical "prior geometrical" fields, the speed of gravity is presumably a function of some cosmological values of the fields in the theory*". The reader will soon realize that with my theory by a simple calculation, the velocity at which the gravitational interactions are transmitted is given as a function v(r) that enters in the new expression of the NLG, where r is the distance from the emission point. About this function more will be said in PART II.

for the Newton's law to work (in flat Euclidian space of course). For the transmission of this information an appropriate carrier is required. This carrier may have any name, as e.g. a wave, a graviton, a baryton or in Newton's times an invisible vehicle of divine or of other origin that would be loaded at the starting point with the information for the magnitude of the mass of the emitting particle. For the values of the masses, the carriers may convey the information in three ways: a) with the mass of the carrier itself, which may be related in some way with the mass of the particle. b) With the number of the arriving carriers in unit time. c) With a combination of the above two ways. For the direction of the application of the force, the information in a Euclidian flat space could be the knowledge at the arrival of the carrier, of the position of the emitting particle and of the one receiving the information, and the direction of the application of the force would be the straight line that joins these two points of space according to the Least Action Principle. Since the position of the one particle is unknown to the other, the interacting particles have two choices to make: Either they must send an infinite number of messengers to all directions or they must choose a messenger that has a spherical shape. The information, however, for the distance that separates the two particles, must be acquired by the carrier itself, during its trip from M_1 to M_2 and vice versa, since there is no other way for a previous acquisition of this information.

This information depends on the mass carried by the baryton, which mass is distance depended (distance from the emission point of the baryton).

Let us now come to a consideration of the instantaneous action. An instantaneous transportation from one position to another implies two things: Either the distance r is equal to zero or the velocity of transportation is infinite. In the first case the law of the Newtonian force would give an infinite force, whatever the magnitude of the two masses might be. In the second case the distance r is indefinite since for $v = \infty$ and $t = 0$ the $r = 0\times \infty$, i.e. an indefinite quantity so that the force law is again inapplicable. So this instantaneous action at a distance that determined the gravitational interactions has been a convenient solution for about 2.5 centuries if not a declaration of ignorance. As I showed in the preceding development, it was not necessary to wait for the principles of STR in order to wipe out this instantaneous action at a distance. It must be noted, however, that only the "instantaneous" was abandoned by STR and not the "action at a

distance". This last one was pulled down by GR with the introduction of the concept of the "curved spacetime" (this is a new concept of course), which substantially interprets the gravitational interactions not with the concept of force but with the properties of the incomprehensible concept of "spacetime" and of the masses in it. Quantum Mechanics, however, requires the exchange of information between interacting bodies under the form of energy and momentum transportation via the quantized field, at least in the case of gravitation, so action at a distance. Perhaps this may be one of the reasons for the non-marriage of these great theories. I hope that the theory I will present here is in fact an intrusion of QM into the original Newton's theory. This means that the GR should be forgotten as a theory of gravitation.

The only that offered to gravitation are the four tests of it, which must be taken into account in any new rival theory. It is true that the NLG cannot confront these tests. Perhaps if the founders of those two previous theories (Newtonian and GR), Newton and Einstein, were thinking in terms of information transmission, such misleading concepts (like instantaneous actions and spacetime) would have been avoided since both are wrong or at least unnecessary.

SOME REMARKS ABOUT THE PLANCK UNITS

As it is known, by the use of the three basic constants of physics i.e.: $\hbar$, c, G and with use of dimensional analysis, one may determine three physical units of length, mass and time. These units are:

$$\left.\begin{aligned} L_{Pl} \equiv L &= \left(\frac{\hbar G}{c^3}\right)^{\frac{1}{2}} = 1.616\ 10^{-35}\ \text{m.} \\ M_{Pl} \equiv M &= \left(\frac{\hbar c}{G}\right)^{\frac{1}{2}} = 2.176\ 10^{-8}\ \text{Kg.} \\ T_{Pl} \equiv T &= L/c = 5.39\ 10^{-44}\ \text{sec.} \end{aligned}\right\} \qquad (1)$$

The Planck length is also the geometrical mean of the Schwarzschild radius $r_s = \frac{2Gm}{c^2}$ and the quantum radius $r_q = \frac{\hbar}{2mc}$ of the same mass m. The Planck mass may also be

derived from the relation $\frac{2Gm}{c^2} = \frac{\hbar}{2mc}$, (in fact $M_{pl}/2$) where M_{Pl} is the mass of a particle the quantum radius of which is equal to its Schwarzschild radius.

What is very often forgotten when the above magnitudes are mentioned is that since they have been derived by dimensional analysis, or even by some hypotheses as the above ones, it is not necessary to represent some existing physical entities that have these magnitudes as the physical limits of their existence. The opposite would be peculiar if it happened. For this reason I consider more reasonable to accept that if some physical entities approach the above magnitudes, then may have a characteristic length aL, a mass equal to a_1M and of course a characteristic time equal to aL/c, where the a, a_1 multipliers (that must be constants) will be determined by experiment or observation or by a theory, which involves such magnitudes. Of course they do not need to be integral numbers since when we use dimensional analysis to find the expression of some law the constant multiplier needs not be integral (e.g. in the case of the simple pendulum the constant multiplier is 2π that cannot be extracted from the dimensional analysis. Another number characterized as a universal dimensionless constant is the Feigenbaum number equal to 4.669201609. In my paper of ref. 10 I discovered another constant multiplier of the Planck mass, equal to 4.656221955. More will be said about the above numbers in APPENDIX B.

Having in mind the foregoing argumentations, let us proceed to the development of the scenario about how the gravitational interactions take place according to my model.

AXIOMATIC FOUNDATION OF THE CONCEPT OF THE BARYTON

Before proceeding to the model I shall use for an interpretation of the machinery of the gravitational interactions, it is absolutely necessary to clear up some concepts that will be mentioned many times in what follows. One of them is the concept of the *inertial* mass. According to Rindler[16] the inertial mass of a body (or of an elementary particle), is defined in the STR by the relation:

$$m = m_0(1 - v^2/c^2)^{-1/2} = E/c^2 \qquad (2)$$

In the above definition two quantities seem to require a further clarification. The quantity m_0 is usually mentioned as the *inertial mass* of the body as it is measured in a frame of reference in which the body is at rest, i.e. from (2) when v=0[†].

In this case $m \equiv m_0$. So in the STR m_0 that is called *rest mass or proper mass* is the minimum inertial mass, which (inertial mass) increases with the increase of the velocity of the body relative to the frame at which the body is initially at rest. This mass m becomes infinite when v=c, always according Rindler. The other quantity is the velocity v. In the STR again, v is always smaller than the velocity of light in vacuum c, for particles of non-zero rest mass. In the case of the Barytons, as we will see further on, the two concepts (i.e. the *rest mass* and the total inertial mass of them) have exactly opposite properties, i.e. the rest mass m_k is the maximum inertial mass of the baryton and the propagating inertial mass m_r decreases with increasing velocity. So before the emission of the baryton it is $m_r = m_k$ and after the emission it is $m_r < m_k$. This will become evident in the development of the ensuing model. In the STR formulation one can say that m is the *moving* mass of a body whereas m_0 is (or rather was) the mass that *is not moving* viz. it was at *rest* when the particle was in its rest frame of reference. *I propose under the form of an axiom that the gravitational interactions take place by an exchange between the interacting elementary particles, of some entities that will be called from now on "barytons".* (A similar process is described in the case of the Electromagnetic field by Griffiths[17, p.16]: "…But in quantum field theory, the electric field is quantized (in the form of photons) and we picture the interaction as consisting of a stream of

[†] For the moment we forget that nothing can be in absolute rest (v=0) since then from the uncertainty principle its position is undeterminable. This point is usually forgotten in the STR textbooks.

photons passing back and forth between two charges, each electron continually emitting them and continually absorbing them. And the same goes on for any non contact force: where classically we interpret "action at a distance" as "mediated" by a field, we now say that it is mediated by an exchange of particles (the quanta of the field)…").

The barytons are neither particles nor waves in the usual meaning we attribute to these concepts in modern physics. The barytons are emitted from all the gravitating sources in the universe, but they have not a distinguished identity before the time of their emission. Before this time they exist as though they are in a ***latent*** *(or* ***virtual*** *and as such not observable) state inside of any elementary particle (the photons not excluded).*

As will be shown in what follows, the inertial mass of any elementary particle may be expressed as an integral multiple of the total (and universally constant) inertial mass of the baryton. Since they are neither particles nor waves, in the usual sense of these entities, there is no meaning to talk for the spin or the wavelength or the electric charge or any other feature that characterizes the known elementary particles. The only common characteristic they have is their ***total mass*** $\boldsymbol{m_k}$ *(i.e. the* **instantaneous** rest mass+ **Kinetic Energy/c^2***). The meaning of the instantaneous rest mass may be given by a rough example: Let us suppose that we have a rocket with initial rest mass m_0 in which the fuel is included. As the rocket starts moving, part of the fuel is spent to give the necessary kinetic energy to the rocket for its motion. So roughly (i.e. ignoring thermal losses etc.) the lost mass was transformed into kinetic energy that permits the propulsion of the rocket. The remaining rest mass (rocket+fuel), which changes continuously, is the one I call instantaneous rest mass. Of course the transformation of the fuel into thermal energy has nothing to do with the complete transformation of a part of rest mass into Kinetic Energy. The difference of the two processes is immense. But although the transformation rule is known ($E = mc^2$) the mechanism of this transformation is not known. The only we can say is that while in the case of photons the energy of the photon may be transformed into an amount of inertial mass that behaves momentarily as a material particle (Compton Effect) and conversely an amount of inertial mass may transform momentarily and totally into photons (e.g. particle – antiparticle annihilation), what and how really happens is not absolutely clear. The m_k is a universal constant and it is the same, independently of the particle*

that emits Barytons. So a neutron or a photon emits barytons with the same total mass m_k. As will be shown, when barytons are emitted they look like a spherical expanding balloon, (for reasons that will be explained further on) with a surface of the shell having a constant width and their mass is distributed uniformly inside this spherical shell. So the baryton, by definition is the expanding shell and not the center of mass of this shell, which to a first approximation, coincides with the mass center of the emitting particle. A more detailed definition of the concept baryton is presented in what follows in conjunction with fig. 1 at p. 22. The baryton is emitted from a spherical volume inside of any elementary particle, with a total mass ≡ rest mass before its emission equal to $(m_k)_0 \equiv m_k$. This emission does not violate the law of mass conservation of the elementary particles or their identity, since the minutest loss of mass of the emitting particle is replaced momentarily by the incoming from all directions, barytons, which run across all space and originate from all the particles of the universe. If we could isolate the interaction between only two particles, the mass defect of one particle would be replaced by the incoming barytons from the other particle.

The diameter of the spherical volume that is occupied by the latent baryton before its emission is again by definition equal to 2aL (c.f. section B above). Immediately after its emission the baryton develops as a spherical balloon with all its inertial mass distributed uniformly within the outermost spherical shell that has a thickness of 2aL too. This thickness remains constant although the shell expands (i.e. the thickness is not reduced as one may think from a comparison with an elastic balloon) because the length 2aL is a minimum elementary length for this particular case and cannot be reduced further. Whenever we shall refer to the initial volume of the baryton that contains its total mass or to the expanding spherical shell as a whole that also contains all the inertial mass of the baryton immediately after its emission (and before it starts interacting with a particle) we will use the special name baryton 1 or B1. If another expanding shell from another particle arrives at the region of the target-particle, interacts with all the latent barytons of this particle that have just been expelled (the details of this interaction will be given in section D). Then it releases on the empty positions of the barytons B1 that have been just emitted, an amount of mass that is determined by a volume V_1 equal to the volume that was occupied by any just emitted B1 and by the density of the mass that is carried by the expanding shell.

This amount of mass (or generally the equivalent amount of energy) that is put down to the empty places of the latent barytons will be called baryton 2 or B2. Since the ***total mass*** *of the baryton B1 is a universal constant, it represents the sum of its instantaneous rest mass and its kinetic Energy/c^2. When the kinetic energy increases the rest mass must be decreasing correspondingly so that the total inertial mass is conserved i.e. it is a constant.*

This is the model that will lead us to our target, i.e. to Newton's law. Of course any one may wonder how I knew that the above model would lead to Newton's Law. In fact I did not. I started however building up models that did not work, having in mind that the right one should be based on the four first principles I stated in the introduction. With a little trial and error I finally managed to arrive at Newton's law (and beyond) with the above axiomatic formulation of the concept of the baryton and the appropriate simple mathematics.

Many authors[4,5,6 et al] have studied the problem of faster than light motion exerted by particles called **tachyons**. All of them have tried to interpret this superluminal motion in the framework of STR. This led them to introduce new concepts like, for example, imaginary mass or energy and to modify the equations of STR in order to show that this theory may be used even if v>c, although the founder of this theory confined it only for particles that move with $v \leq c$. When I started studying the development of my theory and in fact in two publications, one in English and the other in Greek[18,19] I was influenced by the above authors and I worked the case of the gravitational interactions in the same way as the others. Now however, that I completed this theory with the second Part of this book I realised that for the barytons the application of the equations of STR is incapable to cover the requirements of this theory.

What should be done was to discover new transformation rules between the masses that enter in the present theory and probably to any theory that deals with superluminal speeds. But here I only want to solve the problem of gravitation. The basic equation that applies for the baryton case is developed by the following thoughts:

Let the total inertial mass of the baryton, which is in a latent state inside of any elementary particle, before its emission as a baryton B1, is denoted by m_k. Since for the emission and the propagation of the baryton there is no force that may accelerate it or even give to

it an initial blow, the only means that can do the baryton to be ejected and start expanding as a balloon, is the transformation of part of its mass to Kinetic Energy T*.

From the STR we know that the total energy of a body is inferred from relation (2) as $E=mc^2$. If T is the kinetic energy of the body then T in STR, is given by the relation:

$$T = (m-m_0)c^2 = E-m_0c^2 \quad (3)$$

where m_0c^2 is the *internal* energy of the body. For this internal energy Rindler[16] again says that: "…But by far the largest part resides simply in the mass of ultimate particles and cannot at present be further "explained" in terms of *kinetic* and *potential* energy…". So we can say, that the inertial mass of a particle is given by the relation:

$$m = m_0 + T/c^2 \quad (4)$$

In the case of the baryton rel. (4) will be written as:

$$m_k = m_r + T/c^2 \quad (5)$$

One of the basic requirements of this theory is that $m \equiv m_k$ is constant and in fact a universal constant. This seems to contradict rel. (4) since m_0 in STR by definition is constant and T is changeable if the velocity changes or if it is observed from various frames of reference. Things for the baryton are not so. As will be shown, the baryton is at rest before its emission and if the mass of the body in which a baryton belongs increases when the body moves with velocity $v < c$ with respect to any frame of reference according to the rules of STR, the total mass of the baryton remains constant and only the number of the latent barytons in the body increases accordingly thanks to the body mass increase. Apart from this, from (5) we infer that m_k that is the initial rest mass of the baryton i.e. the one before its emission splits into two parts. One is the m_r, which will be called from now on **instantaneous inertial mass** and the other is turned into Kinetic Energy that increases the speed of the baryton expansion.

If the rest mass is the maximum mass of the baryton i.e. if $m_0 = m_k$ that means that the baryton has not yet been emitted by the particle, then we cannot find a restriction that prevents the transformation (gradual or total) of this mass into kinetic energy. As we know in the case of annihilation of the electron-positron

* It is necessary to be emphasised that the baryton is not an entity that can "think" and obtain decisions about the way it will move. We are the ones that simply imagine manners about how the happenings in nature would work better to do the job we expect them to do.

pair, the rest mass of both particles transforms momentarily to photons, the total energy of which is kinetic[*] .

But even a photon that has not yet been emitted by an atom, say, resides in the electromagnetic field of the atom, i.e. it exists in a latent state and only when an electron changes its orbit around the nucleus, a photon is emitted or absorbed. So in the same way, is not unreasonable to assert that the initial rest mass of the baryton, i.e. its latent total mass transforms **gradually** to kinetic energy. This transformation ends in infinite distance from the emission point when the total inertial mass will have been transformed to kinetic energy and the velocity of expansion of the barytonic shell will become infinite, as we will see in the second part of this work. For this behavior will be said more in the ensuing development of the model under discussion (although any reference to infinities is only of mathematical interest, not of physics. If the universe, i.e. the existing totality, is finite, then infinity is meaningless for such a universe).

Finally we suggest that the barytons do not interact gravitationally with each other as the gravitons do. The vindication of this assertion has as follows:

If the barytons that are the carriers of the gravitational interactions (according to my theory) interact gravitationally with each other, we have to invent new carriers for the transmission of the interactions between the barytons. And if these new carriers are subject to gravitational forces (according to the quantum gravity theories it is indifferent whether these carriers have or have not mass since the gravitons are considered to have zero rest mass) they would need new carriers for the transmission of the interactions between each other and so on ad infinitum (as we said in a previous reference for the gravitons). I think that such a picture is out of any logic.

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[*] According to A.P.French[(20)] p.15 "…*Since the energy of a photon is all kinetic (for photons simply cease to exist when we try to stop them in an absorber)…"*

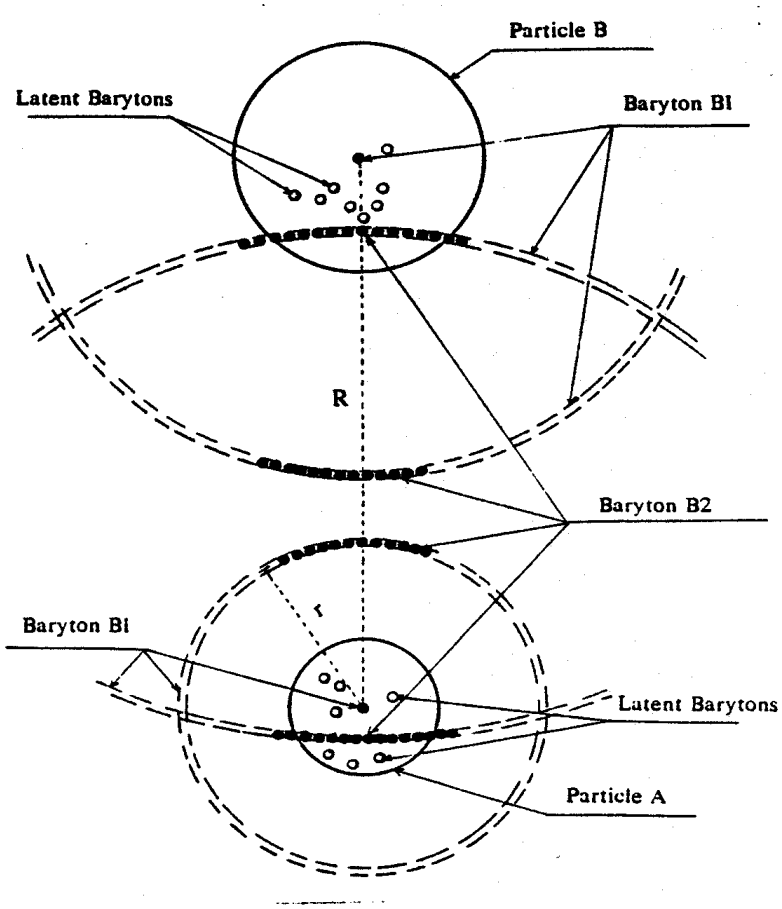

Figure 1

Schematic representation of the way the gravitational interactions between two elementary particles take place through the emission of barytons B1 and the absorption of barytons B2 by the latent barytons of each particle

I will proceed now to show that the model of the expanding shell in the case of the carriers of the gravitational interactions is inevitable and is imposed from the isotropy of space*. This assertion arose from the following thoughts:

* The geometric isotropy of space is based on the principle of sufficient reason, i.e. on the argument that we do not know any reason why certain space directions should be distinguished from others as the authors Adler Basin Schiffer write in their book(21) p.407 .

Let us consider a hypothetically empty space in which two masses M_1 and M_2 appear suddenly from nowhere (e.g. with a white hole process), and we suppose that these masses constitute a universe. An a priori characteristic of a universe is the ability of its different parts (or contents) to communicate with each other and to affect one another by a certain way, for causality not to be violated. We may talk about a universe as a whole only if such a thing happens. According to David Bohm[9] p.92: "…But in the usual interpretation of the quantum theory, *an atom has no properties at all when it is not observed*. Indeed, one may say that its only mode of being is to be observed; for the motion of an atom existing with uniquely definable properties of its own even if it is not **interacting** with a piece of observing apparatus, is meaningless within the framework of this point of view….". Here I put bold letters to the word **interacting**, because according to a point of view an interaction even between two elementary particles is in fact an event of "observation" of one particle by another (and vice versa). So it can be said that the *need* for communication between the various parts of the universe comes first and the interaction (or the "mutual observation") simply satisfies this need. Or to put it in a different way, ***any kind of interaction among elementary particles and more specifically the gravitational interactions that apply to all particles is nothing else but a confirmation of their existence by the particles themselves.*** This point of view satisfies Einstein's belief that there exists objective reality independently if this reality is observed by an intelligent being straight or via a measuring device, contrary to the opinion of the Copenhagen School. As a result of the points of view of this School, one may infer that uninhabited universes in which no observing creatures exist, so these universes are unobserved, cannot exist. This means that at least the initial stages of the universe never existed, since the conditions for life of any kind were forbidden. But we already know (e.g. from the microwave cosmic radiation) that these initial stages did **exist**. Although this subject is not the main task of the present work, I will try to present some thoughts for it at the end of the present work, because I think that the contention between Einstein and Bohr that the "existence" as such of anything is assured only by the collapse or not of its wave function, which is achieved only by the act of observation (by human beings I suppose), touches any basic theory of physics. I think that it is time to get rid of the anthropomorphic

definition of the word "existence". Now I continue on my theory of gravitation.

The masses M_1 and M_2 of our hypothetical universe are supposed to have no electric charge (to concentrate our attention to the gravitational interactions alone), so that the long distance force that can be used as a transmitter of information, is gravitation. For the two masses to interact gravitationally, a message must be sent from one to the other. Any kind of message, indifferently how fast is transmitted, needs a carrier. The mass M_1 has no idea where the mass M_2 is, to send its message along the line joining the M_1 and M_2. The same holds for the mass M_2. So these masses have two alternative solutions: Either sending carriers towards all directions, i.e. an infinite number of carriers under the form of a kind of moving particles, or finding a form of carrier that is unique and with certainty will encounter any mass in whichever direction it is. If there is logic to this imaginary universe, any particle, with certainty will conclude[*] to use a carrier (messenger of information) under the form of an expanding shell. So they avoid the idea of infinity (i.e. infinite number of messengers) that leads to nowhere. Some people might call this entity, spherical wave. I preferred the use of this new concept of the expanding shell, which is neither wave nor particle. The reason of this choice is that the thickness of this shell, that remains constant during the expansion, confines the amount of mass into a certain volume so that it represents a quantum of emitted mass and not a continuous emission. For this reason in the axiomatic presentation of the baryton I defined the thickness of the shell equal to the diameter of the spherical volume that is left after the emission of a baryton. This choice must not create problem, only because, such an entity has not yet been detected experimentally. One must not forget that the existence of gravitons that have been proposed by the theories of quantum gravity has not been detected experimentally, in spite of the fact that the theories that propose the gravitons can be found in numerous scientific statements or official journals on gravitation.

Another characteristic that distinguishes the barytons from the ordinary particles and waves is the mode of their emission and propagation in space. A mathematical description of this mode is given in section D.

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[*] In fact **I concluded** that the choice of this kind of messenger would cover in a better way the communication of the elementary particles in the case of gravitational attraction between each other. The same was done in the case of GR by introducing the curved "spacetime"

There are many questions that cannot be answered by the existing theories of gravitation. The Quantum gravity asserts that the gravitons must be emitted and absorbed by any kind of matter and according to GR, by any kind of energy. The information for the mass-energy of any gravitational force is contained in the energy-momentum tensor T^{ik}. The existing knowledge, however, does not give clear answers to certain simple questions, like:

If we have a finite mass plus energy, contained in a finite volume (a proton e.g. is such an object, the Sun is another and so on), do we know the positions inside this volume the gravitons are emitted from? What is the rate of gravitons emissions? Is it possible this rate to be related to the nature of the emitting substance (mass or energy)? Since any mass is consisted of some elementary particles, does each such particle emits gravitons and how often? Is it the proton or the quarks that are contained in it, or the field around them or the gluons or all of them that emit gravitons? Do the photons emit gravitons and how a graviton exists into a photon before its emission? Is the emission of gravitons a spontaneous process of any gravitational source or some other deeper processes induce it? And finally what is a graviton, beyond its existence as a mathematical entity? Is it a wave, a zero rest mass particle, a wave-function, is it like a photon and indeed what is a photon since all these microscopic concepts cannot be described by some macroscopic models?

These are some of the critical questions that have not been answered satisfactorily by the existing theories. Some of the above questions have not even been posed from those who investigate the gravitation problem, not because they consider them without meaning, but rather because, for the time being, the existing theories are still far away from giving some definite answers.

I close this section to repeat something I said previously that may have puzzled the reader. In the foregoing discussion I somehow endowed the elementary particles with the ability to take decisions themselves since they concluded to choose the barytons in the form of expanding shells. In fact they did not. We, men, have the logic to choose the barytons as expanding shells. If this choice works then this means that Nature has chosen by itself this choice. By the same way nature has no idea what a momentum-energy tensor is. We, humans, have chosen this tensor to understand how nature works. The choice of the barytons simply indicates that the messengers of the gravitational interactions do not follow an uninterrupted emission of mass-energy-momentum

by the elementary particles, but instead the barytons are emitted in quanta as all the other messengers of the known interactions. Do not forget that the Baryton is in fact a model that permits a better understanding of the concept "gravitation". In the same way the spacetime of GR is a model that has tried to do the same thing: Understanding Gravitation.

Finally to understand Nature we need the intervention of a logical human being that can observe the happenings around and can explain them in his/her own language (anthropomorphism), or we must persuade ourselves that the observation by a butterfly of a flower collapses the wavefunction of this flower? I think that the interaction of one particle with another is, as I said, an observation that confirms the existence of these two particles whether we exist or not.

DESCRIPTION OF THE MACHINERY OF THE GRAVITATIONAL INTERACTIONS

We will consider the simplest possible case of two interacting elementary particles A1 and A2 with masses M_1 and M_2 whose centres of mass are away from each other a distance r. The consideration of the interaction of two bigger bodies is an issue of simple superposition (plus probably of something more that will include the total of the contained internal energy of the system). We will not however deal with this issue in the present work. In any case, however, and for simplifying the problem, the dimensions of the particles (or even the bodies) will be considered negligible compared with the distance r in between them, which from now on will be identified as the distance between their mass centres. For the present case this convention is generally accepted in all usual applications of the NLG, as e.g. in the motion of planets around the Sun etc. We must not forget that in microcosmos there are much stronger forces than gravity that hold the various elementary objects being linked (like electromagnetism and nuclear forces).

It has already been mentioned that the baryton and more specifically the B1, is emitted by all elementary particles from a region inside the particles with dimensions 2aL.* Let the **initial**

* At this point I have the idea that for particles composed by other smaller particles (e.g. by u and d quarks in the case of protons and neutrons or by other quark flavours in heavier particles), the barytons must be emitted by the elementary particles themselves and not by their constituents (the quarks) for

mass of the B1 before its emission is $(m_k)_0 \equiv m_k$. This equality has the meaning that whatever is, that makes the barytons being emitted and being transmitted as expanding shells, must be supplied from their own **total mass m_k**, which before the emission is under the form of rest inertial mass and more specifically as a minute indistinguishable part of the emitting particle mass and after the emission is a mixture of reduced or instantaneous rest mass m_r and kinetic energy/c^2. The relation between total inertial mass m_k and instantaneous rest mass from (4) is written now:

$m_k = m_r + T/c^2$ (T=Kin. Energy)

(6)

The barytons then expand as a shell with velocity of expansion v(r) with respect to their emission point. The total mass m_k is considered to be uniformly distributed within the outermost spherical shell of thickness 2aL too. The "uniformly" is the simplest hypothesis that can be done. A different distribution would require more than one hypothesis for its justification and of course would lack universality. The fact that in a definite volume is contained a mixture of inertial mass and kinetic energy should not be heard curiously if somebody thinks that for the photons their total energy which is kinetic according to French[20] is distributed within a volume that is defined (conventionally) by the wavelength of the photon. The exact position in the photon, if it has an infinitesimal rest mass, something rather improbable, cannot be determined with certainty in this volume because of the Uncertainty Principle.

Let us find first what is the amount of mass that is laid down from an incoming baryton to an empty space it encounters in a particle with which interacts. This empty space is the one just left by a baryton emitted from the particle at this same moment. The mass-energy density of the expanding shell in mass units per unit volume is given by:

$$\rho_b = \frac{m_k}{4\pi r^2 2aL} \quad \text{(for r >> 2aL)} \qquad (7)$$

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reasons that will be explained in the ensuing development. In another work of mine[12] I introduced the idea (in contradiction to the Standard Model) that the electrons, muons etc. and their corresponding neutrinos are also particles composed by some more elementary ones called by me Paraquarks. For the same reasons as above the barytons will be emitted by the particles (electrons, neutrinos) and not by their possible constituents (if this idea is proved finally correct).

and the volume to be filled is: $V = \frac{4}{3}\pi(aL)^3$ (8)

So the corresponding mass left by the B1 in the empty place in the A2 particle is:

$$m_1 = \rho_b V = \frac{(aL)^2 m_k}{6r^2} \quad (9)$$

The above elementary mass (which is the B2 baryton) moves along a straight line i.e. along the radius r of the sphere, so that it resembles to an ordinary particle that moves on a straight line, either with a constant velocity $v=c_0$ or with varying velocity v = v(r) with respect to the emission center. In this last case applies the Rindler's *Mass Hypothesis*[16]. According to the above author: "…When particles move under action of continuous forces we need a hypothesis, *viz.* **the mass hypothesis**: we assume that acceleration as such has no effect on the mass of a particle, or in other words, that the mass depends only on the **instantaneous velocity** according to formula (5.10)[*] …". In our case, since we do not work with the equations of STR when use is made of superluminal speeds, will be used a different expression as will be shown further on. But the mass hypothesis is accepted in our case too. The mass hypothesis is widely applied to the particles accelerators where although the particles accelerate, at the moment of their interaction with other particles it is their velocity (or the kinetic energy) at this moment that counts. The question now that is raised is this: Do the equations of the STR for the relation between total mass, rest mass and velocity can be applied in the case of barytons and generally in the case of faster than light particles that have been called tachyons ? According to Einstein in his first article on relativity[**] "…*velocities faster than that of light have no possibility of existence*…". Besides this verdict, physicists have tried by various theoretical ways, to study the case of tachyons. I have red many papers on this subject, which not only theoretically but also by devising some experiments, tried to find the existence of tachyons and of their properties. I have already mentioned three such papers[4,5,6] and the basic effort of the authors is to express the properties of tachyons by the corresponding equations of STR. There are two points that characterize this procedure:

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[*] The formula (5.10) in Rindler's book is: $m=m_0\gamma=m_0(1-u^2/c^2)^{-1/2} = E/c^2$

[**] I found this quotation in a paper of G. Feinberg[4]

a) Usually the authors do not give any idea of how the tachyons may be generated and how emerge from the ordinary matter we know. They simply suggest that once such tachyons have been created one way or another, they travel at superluminal velocities (usually with constant speeds), and they can (and must) be connected with the equations of the STR for mass, energy and momentum, but at the expense of accepting the possibility of existence of imaginary rest masses. They also denote that the speed of light is a lower limit for superluminal particles. Here it is obvious that, a little only part of the physics community (if nobody) **dares** to work outside of the frame of STR (and of GR too). If Einstein was alive would most probably scolded those who ignored his words and tried with his Theory of Special Relativity to examine velocities faster than that of light that cannot exist according to his opinion.

b) Apart from the curiosity about the existence of tachyons, the authors do not give any idea about what is the purpose of their existence and what need of nature they probably serve.

In the present theory of gravitation I have emphatically mentioned that if any theory of gravitation is finally connected with Quantum Mechanics, must anticipate some messengers that will transmit the gravitational interactions and these messengers, gravitons, barytons or any other, **must travel faster than light** for the reasons I presented in the previous sections. So perhaps for first time it became necessary to connect the gravitational messengers with tachyons. I tried hard to achieve this requirement in the frame of the STR, but I finally realized that the barytons couldn't be treated with this theory. Perhaps Einstein would be clearer if he had said that his equations of the STR should never be used for particles moving at superluminal velocities. Of course at that time these velocities had been completely rejected since the enthusiasm for the new theory of Special Relativity did not permit any talk about speeds greater than that of light. Such talks would bring to the mind of any physicist the ostracized Newtonian instantaneous action at a distance. We now make the critical hypothesis, i.e. that the total mass m_k is constant in time.

But the mass m_1 in rel. (9) which is an elementary portion of m_k is not constant in time since it depends on the distance r from the point of emission. Now since we do not accept the transformations of mass according to STR, let us see what else we can do. To do something we must put first the necessary requirements that must be covered by our theory.

The first and basic requirement is that since there is no force to support the baryton in its motion (expansion), this job must be undertaken by the baryton itself. A mass may move either by the application of an external force or by being supplied with energy given again from outside. Such energy however, would disturb the rest mass of the particle from which the baryton is emitted. And we know that the rest masses of the elementary particles are constants. So the only thing that remains to the baryton to do is to spend **gradually** part of its rest mass, which will be turned to energy that will support its motion forward (the transformation will be done in agreement with the basic equation $E=mc^2$, although we do not know even today the mechanism of this transformation). In the case of the baryton the total energy is $E=m_k c^2$. For this reason the basic equation that will be the right one in the case of the baryton is similar to the equation that expresses the kinetic energy of a moving body in the case of the STR.

$$T= (m-m_0)\, c^2 \qquad (10)$$

The meaning of the symbols in the case of the barytons is:

In (10) m denotes the moving mass of a body. In the case of the baryton the moving mass is the m_r that is the inertial mass that remains in the baryton after the gradual transformation of part of the initial mass m_k into Kinetic Energy T. So (10) is written now:

$$T = (m_k - m_r)\, c^2 \qquad (11)$$

The basic difference between (10) and (11) is that in (10) the moving mass m increases with motion whereas in (11) the moving mass m_r must decrease with motion according to the mass transformation formula of STR as long as this transformation is valid. For this reason (11) is written as above since otherwise T would be negative.

Now since the m_k and m_r have the meaning of constant and changeable moving mass respectively and since the barytons have been defined as faster than light particles, the STR transformation of these two masses is inapplicable. One more basic deficit of the transformation formula of the STR, $m = m_0 / \sqrt{1-\frac{V^2}{c^2}}$ is that for v=c gives the result m = ∞ which is meaningless. On the contrary the transformation formula of the NNB, given in (12) below, gives a sensible result. One may think of various other expressions for this transformation. I think that a possible very simple (following Occam's Razor) such expression (transformation rule may be called) could be the following:

$$m_r = \frac{m_k c^2}{v^2} \qquad (12)$$

where for v=c it is $m_r = m_k$ and this happens for r = 0. Then T=0. This means that the baryton starts its motion with the least speed allowed for the tachyons, which is c. The speed of emission of the baryton is a step function at r=0, t=0 where the speed v at the same t = 0 has two values 0 and c as in fig.2 below: (The c^2 and v^2 in (12) are set to indicate speed not velocity)

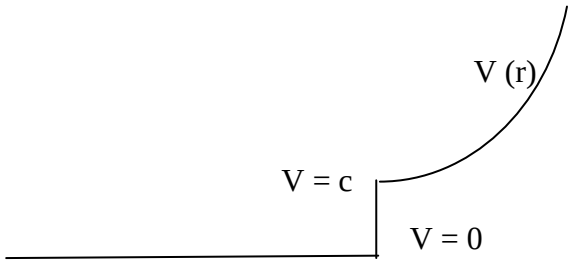

Fig. 2

The shape in fig. 2 is completely indicative. The v(r) may follow any kind of regression or development.

At this point I think that it is useful to remind that this kind of step function is valid also in the case of the photon too. The photon suddenly, (for any allowed reason) from the electromagnetic field where its existence in not apparent (in other words its speed is zero), appears with a speed c. The difference with the baryton is that the photon continues moving at the constant speed c whereas the speed of the baryton increases up to an "infinite" value at infinity.

From (12) and for $v = \rightarrow\infty$ $m_r \rightarrow 0$ and $T = m_k c^2$ following the simple expression:

$T = (m_k - m_r)\, c^2 = (m_k - m_k c^2/v^2)\, c^2 = m_k (1 - c^2/v^2) c^2$ (13)

This last result means that at infinity where $v \rightarrow \infty$ the total rest energy $m_k c^2$ has been transformed to Kinetic Energy T. Of course to the question "what happens if v = 0?" the answer is twofold: a) for v = 0 the baryton is an indistinguishable part of the total mass of the emitting particle. b) For tachyons the lowest velocity is c. The role of the instantaneous rest mass is played by m_r and is equal to: $m_r = m_k - T/c^2$.

In other words m_r is the inertial mass that has not yet turned to kinetic energy.

In STR the transformation rule of mass (with the velocity (speed) of the body) is:

$$m = m_0 / \sqrt{1 - \frac{V^2}{c^2}} \qquad (14)$$

I think that at this point a comment may be done for the case of photons in addition to what was said previously. This comment is completely immaterial for my theory but sometimes things must be put in their correct position.

The problem with relation (14) is: What happens when the particle moves with velocity V = c? According to the STR for any material particle to move with velocity c, an infinite force must be applied upon it to accelerate it until it will attain a velocity c. In the case of the photon, however, although it moves with velocity c, no infinite force (as far as we know) is applied upon it. If however the photon moves steadily with c formula (14) gives:

$$m \equiv m_{ph} = \frac{m_0}{0} = \infty \qquad (15)$$

This means that the photon must have an infinite total moving mass m. Such a particle however, has not been observed in any reference frame.

For the confrontation of this problem in the framework of the STR, most physicists accepted axiomatically that the rest mass of the photon is zero. This means that the photon cannot be at rest in any frame of reference. But then from relation (15) we shall have:

m = 0/0 i.e. indefinite. (16)

From Quantum Mechanics (QM) however, we know that the photon carries a definite amount of energy equal to: $E = h\nu$, where h is the Planck constant and ν is the frequency at which the electromagnetic wave that characterizes the photon, is transmitted. If we take into account the universally known Einstein's famous relation:

$E=mc^2$ proposed by him with the well known (but not absolutely correct) "gedanken" experiment and later by others with different ways (c.f. H.P.French[20], p. p. 27,28), then we conclude that the photon has a moving mass equal to:

$m= h\nu/c^2$ (17)

This however means (from 16 and 17) that:

$$m \equiv \frac{h\nu}{c^2} = \frac{0}{0} \qquad (18)$$

So all the three physical entities h, ν, c must be zero, or at least one of h and ν and c of course.
I really do not know if the physics community accepted the solution of this problem without such arbitrary (and absurd) conclusions. In several textbooks on STR this problem is not discussed. It is silently forgotten.

In an attempt to get a better solution for the case of the photon, I wrote relation (14) a little differently, as in relation (19).

$$m_0 = m\sqrt{1-\frac{V^2}{c^2}} \qquad (19)$$

(in the above formulas I used capital V for the velocity, not to be confused with the Greek letter ν that is used in (17,18) to denote frequency).

If in relation (19) we put V=c and $m = \frac{h\nu}{c^2}$ we have:

$m_0 = (h\nu/c^2) \times 0 = 0$ (20)

In relation (20) there is no indefiniteness i.e. the rest mass of the photon is certainly equal to zero without the need to introduce it axiomatically afterwards. But also its moving mass (= pure kinetic energy) is different from zero and additionally in accordance with QM ($h\nu/c^2$) and with relation $E=mc^2$. END OF COMMENT.

The question that is raised now is whether the hypothesis of the constancy of the total mass m_k is reasonable or not. We talk about the baryton as though it is an ordinary massive particle, i.e. a particle the constant total mass of which (instantaneous rest mass + K.E./c^2) is different from zero. The instantaneous rest mass m_r the magnitude of which depends on the distance crossed by the expanding shell from the expansion center, becomes equal to zero only in the case where $v \to \infty$, but even in this case the m_k will be different from zero but all of it will have been transformed to Kinetic energy.
So there is a correct energy balance. Why, however, the m_k has to be constant and the m_r changeable? The reason is that if the barytons have a rest mass different from zero, they cannot move at the marginal velocity c. When they are emitted they start with a velocity c (as we showed earlier), which will increase continuously and must tend to ∞ as $r \to \infty$, i.e. when they will have crossed an infinite distance from the point of their emission, since at infinity the gravitational interactions are nullified. If the barytons are accelerated, the necessary energy will be supplied by their inertial

energy $m_r c^2$, which is the only available energy source for their motion. So by keeping m_k constant, their rest mass at $v \rightarrow \infty$ will become equal to zero, permitting the achievement of an infinite velocity **at an infinite distance from their emission point.** How this increase of velocity will happen will be cleared further on (when we shall deal with the mass of the baryton)[*].

I think that it is obvious that the fact that the velocity of propagation of the baryton becomes infinite at an infinite distance from its emission point, by no way means that we return to the instantaneous action at a distance according to Newton's point of view. Here we have a gradually increasing velocity and consequently a gradual increase of the time required for the corresponding interaction. Simply this time is shorter than the time required crossing the same distance with velocity c.

At this point must be said that once the barytons start moving with superluminal velocity, cannot be at rest in any frame of reference, keeping at the same time their identity as expanding shells, and for this reason they appear as superluminal objects to all Lorentz systems. From the above fact we deduce that whichever the velocity of the emitting center may be (this point coincides finally by definition with the mass center of any particle), since the velocity of all elementary particles with $m_0 \neq 0$ is less than c, the barytonic shell will expand with superluminal velocity with respect to its emission center. **So the assertion that Newton's law is not valid for fast moving bodies is without meaning if the gravitational interactions are transmitted with superluminal velocity.** G. Feinberg[(4)] has made this statement in different words. As he says: " ….*If a body travels faster than light with respect to one observer, it will do so with respect to any other observer himself traveling in relation to the first at less than the speed of light*….".

The total momentum of B1 as a whole must be zero (with respect to its emission centre), since its initial momentum (before its emission) is also zero. This is correct since if we consider a small part of the expanding shell with a mass Δm at point B (fig.3) that moves with velocity v to the right, a similar part at point A will move with velocity –v to the left so that the total momentum of

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[*] The extension of any theory of physics to infinities is meaningless, since infinity by definition is never reached. So nothing reasonable can be discussed about the behaviour of any kind of objects at infinity. What is said about infinite distances, times, velocities etc. must be taken only verbally and not as something that can really happen.

these two parts with respect to the center of the reference system from which the B1 expands is zero; the same holds for any couple of opposite moving similar parts. The above point of view holds in the case where the emitting particle is at rest with respect to the particle it interacts gravitationally with. If the one particle moves with constant velocity with respect to the other, then it transmits this velocity to B1, during the moment of its emission. The geometrical center of B1 moves with the same constant velocity with the expanding shell. If the velocity of the emitting particle is not constant with respect to the other particle, i.e. if the particle is accelerated (or decelerated) by other forces that may cause this kind of motion, then the center of the emitted B1 will move with a constant velocity, which will be equal to the velocity of the particle at the moment of emission of the B1. But since all material particles can move only with velocities <c whereas the expansion of the B1 takes place with continuously increasing superluminal velocity, there is only a very little displacement of the particle during the time taken for the transmission of the interaction from one particle to the other.

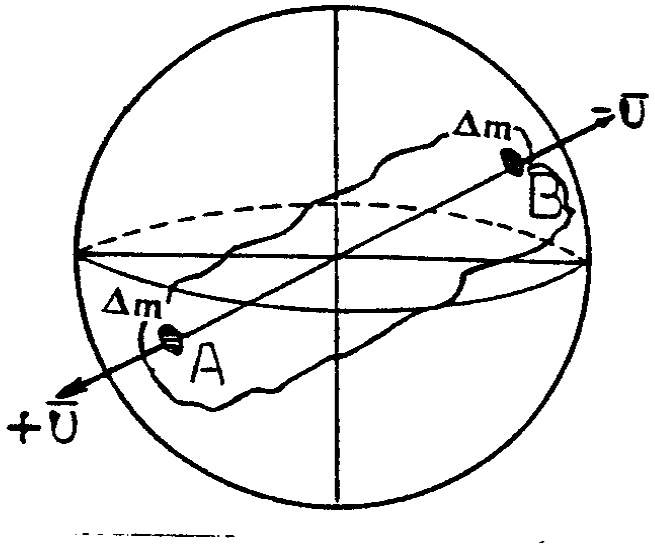

Figure 3

The momentum of the expanding barytonic shell is zero with respect to the centre of emission (centre of mass)

As will be shown in the ensuing development, the momentum of the B2 baryton is not zero wherever it interacts with an elementary particle, since then it is not connected with the diametrically opposite B2. The B2 barytons are finally the ones that interact with the particles they meet during their motion from one particle to another. So since the universe is full of elementary particles of any kind it is to be expected that when the baryton B2 on the right of fig.3 interacts with an elementary particle the same will be done by the baryton B2 with another elementary particle on the left of fig. 3 and the time difference of these two interactions may be considered as completely negligible.

Returning to the main subject of this work, what we need to determine is how the barytons can be used for a derivation of the NLG. This will be achieved in what follows with the least possible hypotheses. Before however this discussion, the definition of two concepts is necessary.

Definition 1

We define by T_b the lifetime of a baryton as it results by use of the Uncertainty Principle i.e.:

$$\Delta t \equiv T_b = \hbar / 2m_k c^2 \qquad (21)$$

where $m_k c^2$ is the constant total energy of the baryton.

During this period of time the baryton exists as a "virtual" entity without any violation of the law of energy conservation, under the presupposition that it does not interact with any kind of particle. According to David Griffiths[17]: "… Actually, the *physical* distinction between real and virtual particles is not quite sharp as I have implied. If a photon is emitted on Alpha Centauri and absorbed in your eye, it is technically a virtual photon I suppose. However, in general, the further a virtual particle is from its mass shell the sorter it lives, so a photon from a distant star would have to be extremely close to its "correct" mass; it would have to be *very close* to real". As a calculational matter, you would get essentially the same answer if you treated the process as a two separate events (emission of a real photon by star, followed by absorption of a real photon by eye). You might say that a real particle is a virtual particle which last long enough that we don't care to inquire how it was produced or how it is eventually absorbed…". R. Feynman[22] too denotes (p. 95): "…*In a sense every real photon is actually virtual if one looks over sufficiently time scales. It is always absorbed somewhere in the universe."*

Talking about messenger particles, i.e. particles that mediate for the achievement of interaction between (non messenger) material particles, I would prefer to distinguish between "real" and "virtual" by another way. **A messenger particle that has been emitted, one way or another, from a source i.e. from an ordinary material particle (electron, nucleon, or other baryon etc.), is virtual as long as it does not interact with any other particle. This messenger particle turns to be real at the very moment of interaction with another particle. At this moment its existence is guaranteed by the other particle.** So a virtual particle is one that has the capability to mediate the interaction between material particles but its existence before the interaction makes it to be *virtual* since everything it possesses is only a "potentiality" for interaction. On the other hand as I have said earlier, an interaction of two material particles with each other is in fact an "observation" of one by the other. So the elementary particles **EXIST** thanks to their interactions via the various force

fields. I suppose that this point of view would have satisfied both Einstein and Bohr if they had thought in the above way.

In some analogy with the case of photons, we may assert that unceasing emissions of barytons from all elementary particles take place, for which the following cases may occur:

A) The emitted baryton starts with an initial velocity $v_0 = c$, it expands up to a distance r_1, where its velocity becomes $v_1 > c$, then it inverts its motion and with the same velocity v_1 returns and having reached again its initial velocity c is reabsorbed at its emission place. This is a very ideal case that has a zero, I would say, probability to happen in our universe, even if it is finite, compared with the most probable case B below. The reason is this: Although the B1 is endowed with a lifetime $T_b = \hbar / 2m_k c^2$ (which is rather short even if $m_k \approx 10^{-50}$ kg that means that $T_b \cong 0.06$ sec), it never inverts its forward motion (expansion) because if its velocity is greater than the velocity of light c and its total mass m_k is equal (or less) to the conjectured rest mass of a photon (let us say ~ 10^{-49} kg) then the half lifetime is about $6\ 10^{-2}$ sec. So the distance covered during this time is greater than $6\ 10^{-2} \times 3\ 10^8 = 1.8\ 10^7$ m. and more, since the baryton expands with velocity > c[*]. We will return to this point later on.

For its motion to be inverted it must not have interacted with any other particle, so that when it returns to its initial position, it brings the exact amount of mass it extracted from the particle during its emission (because of the law for mass- energy conservation). So although globally there is no violation of this law, this law is violated locally since as it is generally accepted the rest masses of the particles are universal constants. So the constancy of the rest mass of the emitting particle controls in a way the lifetime of the baryton, as it was defined above. The average density of the ordinary (observed) matter in the universe is about[(23)] $3\ 10^{-28}$ kg/m^3 or approximately 5 protons (or hydrogen atoms)/m^3. So the maximum separation of such particles, even in the most remote places of the universe, cannot be greater than a few meters. If the photons and neutrinos that are flooding the universe to innumerable quantities are subject to gravitational interactions as well[**], then the above maximum distance is dramatically shorter

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[*] In the above statement we used the velocity of light c because we have not yet determined the actual velocity of the baryton expansion.

[**] For the neutrinos, I have done some calculations based of the concept of the paraquarks I developed in my book[(12)]. I resulted that they do not make any kind of harmonic motion (either rectilinear or circular) so no Zitterbewegung that

than the distance that can cross the baryton B1 during its half lifetime. So there is no case the barytons B1 to reverse their motion and be reabsorbed at the place they were emitted from. For this reason its empty place will be filled immediately by the incoming from all directions B2.

B) Let us consider first two elementary particles that interact gravitationally with each other. Let A1 emits a baryton B1 that encounters the other particle A2. What we need now is to find the amount of mass left by the incoming B1 from A1 on an empty space inside A2 from which a B1 too has been emitted. The emitted B1, as it expands from the place of its emission, encounters the particle A2. Because the equivalence principle imposes equivalence between inertial and gravitational mass, we may imagine that the barytons, which constitute expressions of gravitational mass, exist inside all particles in a latent state as we have already said. This means that the number of barytons that are contained in a particle is equal to M/m_k, where M (for small velocities between the interacting particles will be $M \cong M_0$) is the inertial (rest) mass of the particle and m_k the constant total mass of the baryton B1. So the B1 as it sweeps the region around it where exist elementary particles, leaves in them part of its mass to fill empty places inside the particles it encounters. The amount of mass left in an empty volume of the A2 is determined by the product $\rho_b \times V_b$ where ρ_b is the mass density inside the shell of any B1 baryton and V_b is the volume occupied by a latent B1 inside any elementary particle and so it is the empty volume left immediately after the emission of a B1. The expression for the ρ_b is taken from expression (7). I calculated the mass transferred by the incoming B1 from A1 to one empty volume of A2. This amount is given by (9) where I determined it. Of course I suppose that an empty place of particle A2 will be finally filled completely by the continuously coming B2 from particle A1.

The mass m_k in (9) is the mass of B1 as this B1 was defined in the foregoing. As it is obvious, it does not depend on the masses of the

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means that they will be not subject to gravitational interactions. As P.C.Davies[24] say: "…*Neutrinos come close to being pure nothing, except for a vital property called spin*…". In my book where I examined the case of the neutrinos I considered them as composite particles by three more elementary ones, I called paraquarks, and I considered their spin as being due to the intrinsic angular momentum of the paraquarks and the alignment of their spins so that the composite particle (neutrino) can have a spin ½.

two particles or on their separation distance whereas the mass of B2 (denoted as m_1 in (9)) depends on this distance.

Definition 2

We define by n_b the number of barytons B1 emitted by any elementary particle in time T_b. This number is given by the relation (22) as will be shown further on.

$N_b=M/m_k$ (22)

where M is the total inertial mass of the particle and m_k the total costant mass of any baryton B1. This total inertial mass of the elementary particle is given by the known relativistic relation: $M = M_0 / (1-u^2 / c^2)^{1/2}$. In this case (i.e. with an increased mass of the particle A1, due to its motion with velocity u with respect to the particle A2) since m_k is a universal constant, the increase of the mass of A1 is translated to an increase of the number of the latent barytons and not of the constant barytonic mass m_k. The determination of N_b comes from the study of the motion of a packet of free waves in the Heisenberg representation, which is done by an elementary particle (e.g. an electron) that follows a complicated motion that comes from the addition of a classical uniform rectilinear motion of velocity $v=\langle \mathbf{p}/H \rangle$ and a *rapidly* oscillatory motion, $\langle i\left(\alpha(0)-\frac{\mathbf{p}}{H}\right)\frac{e^{-2iHt}}{2H}\rangle$ whose amplitude and period are of the order $\hbar/2mc$ and $\hbar/2mc^2$ respectively, where m is the mass of the particle, p its momentum and H the Hamiltonian. These three magnitudes are taken independent of time (c.f. Messiah[13] for the meaning of the symbols).

I suppose that for a quickly moving particle the mass m must be the inertial mass as it was defined in rel. (2) i.e. the moving mass. This is not cleared in the previously mentioned book[13] but is noticed in a book written in Greek by Stef. Trahanas[25] with title "Relativistic Quantum Mechanics" p.64). But it has not been discussed what happens when p and H are time depended i.e. when the motion is accelerated (or decelerated). In this case, as we said previously the Rindler's *Mass Hypothesis* must probably be applied. But this kind of varying velocity of a particle is not discussed in the above two books that discuss the case of the Zitterbewegung.

Anyway, in the present case we shall consider that the period of this motion is the one given above. Schrödinger has called this oscillation: "Zitterbewegung". According to Milo Wolff[7], a lot of

research has failed to find an explanation for this motion[*]. The idea of the Zitterbewegung, although it was born for the case of electrons and it is usually referred to these particles (Dirac particles as they are usually mentioned), should be normally expected to apply to any other particle that obeys the Fermi-Dirac statistics. For such an extension I have not found references in the existing literature I had at my disposition (13, 25). But the bosons too with zero spin must present Zitterbewegung since the Klein-Gordon equation accepts both positive and negative eigenvalues of energy (c.f. ref.13 p.887). So they must also interact gravitationally with the rest of the particles. From the test of GR about the bending of light rays when they pass near strong gravitational sources (the Sun e.g. et al) we believe that the photons too are subject to gravitational interactions. So the bosons with spin 1 (photons) should exert Zitterbewegung during their free motion too (if finally the idea that the Zitterbewegung is proved the cause of the gravitational interactions). For this reason I will try to give a deeper meaning to the Zitterbewegung, because, although this peculiar motion is generally accepted, the consequences of it have not been investigated in depth and its contribution in the area of natural happenings remains obscure. I

[*] In a more recent work of mine[(12)] I showed that the quarks inside the nucleons execute quantum harmonic oscillation. Also the three constituents of electron and the electron neutrino, called by me *paraquarks* execute the same motion, which in the exterior of the nucleons and of the electrons and neutrinos is displayed as "Zitterbewegung". The idea that the leptons are composed particles too has been strongly supported by logical arguments in the above new work of mine, and has been suggested by other people too as e.g. in ref. (26, p 363) where the authors write: "…At present there is no deep understanding of this repetitive fermion structure. (The existence of family symmetry group? Lepton and quark substructure?) This is usually referred to as the *fermion family problem* …".A strong support to the idea that the leptons are also particles composed by three sub-particles called by me "paraquarks " as I said before, is a phrase in the book of Steven Weinberg[(27)] under the title "The First Three Minutes" where he writes: "…*The fact that the universe has no electric charge tells us that there is now* ***precisely*** *(*the emphasis is mine*) one negatively charged electron for each positively charged proton…".* From the above sentence an immediate question is raised: Who measured or ordered the exact number of protons and electrons in a universe for which we are not yet certain whether it is finite or infinite and deduced the above exact equality? Or what mechanism made possible this equality? The answer is given in my book[(12)] and in two words this equality is due to the simultaneous production of one proton and one electron from the splitting of the "protoquaqrks" as I called them ≡ Mini White Holes in one positive and one negative particle (quark-paraquark). The details are given in my book[(12)] .

say this, because nowhere I have found an explanation why only some particle wavepackets present both positive and negative energy solutions and why the two solutions present necessarily a kind of interference.

As it has already been defined, the barytons are emitted by all elementary particles from certain positions inside the particles, which positions have dimensions of the order of Planck length and for symmetry reasons these positions have spherical shape. The fact that some particles are considered to have a point-like character does not entail that the barytons cannot be emitted by them, for the following reasons: A) The word "point-like" is not a mathematical point which is supposed to posses (or tend to) zero dimensions. It is simply a convenient acceptance for the description of the particle behavior during an interaction. B) Additionally for every, even point-like, particle with not zero rest mass, corresponds a quantum radius $\hbar/2m_0c$, which is many orders of magnitude greater than the Planck length that characterizes the baryton before its emission. C) There are opinions that have been expressed by some people, that even the leptons may have a non point-like structure[26]. I hope that I have adequately shown in my book[12] that electrons and electron neutrinos are composed also by three more elementary particles I called "paraquarks". So it is possible that the places of emission of the barytons, are materialized inside the elementary particles so that during their trembling motion (Zitterbewegung), generate places that achieve Planck dimensions. This may mean that inside these particles are repeatedly created places of emission of barytons. The spherical shape apart from the resemblance of these places with a white hole metric from which mass emerges from a Sub-Planckian region, as I have shown in another work of mine[10], results also from the Occam's razor of least hypotheses and of simplicity. Although this idea requires an extended development, I will try to give in brief its basic features.

So the Zitterbewegung is accepted as an existing phenomenon additional to the rectilinear motion of the electrons and according to my opinion, of most elementary particles, but its existence has not received a solid explanation. The Zitterbewegung is usually connected with a classical uniform rectilinear motion of the electron, so that other types of motion, as far as I know, are not discussed in connection with this peculiar motion. Do the electrons and the other fermions present Zitterbewegung in other types of motion where the momentum p and the Hamiltonian H depend on

time? And of course in the case of particles at rest as STR accepts them? What about the other leptons (μ, τ, ν etc.) and what about the baryons (nucleons and other heavier baryons) and so on, do they present Zitterbewegung? And beyond that, nowhere I found reference about a possible contribution of the Zitterbewegung to the happenings in the universe. If such a motion were absent would the universe be the same as it looks to us now? In my book[12] I determined the bare masses of the u and d quarks (as I already said) by identifying them as the result of an endless simple harmonic quantum oscillation of the quarks inside the nucleons the energy of which is equivalent to the bare u and d quark masses (times c^2). I missed however to notice that this motion simply changes the separation of the quarks mass centers so that the quarks inflate and deflate continuously minimizing and increasing endlessly the dimensions of the nucleons. If somebody could see a nucleon say, moving in a straight line would get the following (gross) picture of this motion:

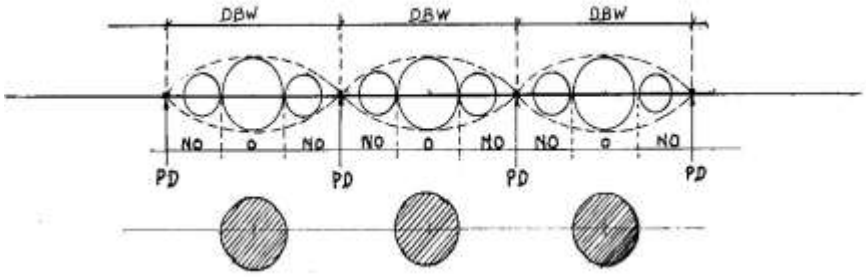

Fig. 4

Notes: DBW short writing for…De Broglie Wavelength
NO " " " … Not Observable particle
O " " " … Observable particle
PD " " " … Planck Dimensions

The observable particles may be slightly elongated in the direction of motion according to the capabilities of the instruments and method we use for the observation.

What may be inferred from this picture? Since the size of the quarks (in the case of nucleons) increases and decreases continually from the minimum size of the order of Planck length to the maximum size of about a little less than 1/2 of the Compton wavelength of the nucleon, what we can observe is only this maximum size of the nucleon, perhaps the indicated in Fig. 4 three central sizes of the nucleon since our observing instruments would

be unable to intrude to the small sizes left and right of the center because the energies available today are much less than the Planck's energies of about 10^{18} GeV and more. So the nucleons could be resembled to a particle that jumps from one place to the next at certain constant time intervals and in between these appearances seem to be empty space. I do not know if such a picture has something to do with Zitterbevegung. Searching however in my poor bookcase for other books that mention something about Zitterbewegung, I found a book by Robert Guiran[28] from which some quotations are worth to be presented here. a) "…*What does exist is a discontinuous series of events, like a string of breads, between which there is, in the words of Reichenbach, an interphenomenon of which we know nothing, for in it the object has disappeared after destroying itself. All that remains as witness to its propagation is de Broglie wave, intangible and non physical, which in its turn will disappear following the reappearance of any corpuscle*…". b) … *The fluctuations of a discontinuous trajectory are justified by Heisenberg's uncertainties*…". c) "…*And is not this in fact what an electron does?...".* d) *Since Dirac's theories did not cover a particle at rest, he was forced to assume that the electron is always moving at the speed of light, but that its physical trajectory flickers in such a way that it had an 'average velocity' down at the level of that recorded in experiments. This is the 'Zitterbevegung' or 'flicker path' of the electron…".* In my book[12] I have shown that the electrons and electron neutrinos are composite particles and they are constituted out of three basic particles I called 'paraquarks'. These particles execute, as in the case of the quarks in nucleons, a simple quantum harmonic oscillation along with a peculiar circular motion, the periodic frequencies of these two motions being equal. So the dimensions of both, nucleons or electrons increase and decrease continually so that the nucleons and the electrons inflate and deflate correspondingly and Fig. 4 expresses the same appearance and disappearance of these particles during their rectilinear motion. In this way I think that the interrupted rectilinear motion of the above particles (and many others) finds now a serious support in the internal motion of their constituents and the inability of the observation of the above events is due to the lack of appropriate instruments capable to observe (or detect) dimensions smaller than the quantum radius of any particle, which dimensions approach periodically the Planck length region. So the "interphenomenon" of Reichenbach is no

more an unexplained event. The Zitterbewegung, on the other hand, has found also a solid explanation of its existence, since the reason of the interference of both positive and negative energies in a wavepacket alone, does not explain the cause of their existence. With my theory, as presented in brief in the foregoing discussion a very important role has been given to this peculiar motion, i.e. the genesis of gravitation among the various elementary particles of nature. The origin of the Zitterbewegung is definitely due to the Uncertainty Principle, stating clearly that nothing in nature may stay immovable, if it has to be somewhere in the universe. Perhaps if Heraclitus knew Quantum Mechanics could have said: Everything moves. At this point I must say that the identification in Fig 4 of the wavelength of the obvious wavelike motion of nucleons and electrons with the De Broglie wavelength is done without a preceding analysis. This idea was supported by the internal inflation and deflation of these particles being a continuous process so that the tangent line that encloses the particles is in fact the picture of a wave group. So the behavior of the above particles in some circumstances as material entities and in others as waves, not completely explained up to now, finds a new interpretation being attributed to the continuous internal motions of the particles that constitute the nucleons and the electron (quarks and paraquarcs). As it has been shown[29] "*...The de Broglie wave group associated with a moving body travels with the same velocity as the body. The wave velocity w of the de Broglie waves evidently has no simple physical significance in itself...".* The above explanations that were presented for a better understanding of the Zitterbevegung, which is the basic cause for gravitation, lead to some further interesting outcomes.

Let us consider an electron that follows a rectilinear motion with constant velocity. The de Broglie wavelength is: $\lambda = h/mV$. The quantum diameter of the electron is: $d = \frac{\hbar}{m_0 c}$. One condition that must be fulfilled in Fig. 4 is that $\frac{\lambda}{d} > 1$. It is $m = \frac{m_0}{\sqrt{1 - \frac{V^2}{c^2}}}$ so that after few transformations the imposed condition for λ and d yields:

$V_{max} < 0.98757c$. This means that no material particle can be accelerated beyond this velocity whichever force is applied upon

it, if the assumption that λ, as defined as the de Broglie wavelength in Fig. 4, is valid. The above velocity cannot be surpassed as can be shown with the above simple example: Let V=0.99c. Then: λ/d = 0.8863524 < 1 which is obviously an unacceptable result. I really do not know if velocities greater than the above marginal velocity V_{max} of any kind of particle have been attained in any of the existing particle accelerators for individual (i.e. not colliding) particles. We talk of course for the velocity of the particle with respect to its emission point inside the accelerating machine. Then the interpretation given above of the Zitterbevegung has to be reconsidered. The above condition must hold for any elementary particle since the ratio λ/d is independent of the particle mass*.

To end this intermezzo I simply remind the reader that the velocity of any principal particle (as the quarks and the para-quarks I have introduced in the other work of mine[12]), never becomes zero so that the idea of the famous "rest mass" of the STR never can be attained at least by the above basic particles, except only in approximation. But it is true that in books that discuss the problem of this motion, I did not find any reference about an experimental observation of the Zitterbewegung. Only expressions like: "oscillatory motion", "Complicated motion", "characteristic trembling", "to and fro motion", "flicker path of the electron" etc. are present in the examination of this peculiar motion.

1) Now what in fact is needed for the development of the present theory of gravitation is that in the interior of the elementary particles at certain fixed temporal intervals the realization of a region with Planck dimensions takes place by one way or another.
2) If Zitterbewegung is insufficient to provide the necessary conditions for the emission of barytons by any elementary particle, may other mechanisms be found that do the job. They will create inside the particles the condition for an eternal periodic appearance of a region with dimensions of Planck order of magnitude, from which a baryton will be emitted. Such a mechanism in the interior of baryons but also of the hadronic mesons, may be due to the internal motion of

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* The ratio $\frac{\lambda}{d} = 2\pi\sqrt{\frac{c^2}{V^2} - 1}$ which is >1 for V<0.98757(0492)c as we also derived above .

the quarks that constitute all hadrons, as I have shown in my mentioned work[(12)**].

3) For the leptons and leptonic bosons ($W^{\pm}$, Z and the photon), I have expressed the opinion that these particles are composite too, constituted by more elementary particles I have called γ_x particles (or paraquarks), which with certain combinations constitute the leptons and the heavy bosons as well as the photon too, in such a way that an internal motion may occur inside these particles too.
4) Some other, as yet unknown mechanisms may be discovered in the future, which will explain the continuous and spontaneous emission of barytons by any elementary particle. For the time being, however, we will stand to the Zitterbewegung case, which seems as the most promising solution in our investigation.

A simple interpretation is now given to the n_b that was only defined previously.

If the frequency of the Zitterbewegung is $\frac{2mc^2}{\hbar}$, then according to the preceding analysis, this frequency represents the number of emitted barytons per second by any elementary particle. So during the lifetime of the baryton the number of emitted barytons will be equal to:

$$\frac{2mc^2}{\hbar} \times \frac{\hbar}{2m_k c^2} = \frac{m}{m_k} \equiv \frac{M}{m_k} \text{ barytons} \qquad (23)$$

as it was indicated in the above definition 2, i.e. the total mass of the particle will be emitted in the form of barytons successively. M is the inertial mass of the particle.

The above result constitutes probably a further support to the Equivalence Principle between inertial and gravitational mass, since the total mass of the particle is diffused to the outer space under the form of barytonic mass. Consequently the continuous exchange of barytons among all material particles does not permit the detection of any kind of reduction (or of increase because of the incoming barytons) of the inertial mass of the elementary

** In this book of mine the bare masses of the u and d quarks are simply the mass equivalent of the energy of a simple harmonic quantum-mechanical motion performed by the u and d quarks inside the nucleons thanks to the mass-energy relation $E = mc^2$.

particles. This fact, however, implies conveyance of momentum from one particle to the other, as will be shown immediately below.

Let us follow now the course of the baryton B1 that was emitted in the above way. Let us suppose that in time t after its emission from the No1 particle, encounters a particle No2 that is a distance r away from the particle No1. Then it delivers to particle 2 an amount of mass m_1 given from (9) $M2/m_k$ times, i.e. as big is the number of the latent barytons of particle 2. So the oncoming shell interacts in effect with the total mass of particle 2.

Since in time T_b, M_1 / m_k barytons are emitted by particle 1, in time t will have been emitted:

$$b_1 = \frac{M_1}{m_k} \times \frac{t}{T_b} = \frac{2c^2 t M_1}{\hbar} barytons \tag{24}$$

In the above relation t is a function of the distance r i.e. t = t(r) (and vice versa r = r(t)). The oncoming barytonic shells from particle 1, deliver in time t to all latent barytons of particle 2, which as we said are equal in number to M_2 / m_k, an amount of mass equal to:

$$m_2 = m_1 \times b_1 \times \frac{M_2}{m_k} = \frac{GM_1M_2}{r^2} \times \frac{ta^2}{3c} \tag{25}$$

In (25) use was made of the fact that $m_k \neq 0$ and also of the expression (1) for L since L is contained in the expression of m_1 from (9). If the velocity of the B2 barytons that are delivered to particle 2 at a distance r is v(r), then the momentum they convey at this distance (since they are captured by particle 2 their total momentum will be transferred to this particle) will be equal to:

$$p = m_2 v(r) \tag{26}$$

This momentum is transferred to particle 2 so that the force applied to this particle will be equal to:

$$F_{1,2} = \frac{dp}{dt} = \frac{dp}{dr}\frac{dr}{dt} = \frac{dp}{dr}v = GM_1M_2\frac{a^2}{3}\frac{v}{c}\frac{d}{dr}(\frac{vt}{r^2}) = -\frac{GM_1M_2}{r^2}\frac{a^2}{3}\frac{v}{c}(\frac{2vt}{r} - \frac{dv}{dr}t - 1) \tag{27}$$

As can be verified (and it is normally expected), we would arrive at the same result if we had started calculating the force acted on particle 1 from particle 2 i.e. the force $F_{2,1}$. What is necessary to point out is that Newton's law for instantaneous equality of action and reaction may still be valid in the sense that the time needed for the baryton from the particle 1 to reach the particle 2 is the same with the time needed for the baryton from particle 2 to reach

particle 1. So the equal forces $F_{1,2}$ and $F_{2,1}$ are applied simultaneously on the two particles, even if the relative velocity of the particles is the velocity of light c (since v(r)>>c by definition). So although the velocity of propagation of the gravitational interaction is not infinite, the application of the gravitational forces on the particles is simultaneous. Of course the simultaneity is obvious in the case of infinite and constant velocity of the interaction, which however never happens.

The result of (27) may appear strange at first glance. Indeed somebody may wonder how possible is the transferred momentum to be in the direction of the motion of the baryton and the applied force to be to the opposite direction. This is due to the mass m_2 (relation (25)). Let us see for simplicity (since we still do not know the expression for the v(r)) what happens in the case where the velocity at which the barytonic shell propagates is constant. Then t = r/v so that from (25) we have:

$$m_2 = m_1 \times b_1 \times \frac{M_2}{m_k} = \frac{GM_1M_2}{r} \times \frac{a^2}{3c} \propto \frac{1}{r} \qquad (28)$$

This has the meaning that the more the distance between the interacting particles increases the more m_2 decreases. So from (28) is inferred that the momentum of m_2 will be proportional to 1/r for constant velocity. This is due to the rest mass of the expanding B2 being not constant but varying with the distance from the emission centre i.e. with time (and for this reason I called it in the foregoing instantaneous rest mass). So although there is no external force to act and push the baryton, the fact that it is accelerated with the increase of the distance r from its emission point, may be translated as the application of a force which usually is given by the relation $F = dp/dt = dp/dr \times dr/dt = -1/r^2 v$. So this force will be proportional to the $(-1/r^2)$ i.e. it will be opposite to the direction of momentum and this is the force applied on the target-particle. I think that this is the correct but unexpected result of the above calculations that strengthens the belief on the chosen model for the gravitational interactions.

The application of the modified Newton's law of gravitational attraction between two particles, presupposes the knowledge of the function v = v (r), i.e. the speed of the expanding barytonic shell, which is the speed of propagation of the gravitational interactions. The ignorance of this function v(r) renders the use of the modified law of the Newtonian attraction problematic. As I have already said, since there is no instrument that can measure superluminal

velocities the only one can do is to find by trial and error a function v(r), which if it gives acceptable results in the calculation of the four tests of GR, this will be an indication that this function is pretty close to the real one that exists in nature. This method of course presupposes the existence of very accurate values of the relevant magnitudes from observation. As the reader will soon realize in part II bellow, such accurate values are still missing and for this reason I used the existing ones from the literature, but every time that one more accurate value has been measured with greater accuracy the calculations must be repeated for a better determination of v(r)[*].

So I conclude:

From what I know, the derivation of the law of Newton's universal attraction, without any support from experiment or observation in its complete expression has not been done by any of the existing theories of gravitation. Complete expression means with the simultaneous appearance of the product of the two masses M_1 and M_2 in the numerator of its known expression of the gravitational force, with the r^2 in the denominator of the same expression, with the negative sign in front of it that indicates the attractive character of the gravitational force, plus with the proof that the velocity of propagation of the gravitational interactions is equal to c in the NLG case (instead of the instantaneous action at a distance) and finally plus the appearance of the gravitational constant G not as an experimentally determinable constant with the application of the NLG but as a parameter that can be determined (in principle) from the knowledge of the minimum real length, the minimum real time and the maximum elementary mass in the Universe[**], The above analysis is an indirect verification of the machinery of the Newtonian law of gravitation, since the derivation of expression (27) contains as a special case the NLG.

As it is obvious from (27), apart from the determination of the function v(r) we need the determination of the multiplier of the Planck length {a}. The $\sqrt{3}$ we used in the derivation of the simple NLG is almost certain that would not be valid in the case of the complete NNL as it appears in (27). So this parameter must also be determined by trial and error.

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[*] As P.C. Davies say[(24, p.134)] "The Weinberg-Salam theory contains constants which must simply be fixed by Experiment" And the GUTs too need some experimentally determined constants.

[**] About a more profound determination of the three basic constants h, c, G, look in APPENDIX C.

Because, for the time being, we can not even think for a device that will be capable to measure the velocity at which the gravitational interactions propagate, the propagation of the gravitational interactions may be understood easier with the following gross example: Let us consider the thunder-lightning case. As it is known these two simultaneous physical events propagate in space with different velocities and their propagation is achieved through different dynamical fields. The lightning is transmitted by the velocity of light in the (quasi-empty) space and the thunder is transmitted with the velocity of sound as a disturbance of the material particles that exist in the space between transmitter and receiver. If this space were empty from any kind of matter, the thunder would not be received at the observer on earth. So there is a similarity if we replace the velocity of light at which the gravitational waves propagate according to GR, by the much greater velocity at which the barytons propagate in space and the velocity of sound by the much greater velocity of light at which the gravitational waves (as they are called in GR) are transmitted through space as the GR asserts. The two transmissions of gravitational origin are completely different with each other and **it is worth to wonder how nobody as far as I know, has not understood the difference between transmission of gravitational interactions and transmission of gravitational waves.** The gravitational waves are characterized[(24)] as **ripples** of the space itself or as a kind of travelling spatial deformities (space warps) and are produced when big astronomical masses either collide with each other or they collapse in neutron stars or black holes. In this case the (non-existing **gravitons)** neither are mentioned nor are they useful. If you think in depth, the mistake is due to the hesitation of most people to deviate from the principle or law imposed by Einstein himself, that there are no velocities greater than that of light.

The only method for the determination of the function v(r) is the use of the trial and error method. In Part II I shall give the details of this method and the results I obtained by using the observational data of the four tests of GR. It was a tedious work since I had to choose among an innumerable number of functions that could be used as an expression of the velocity v of the gravitational interactions, and mostly I worked with a trial and error method accompanied sometimes with a little intuition. If in the future the necessary observations will provide us with more accurate values for the four tests of GR, then the accuracy of my theory could be

increased either by changing the applied function v(r) or by changing the other factor of eq. (27) that must be determined too, which is the value of {a} that is the multiplier of the Planck length in the case of the derivation of the NNL. This factor cannot be the $\sqrt{3}$ as we accepted in the case of v=c=constant. And for this factor too we shall use the trial and error method until we get acceptable results from the use of the observational data from the precessions of the perihelia of the 3+1 planets, for the bending of light rays passing near the sun and the delays of radar signals that also pass near the sun surface.

In the preceding derivation we considered the interaction of one baryton with the first elementary particle it encounters. Since a little part only of the baryton mass is deposited on the particle, the baryton continues its expansion but now its total mass is not m_k but a little less. If it encounters another particle its mass is reduced again and so on. So the question is whether the use of the same derivation of Newton's law after many successive interactions of the baryton with elementary particles is legitimate as the one we applied in the case of the first particle. As it can be easily proved the error is negligible and produces a not detectable difference in our calculations at ordinary gravitational cases. At very extreme conditions, however, the strength of the gravitational force seems to weaken considerably. So we will start with such an extreme case.

We chose the most compact body in the universe, i.e. a neutron star. The case of a black hole may be an extension of the neutron star[*]. We will consider the gravitational interaction of a neutron that is in the outermost surface of the star. For our rough calculations we will consider that the neutrons are uniformly distributed in the volume of the star (the real distribution may be different but for our purpose this does not present any significant effect) in a close packed arrangement, and as such we chose the cubic system with spheres on the faces of the cube, which from the crystal systems yields a packing fraction equal to: $\frac{\pi\sqrt{2}}{6} = 0.7405$ (the greatest packing fraction in the case of close packed spheres). We divide the volume of the neutron to homocentric spherical shells of thickness $2r_0$ where r_0 is the average radius of the nucleons in a big nucleus, which from another work of mine[(30)]

[*] As will be shown later on, for distances a little less than 10^9 m, the correct result is obtained by application of the NLG rather than the NNL.

was found equal to ~1.05 10^{-15}m. Then it can be proved that in the volume of the n^{th} neutron shell there exist on the average $4\pi n^2\ \sqrt{2}$ neutrons.

In the first neutron shell, the B1 deposits a total mass equal to:

$$\frac{4\pi\sqrt{2}M_2(aL)^2}{6(2r_0)^2} \tag{29}$$

The mass density inside of B1 as it enters in the second neutron shell will be equal to:

$$\left(m_k - \frac{4\pi\sqrt{2}M_2(aL)^2}{6(2r_0)^2}\right)\frac{1}{4\pi(4r_0)^2 2aL} \tag{30}$$

Then the mass deposited to the $16\pi\sqrt{2}$ neutrons of the second shell is equal to:

$$\left(m_k - \frac{4\pi\sqrt{2}M_2(aL)^2}{6(2r_0)^2}\right)\frac{16\pi\sqrt{2}(aL)^2}{6(4r_0)^2}\frac{M_2}{m_k} \tag{31}$$

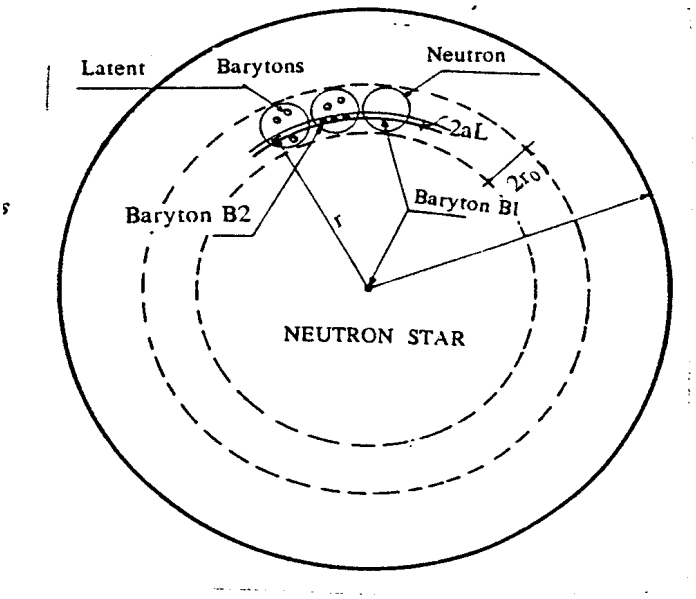

Figure 4

Interaction of the Bl at the centre of a neutron star (or a black hole) with the rest neutrons of the star

If we continue the calculation with the same method, we may derive to a first order approximation (i.e. omitting terms of order

of magnitude greater than $(L/r_0)^2$ as e.g. $(L/r_0)^3$ and so on) that the mass that remains in the B1 that was emitted from the centre of the star, will be given after n interactions (i.e. with the outermost neutron shell), by the relation (32):

$$M_{B1} = m_k\left(1-\frac{2\pi n\sqrt{2}M_2(aL)^2}{3r_0^{\,2}m_k}\right) \qquad (32)$$

We are interested in the value of the expression $A_i=\frac{2\pi n\sqrt{2}M_2(aL)^2}{3r_0^{\,2}}$ (33)

For the convenience of the reader I make a brief presentation of the symbols in (33). So for i= 1,2,3… we have:

1) n is the number of homocentric shells which have a thickness equal to the conventional diameter of a neutron (or proton) according the to case. (for a neutron the diameter is taken equal to $2.09\ 10^{-15}$ m.
2) M_2 is the mass of a proton or a neutron equal to $\approx 1.67482\ 10^{-27}$ kg.
3) L is the Planck length equal to $1.616\ 10^{-35}$ m.
4) {a} is a multiplier of the Planck length as it is determined in the second part of this book.
5) r_0 is the radius of a neutron or a proton as it was determined in the previous work of mine[30] in the case of massive nuclei ($r_0 \cong 1.045\cdot 10^{-15} m$)

For a neutron star with radius ~8 Km, the n is equal to $8000/2.1\ 10^{-15} = 3.8\ 10^{18}$ and since $M_2 = 1.67482\ 10^{-27}$ kg, L = $1.616\ 10^{-35}$ m, a= 0.39269908 and $r_0 = 1.045\ 10^{-15}$ m, expression (31) gives:

$A_1 = 6.951768\ 10^{-49}$ kg and the value of (32) is given in (34)

$M_{B1} = m_k(1-6.951768\ 10^{-49}/m_k)$ (34)

In (32) (and in (33) too), the value of the multiplier {a} in aL has been obtained from the examination of the advance of Mercury which will be presented in the second part of this book. It was found (as a best estimation) equal to 0.392699086. Now expression (34) has the meaning that the mass that remains in the B1 that was at the center of the neutron star, after interactions with all neutrons of the star becomes zero either if m_k is zero from the very begining, which is a trivial case that has no meaning according to what we said in the foregoing analysis , or it is equal to $6.95177\ 10^{-49}$ kg. This is the minimum mass of m_k and the mass that remains in the expanding shell B1 is nullified. For this reason we have a greater limit for the inertial mass of the B1 so that we

must write: $m_k \geq 6.95177\ 10^{-49}$ kg.≡ $6.95177\ 10^{-46}$ gr. This last numerical result gives the first idea about the initial inertial mass of the B1. In what follows I will do four more calculations for m_k in more extreme circumstances to find more values for m_k.

The next case is the lightest possible black hole that is created from the collapse of a star. We talk about the mass of a star that remains after a supernova explosion. According to a work of mine about the fate of mass falling towards the central singularity of a Schwarzschild black hole[12] the least mass necessary for the formation of a black hole is equal 2.008456 Sun masses = $3.9887573\ 10^{30}$ kg and the whole volume of the black hole is occupied by the above mass. So the outermost layer of this mass has a radius equal to the Schwarzschild radius of the mass = $5.931354\ 10^{3}$ m. Since the above limit of mass differentiates the black hole from a neutron star, we suggest that the total mass of the hole is a collection of neutrons in a close packed assembly. The average radius of the neutrons however is now a little less than in the case of the neutron star since the neutrons are squeezed in a smaller volume because of the gravitational attraction of the Black Hole. This radius was found in my previous work, equal to $4.01637\ 10^{-16}$ m. The neutrons are again in close packed assembly. Application of the above data in (33) gives:

$A_2 = 9.14468\ 10^{-48}$ kg something that means that m_k must be greater than A_2 since otherwise the M_{B1} would be negative.

The next astronomical body we shall examine is the Sun. We shall find again the value A_3 for the Sun. Here we have to make some alterations in our calculations. In the case of the Neutron Star and the lightest Black hole the neutrons inside these bodies were in a close packed system of equal spheres. In the case of the Sun however this situation is not valid. For this reason we will work differently. So:

a) For the Sun we consider that the number of neutrons is equal to the number of protons and for this reason the mass M_2 in (32 or 33) will be taken equal to the mean value of a neutron and a proton, e.g. equal to $1.67482\ 10^{-27}$ kg.

b) The average density of the Sun mass is:

$$\rho_{sun} = \frac{m_{sun}}{\frac{4\pi R^3{}_{sun}}{3}} = 1.4077 \cdot 10^3\, kg/m^3 \qquad (35)$$

So in one m^3 will be on the average:

$$\frac{1.4077\cdot 10^{3}}{1.67482\cdot 10^{-27}} = 8.405\cdot 10^{29}$$ nucleons.

So it is easily found that the radius of a sphere that contains only one nucleon is equal to:

$x= (3/4/\pi/8.405\ 10^{29})^{1/3} =6.573418\ 10^{-11}$ m. (36)

All these fictitious spheres constitute a close packed assembly again. Although it is rather immaterial for the present investigation, I cannot help it not to point that the above radius that expresses half of the average distance between the centers of two nucleons in the interior of the Sun is pretty close to the first Bohr radius of the hydrogen atom which is $5.3\ 10^{-11}$ m. We may now apply the above data in order to calculate the A_3 in the case of the Sun. $n=5.2948\ 10^{18}$, $M_2=1.67482\ 10^{-27}$ Kg. The result is: $A_3 = 2.44431\ 10^{-58}$ kg.

Now one naturally would expect that the next celestial body to be examined should be a galaxy. The galaxies however have so many types of shape with different masses and radii so that the problem with galaxies cannot be treated properly, mainly because in the case of galaxies exist serious departures from a spherical body. So finally I made the calculation for the whole observable universe with a mass equal to $9.3\ 10^{52}$ kg and a radius equal to $1.379\ 10^{26}$m. This radius corresponds to a Hubble parameter H_0 =67 Km sec^{-1} Mpc^{-1}.

The above values were found in another work of mine[31 p. 99]. The result of the calculations was that $A_4 = 2.92\ 10^{-70}$ kg.

I present the above results below in order to show that the mass m_k of the B1 baryton is reduced with the mass density of the body it is connected with.

Baryton inertial mass:

1) Black Hole with 2 Sun Masses: $A_2 = 9.14468\ 10^{-48}$ kg so it has to be $m_k \geq 9.14468\ 10^{-45}$ g

2) Neutron Star: $A_1 = 6.951768\ 10^{-49}$ kg so it has to be $m_k \geq 6.96\ 10^{-46}$ g

3) Sun: $A_3 = 2.44808\ 10^{-58}$ kg so it has to be $m_k \geq 2.45\ 10^{-55}$ g

4) Observable universe $A_4 = 2.92\ 10^{-70}$ kg so it has to be $\geq 2.92\ 10^{-67}$ g.

From the above table one thing is for certain. The mass of the baryton B1 must be greater than the value of $A2 = 9.15\ 10^{-48}$ kg in order to cover all the cases we examined. Otherwise if m_k is less than the first value then the mass left in the barytonic shell is negative so the outermost neutrons of this black hole will not

interact gravitationally with the nucleons at the central region of the black hole. Somebody however may put a further question: What happens with more massive black holes? In my book[12] I showed that the mass that collapses in a Schwarzschild black hole never reaches the central singularity, contrary to the general opinion of the supporters of GR, although even the MTW authors[32] accept that the Einstein's equations must fail in the face of the infinite curvature; and as they say "*To postulate that the particle re-emerges from the earlier singularity is to make up an ad hoc mathematical rule, one unrelated to physics…".* This total mass is concentrated in a sphere of radius ~4.167398 10^3 m whichever the collapsing mass may be, even the mass of the whole observable universe. I will not try to prove that the value of the expression A_i in this case will be a rather big number. This circumstance made the problem of the value of m_k rather very perplexing. In the case of huge black holes I did not tried earlier to solve this problem because I had not developed the present theory of gravitation. Now after a lot of thinking, I hope that I managed to propose a solution that will give the answer.

The idea of the concentration of the collapsing mass is correct. This concentration is due the continuous reduction of the radius of the neutrons that constitute the collapsing mass with the result the **repulsive** nuclear potential among the neutrons increases as they come closer to each other so that the attraction of the black hole is counterbalanced by this potential (for the outermost neutron). This mechanism prevents the approaching of the central singularity thanks to the exchange among the neutrons continuously heavier zero spin mesons the mass of which is fed by the gravitational energy of the black hole on the neutrons. This mechanism to be understood better needs the knowledge of my previous works[10,12,30]. But, in the same book of mine[12] I showed that the bare masses of the u and d quarks inside the nucleons are nothing more than the energy of a quantum simple harmonic motion of the u and d quarks and I obtained a formula that expresses the ratio m_d / m_u with a simpler expression than the Gell-Man - Ocubo formula. This harmonic oscillation is basically due to the Uncertainty Principle that prevents a stationary state of any particle under all possible conditions of its state. This means that even in the case of the mass of a black hole, the neutrons that constitute this mass (or perhaps other heavier baryons) are continuously swelling and un-swelling so that at the moment of their closest approach they develop the maximum value of this

repulsive force among each other that prevents the approaching of the singularity. So beyond the degenerate states of the electrons and neutrons that hold the collapse of stars to white dwarfs and neutron stars, exists one more resistance that prevents the approaching of the central singularity in the case of the black holes. This resistive factor is presented for the first time in the physics literature, in my book[12]. As I will show in the development of this book the NLG has application to the case of the collapsing black holes thanks to the final dimensions of these objects. To give an example I shall present a black hole with 10^6 Sun masses. The radius of a neutron when the collapsed mass is at the smallest dimension inside a black hole is found in my mentioned book[12] equal to $3.5616\ 10^{-18}$ m. Its maximum radius when it is in ordinary matter is equal to $1.045\ 10^{-15}$ m. The ratio of these two radii is 293.45. Since again in my previous work I determined the radius of the collapsed mass equal to $4.168868\ 10^3$m* this radius will be taken into account in the ensuing calculation. $n = 4.168868\ 10^4 / 3.5616\ 10^{-18}/2) = 5.852521\ 10^{20}$
So the value of A_5 with application of formula (33) yields:
$A_5 = 4.61\ 10^{-42}$ kg or $4.61\ 10^{-39}$ gram.

It is rather impressive that even a black hole with 1000000 Sun masses yields a mass of $m_k \geq 4.61\ 10^{-42}$ kg. I think that it is yet unknown observationally what is the limit of black holes mass in the universe so m_k may be not much greater than the above value to cover even heavier black holes.

Before having any intention to write this book I had red several articles about the possibility of a photon to posses a certain rest mass[33,44,35,36,37]. In the last of these papers are given the results of five different calculations that range from 10^{-49}gr. up to $2\ 10^{-43}$ gr. More specifically the proposed possible values are:
Limits of the possible rest mass μ of photons:
a) Terrestrial measurements of c at different frequencies: $\mu \leq 2\ 10^{-43}$ gram.
b) Measurements of radio dispersion in pulsar signals: $\mu \leq 10^{-44}$
“

* I must remind to the reader that this radius ($4.168868\ 10^3$ m) is not the radius of the event horizon of the Black Hole, which is equal to $2.953191\ 10^9$ m. I have not a ready answer about what happens in the region between the above two radii. Two alternative possibilities may exist. This region is either a completely empty space or it is transient space crossed by the particles that fall continuously in the interior of the black hole and are accumulated in the sphere with the smaller radius of the above two radii.

c) Laboratory tests of Coulomb's law $\mu \leq 2\ 10^{-47}$ "

d) Limits on a constant "external" magnetic field at the earth's surface $\mu \leq 4\ 10^{-48}$ "

e) Experiments with very low-frequency parallel resonant circuits $\mu \leq 10^{-49}$ "

Because most of the above experiments have been done in the neighborhood of Earth it is expected that they do not concern extreme astronomical objects used by me for the determination of the baryton inertial mass m_k. The closest astronomical object (star) near Earth is the Sun. If we take the result for m_k from the Sun and the last result for of the above measurements it can be written:

$$2.45\ 10^{-55}\ \text{gram} \leq m_k \text{ and } \mu \leq 10^{-49}\ \text{gram}$$

These two inequalities satisfy the requirements of the limits of both the baryton inertial mass and the photon rest mass. Perhaps the final and true value of these two masses should be found in between the above two limits. On the other hand we found that the baryton inertial mass m_k must be greater than $9.15\ 10^{-45}$ gram in the stringent case of a 2 Sun masses Black hole. But then since any photon is attracted by the black hole, for this interaction must posses at least a mass greater than $9.15\ 10^{-45}$ grams in order the interaction to take place. This requirement is satisfied by the first two results of the photon rest mass. This situation indicates that: (a) new experiments for the photon rest mass are required for a more accurate estimation of any rest mass of this particle and (b) an investigation in depth for the reason that the photon rest mass and the baryton inertial mass are of the same order of magnitude.

As I have already said for the mass of the baryton in this theory, it is not present explicitly in the final expression of the NNL (formula (27)) and whenever some calculation requires the presence of photons (as e.g. in the case of radar echoes delay) it is enough to consider the photon as having a total mass equal to $h\nu/c^2$ and the only requirement is to be different from zero. Of course in this case, the problem of the mechanism of transformation of energy to inertial mass and vice versa has not yet found a solution.

If the energy of a photon that is equal to hc/λ is translated to an equivalent amount of total energy m_0c^2, the photon wavelength that corresponds to the mass $9.15\ 10^{-48}$ kg, is possible to be estimated. To this mass corresponds a wavelength equal to $\lambda \cong 2.4\ 10^5$ m, or to a frequency of ~1240 sec^{-1}. So if the baryton has the above calculated mass m_k, this means that electromagnetic

radiation with wavelength greater than ~4.6 10^6 m or with a frequency about 1240 Hertz of electromagnetic nature, will not be subject to gravitational interactions. The energy of this radiation will be much less than the total energy of the baryon $m_k c^2$, under the presupposition, of course, that the above rough estimation is valid. It must be mentioned that electromagnetic radiation of this order of magnitude or with wavelength 2.4 10^5 m is beyond the limit of long electromagnetic radio waves, which are of the order of 3 10^4 m. So it can be said that the maximum inertial mass of the barytons must be of the above order of magnitude, i.e. (9.15 10^{-45} g or 9.15 10^{-48} kg), so that the maximum of the spectrum of the electromagnetic radiation is subject to gravitational interactions. But also it cannot be omitted to be noticed once again the proximity of the baryton inertial mass as it was determined coincidence or this fact reflects a new mystery of nature? I cannot say. Of course, what happens with the elementary particles the mass of which is not subject to observable fluctuations due to the emission of barytons since the emitted barytons are replaced immediately and continuously by the incoming barytons, does not happen with the quanta of the electromagnetic radiation i.e. with the photons. The reason is that the photons are subject to fluctuations of their frequency when they approach or recede from a gravitational source. I cannot help to mention that both theories of Relativity demand a zero rest mass for the photon. In the present theory of mine, as I have already said, wherever the mass of the photon is necessary for my calculations, this mass is simply the equivalent of the energy of the photon in mass units i.e. the $h\nu/c^2$ and this is enough provided that it is different from zero. On the other hand in view of the mentioned above research on the possibility that photons may posses a very small indeed rest mass, I cannot neglect such a possibility.

The fact that the interaction of a baryton that is emitted from the center of a black hole, with the particles that are at the event horizon is exhausted does not mean that the black hole does not interact gravitationally with its environment. We must not forget that we started considering the innermost baryton. All the other barytons from the particles in the black hole not nearby the center extend the interaction beyond the event horizon from which they escape easily since their velocity is superluminal.

One last comment, I think will be useful. One of the main points that made the theory of tachyons to present a basic disadvantage was that they presented an anomaly to the problem of

cause-result. Because of their superluminal velocity, application of Lorentz transformations arrived to the conclusion that the result may precede the cause in time, something that is unacceptable. With respect to this point the (Greek) reader may find more information in an article of mine, presented in a Greek journal(38) and in other relative papers in other journals by other authors. The barytons, however, even though they expand at superluminal velocity, do not present the above problem for two reasons.

A) Because since they are neither ordinary particles, nor waves, there is no case to talk about the possibility of their reflection and return to the position they were emitted from, earlier than the time of their emission. This problem as we said was one of the basic objections for the acceptance of the existence of tachyons, since they violated the principle of causality. But the tachyons were imaginary particles and all the authors that had dealt with them, made no suggestion about their nature. The only characteristic that was attached to them was their superluminal velocity and the consequences of this acceptance. Another difference between barytons and tachyons is that the former cannot be emitted at will, as it happens e.g. with the photons (and the tachyons if exist). The barytons are emitted continuously by any gravitational source (material particles and photons) and are absorbed by all the particles willy-nilly.

B) Since the barytons do not obey to the mass transformations of the STR as I have already shown, they will also do not obey to the Lorenz transformation equations of space and time coordinates among various inertial systems. And the reason of the paradoxes of tachyons in the case of the cause-result problem, are due to the application of the Lorenz transformations to the tachyons too.

The application of the modified Newton's law of gravitational attraction between two particles, presupposes the knowledge of the function v = v (r), i.e. the velocity of the expanding barytonic shell, which is the velocity of propagation of the gravitational interactions. The ignorance of this function v(r) renders the use of the modified law of the Newtonian attraction problematic. We shall examine however the special case where the velocity of the barytonic shell is constant, let us say c_0.

So expression (27) reduces to:

$$F = -\frac{GM_1M_2}{r^2}\frac{a^2}{3}\frac{c_0}{c} \qquad (37)$$

since for $v=c_0$ = const. it is $t=r/c_0$ and $dv/dr = 0$.

By letting the determinable parameter $a = \sqrt{3}$ and $c_0 = c$ we obtain Newton's Law without the handicap of the instantaneous action at a distance.

On the contrary the derivation of the NLG by the above way, led to the mathematical proof that the velocity of the gravitational interactions is c in the case of the NLG. As it is known, the above requirement was imposed in gravitation by the STR (and the GR) as a consequence of the constancy of the velocity of light in vacuum without any theoretical or experimental proof. The velocity at which the gravitational interactions propagate in empty space (and generally in space) has not been measured by any kind of experiment or observation. The simple assumption of GR that the gravitational interactions must be transmitted with the velocity of light in the same way of the transmission of the electromagnetic interactions with velocity c, (since in both cases the wave equations have the same form) is wrong for the following reason: The wave equation of the gravitational field in the linearized theory yields the result that gravitational effects propagate with velocity c because the Riemann tensor, which gives an absolute criterion for the existence of a gravitational field, itself obeys the wave equation (c.f. ref. 21, p.318). But this wave equation refers to the propagation of gravitational waves that arise e.g. from the collapse of big stars or from collisions of big celestial bodies (stars, galaxies etc.) This is, however, a completely different case from the propagation of the gravitational interactions between any two bodies or particles with big or small masses. The velocity of these interactions has never been measured experimentally, as we said above. The tangible proof I gave above for this issue needs no assumption whatsoever. Let the reader compare the above results of GR about the velocity of propagation of gravitational waves with the gravitational interactions in the case of the NNL that resulted naturally from the model of barytons.

I think that it is worth to say something about the gravitational field. The GR by the use of tensors has created a model for gravitation that starts from the hypothesis that spacetime is curved and to this curvature is due the existence of gravitation. The existing masses in any point of space, curve the space around them thus creating the *gravitational field* in which is stored the gravitational potential energy. The mathematics of this theory describes correctly[*] the macroscopic gravitational effects but do

[*] Though by using an unacceptable trick as it is clearly shown in Appendix A.

not give answers to two basic questions: 1) what is the form of these *depots* where the potential energy is stored? And 2) what happens if we wish to examine how gravitation acts in very short distances i.e. if we wish to quantize the gravitational field? It is up to the reader to decide which theory is more phenomenological: The present theory of mine, or GR, which is based on the existence of curved spacetime? Has somebody discovered a device that measures in a straightforward way the *curved spacetime?* Can anyone depict with his/her senses or in his brain a piece of curved spacetime; even of curved space? Is there an instrument that measures spacetime and in fact, in what kind of units? Of course somebody may comment: "Well the concept of spacetime is a mathematical model used by Einstein to develop his theory of GR that permitted him to extend the invariance of the physical laws to the non inertial systems, something that was achieved in the STR for the inertial systems. The application of this achievement to gravitation failed since gravitation is a force that accelerates all bodies so it cannot be described in the framework of the STR. By a similar process (the commentator continues) you used another model, that of the barytons, to develop your theory of gravitation. Both (Einstein and you) used concepts that cannot be grasped by the human mind. So only the experiments or observation may prove who is right and who is not". The answer to the above comment is given a) In Appendix A where it is shown that GR without Newton would never be a theory of gravitation, whereas my theory not only does not need Newton's Law of gravitation but on the contrary derives NLG from first principles, without the hypothesis of instantaneous action at a distance. b) The concept of the baryton, as it was presented here, is easily grasped by our mind since it resembles simply as an expanding spherical balloon with constant (definite) thickens of its outermost "skin". c) Even the use of the gravitational constant G has been proved in Appendix C that is nothing else but a function of the minimum real length in the universe, the minimum real time too and the maximum possible real mass of an elementary particle. The existence of these three concepts may also be characterized as first principles, basically due to the Heisenberg's Uncertainty Principle. d) As will be shown in Part II of this work, the application of my theory in the case of the four tests of GR gives more reliable results than those obtained by application of the equations of GR.

The above analysis is an indirect verification of the machinery of the Newtonian law of gravitation, since the derivation of expression (27) contains as a special case the NLG.
Of course we now suppose that the NLG is approximate to the real NNL and in the case of weak fields these two laws will give almost similar results. Things are not exactly so and after the development of the second Part I will explain the reason.

I think that at this point I must close the first part that refers to the issue "The machinery of Newtonian Gravitation". The reader is begged to forgive the repetitiveness I used many times in many places. I did it for a better establishment of a new way of thinking about gravitation, not with the use of the concept "field", or Graviton, or the Curved spacetime, but with the continuous emission by all particles in the universe (or perhaps not all) of the barytons as I described them. But for one more reason I made extensive analysis for certain points of this work because I wanted to persuade myself that any new idea I used in developing this theory of gravitation must be based on logical grounds.

I urge the reader to read the three Appendices (A to C) that follow, which complement the presented theory, but also show how much impetuously (not to use a more severe expression) the GR became acceptable by the physics community, although as in Appendix A I showed, it cannot be considered as a genuine theory of gravitation.

One more final remark will not be useless.

I started building up the presented theory without any idea that the calculations and the chosen model would lead up to the NNL. The only acceptance I did was that I put the determinable parameter {a} in (27) equal to $\sqrt{3}$. All other assumptions are within the framework of the chosen model. But I had clearly said from the very beginning that any relation that is derivable by dimensional analysis presupposes the probable existence of a numerical constant at the end of the derivation. As an example I present the derivation of the law of motion of the simple pendulum (with small amplitude). Let g the acceleration of gravity. Any acceleration has dimensions length / time^2. If we put the period of the simple pendulum T as time, and the length of the pendulum as length, then we have $g = L \times T^{-2}$ from which $T = \sqrt{\frac{L}{g}}$. This is the law of the simple pendulum but without the numerical coefficient that multiplies the above square root and it is derived

by the ordinary analysis of the pendulum motion. It is therefore absolutely clear that only the presented here model of the gravitational interactions produces without any previous knowledge either from observation or from experiment, the NNL. For the final expression of this new law of gravitation, we will see how the expression of the v(r) but also the value of the parameter {a} may be determined. But this determination is open to certain modifications when more accurate experimental and /or observational results about the behavior of the planets in their motion around the Sun will be available.
This first Part does not end here. After the second part I will present some interesting items for which some results from the second part were necessary.

APPENDIX A

SOME COMMENTS ON THE RELATION BETWEEN GENERAL RELATIVITY AND THE NEWTONIAN LAW OF GRAVITATION*

THE COMMENTS
The motivation for the formulation of the comments that follow immediately below was given by reading the book of Adler-Basin-Schiffer(21) under the title "Introduction to General Relativity" (second edition). At page 131 sec. 4.3 of this book we read: "Gravity as a Metric Phenomenon". The analysis given in this section eventually concludes to the relation (1) in three-dimensional vector notation:

$$\frac{d^2\bar{x}}{dt^2} = -\frac{c^2}{2}\varepsilon\nabla\gamma_{00} \qquad \text{(A1)}$$

where ε is a small constant and $\varepsilon\gamma_{00}$ represents a very small time-independent perturbation, which is due to the presence of a gravitating body and goes to zero very far from the body.
The above authors literally write: "*This is simply Newton's equation of motion in a classical gravitational field derived from a scalar potential* *if we identify the scalar potential as (in relation (A2)):*

* This is a brief account of a paper published in the International Journal Physics Essays(3) in a revised form after the new ideas I developed in the present work.

$$\phi = \frac{c^2}{2}\varepsilon\gamma_{00} \qquad \text{(A2)}$$

And they continue:

"Conversely, given the classical potential φ , the motion of a particle will be along a four-dimensional geodesic if the g_{00} term of the metric tensor has the form (as in relation(A3)):

$$g_{00} = 1 + \frac{2\phi}{c^2} \qquad \text{(A3)}$$

(The underlined parts are from me).

Now watch the above sentences. In all cases the authors take for granted the knowledge of the classical potential from Newton's law of gravitation and they identify it with the result of the solution of Einstein's equations in the case of weak fields and small velocities compared with that of light. Let us make however a naïve hypothesis: Suppose that Einstein had been born before Newton, say in 1600 A.C and Newton in 1800 A.C, but both had discovered their known laws about gravitation, i.e. Einstein the General Theory of Relativity and Newton his law of Universal attraction. Or equivalently suppose that Newton had never been born or had not discovered his law of gravitation. In these cases the potential φ in relation (A2) would be unknown to Einstein (and/or to his successors) so that he would be unable to identify his result with φ. Would Einstein's theory be sufficient to calculate or find experimentally the value of ε or of γ_{00}? And beyond that, would it be possible to introduce the gravitational constant G in the equations of GR, as it is done on the right hand side of the basic field equations?

$G_{\mu\nu}=-8\pi G/c^4 T_{\mu\nu}$ (A4)

The $-8\pi G/c^4$ constant is again introduced by an appeal to the classical Poisson's equation of the gravitational field, i.e. this constant is introduced in the case of the general equations of GR although it is valid only when the gravitational field is weak and the velocities are << c. And something more: The gravitational constant G has been experimentally determined by Cavendish-type experiments in which use was made of the Newtonian law of gravitation, i.e. in the case of weak fields etc. Does somebody know any experiment for an independent determination of G via the equations of GR? If not, how is it correct to use G in the solution of the Schwarzschild metric since G is determined for weak fields in this case too and the same metric leads to the inevitable infinities of the central singularity? On the contrary the

derivation of the Schwarzschild radius $2GM/c^2$ is quite natural from Newton's law if we equate the escape velocity from a gravitational field to the velocity of light c. In this case it would be perhaps acceptable to convert existing energies of any kind into gravitating mass through the famous equation of Special Relativity $E = mc^2$ and add $m = E/c^2$ to the rest mass of the bodies under consideration. So besides the fact that the GTR borrows two outcomes of the Newtonian theory (the gravitational potential and the experimental value of G and this is again apparent when the authors Adler-Bazin-Schiffer[21] write in p.195 "… The unknown constant of integration *m* which appears in the Schwarzschild element can be determined by an appeal to correspondence with Newtonian theory…"), this theory (the GR) is considered the best theory of gravitation although it is based on a model of curved spacetime which is not comprehensible either by our senses or by our imagination and its validity is based on very few and very controversial experiments. In fact it would be interesting to perform an experiment (if ever possible) for the determination of the gravitational constant G by using the equations of GR in the case of a strong gravitational field, for example inside a Black Hole instead by the Newton's law of gravitation which is supposed to be applicable only in the case of weak fields. Who can be sure that in this case G would be a constant and not a variable depending for example on the masses of the interacting bodies or on their mutual separation? A possible slight difference of these two measurements could possibly be enough to bring the results of the four tests of GR equal to those obtained by application of Newton's Law (or vice versa). The constant *m* used in the above quotation of the mentioned authors, is equal to $\kappa M/c^2$ where κ is the gravitational constant G coming from Newton's Law of Gravitation. So our hypothetical question may finally be not as naïve as it looks at first glance.

Of course one may question the validity of the theory of Newtonian gravitation with respect to the alleged *instantaneous action at a distance*. In the first part of the present work I have accepted, in deriving from first principles (i.e. theoretically) Newton's Law of gravitational attraction, that the velocity at which gravitational interactions propagate, must be greater than

the velocity of light c as a variable velocity v(r) depending on the distance r from the source, which tends to ∞ as $r \to \infty$. [*]
It is to be mentioned that the propagation of the gravitational interactions must not be confused with the propagation of gravitational waves, which are produced for example when a star collapses to a neutron star or a Black Hole. A similar opinion has been expressed by G.D.Ransford[14] who also asserts that the velocity at which the gravitational interactions propagate is close to 10^8 times the velocity of light as Laplace has calculated 2 centuries ago (something that I do not accept) and as others more recent researchers have also suggested[15]. As a matter of fact no one has ever measured experimentally the velocity at which gravitational interactions propagate and the fact that in GR the velocity c is accepted, comes from two reasons: a) From Special Relativity where the velocity c is an upper limit of all kinds of velocities and b) from the fact that, according to Adler-Bazin-Schiffer[21] p.318 "…*the Riemann tensor, which gives an absolute criterion for the existence of a gravitational field, itself obeys the wave equation. It follows that, in the linearized theory, gravitational effects propagate with velocity c..*".

Moreover GR cannot be reconciled with QM up to now. Besides, my theory as described in the main text has somehow connected gravitation with QM through the mysterious property of almost all elementary particles to perform the peculiar motion called Zitterbewegung by Schrödinger. This conclusion obviously leaves open the problem of any particle that does not perform Zitterbewegung. This would have the meaning that such a particle would not be subject to gravitational interactions. If such a possibility is proven sometimes correct, it will be a real revolution in all branches of physics (for example, even interstellar travels would be much easier). For the time being, however, I leave it as a mere speculation and nothing more.

Doubts about the validity (and necessity) of GR have been expressed by other authors on different grounds, (e.g. about the curvature of space and on the experimental confirmation of GR by the famous "four tests" (see Nedved[39] , P.Marmet and C. Couture[40] , Hans Montanus[41], P.Marmet[42] who in his paper

[*] When I wrote the present article I had not yet determined the function v(r) as it is done in the second part of this book. Also I had concluded to the wrong result that the baryton starts with a velocity a little greater than c and at infinity the velocity is c. In the present book things about the velocity at which the gravitational interactions propagate in space has been cleared completely.

states that: "*Space is mathematically flat and the relativity principles are useless"*. J.G Gift[43] too in a recent paper supports that the GTR should be abandoned and he proposes a return to the Newtonian gravitation.

But even when an *effective potential energy* is used in the case of the simple Schwarzschild metric, there again exists a basic inconsistency that does not permit the formation of a Black Hole. I think that it is worth referring to this case more analytically. According to Adler-Bazin-Schiffer[21] again, p. 266 sec7.9 with the title Effective Potentials and Black Hole Energetics, the authors of this book conclude that for the case of a Schwarzschild Black Hole an effective potential energy function can be used in analyzing the motion of bodies in the Schwarzschild field. This function has the form:

$V = mc^2 – GMm/r + L^2/2mr^2$. (A5)

If there is no angular momentum then L = 0.

A similar expression is given by Misner-Thorne-Wheeler[32] p. 660 Box 25.6.

Now let us consider a non-rotating body with spherical symmetry and mass M and let us see what is the potential energy of a particle of mass m on the outer surface of a collapsing star having the above potential energy V, at various distances from the center of the big mass M (without the L term). Relations (A6) up to (A9) show the result:

At $r = 0$ $V = -\infty$ (A6)

At $r = GM/c^2$ $V = 0$ (A7)

At $r = R_s = 2GM/c^2$ $V = +mc^2/2$ and (A8)

At $r = \infty$ $V = mc^2$ (A9)

As it is obvious, from r=0 up to $r = GM/c^2$ the potential energy is negative or 0 so that the force is attractive. But from $r > GM/c^2$ up to $r=\infty$ the potential energy is positive and consequently the force is repulsive. This result has the meaning that the formation of a Black Hole is impossible.

From all the above analysis the conclusion is that GR by no means can be considered as the best theory for gravitation and perhaps the only that offers is that the laws of Physics remain invariable in the non inertial frames of reference, something that has been expressed from the Covariance Principle and the Principle of General Invariance, which plays an important role to the proof of the equality of the gravitational and inertial mass, which is known as the Equivalence Principle. It is however interesting to be noticed that this last principle has also been

disputed by some researchers. I simply mention that this equivalence, results naturally and automatically from my own theory of gravitation without the introduction of the curved space-time*. Closing this presentation you will permit me to express one more question: For about 90 years, for this celebrated theory of GR, have been written millions of pages trying to extract more information from it, with its so elegant equations, as very frequently are called, without any significant success (such as for example its unification with quantum mechanics). So the resulting question is: Nobody has spotted the above arbitrariness's and errors in the way it was tried the connection of GR with gravitation, or all people settled down with the way this connection was done, considering that the Newtonian theory had nothing to offer to gravitation? In the mentioned book of mine(18) (and in the present book of course) the theoretical deduction of Newton's law with some minor modifications makes it possible to connect gravitation with quantum mechanics and at the same time it releases the Newtonian theory from the certainly erroneous "Instantaneous Action at a distance". In view, therefore, of what has been developed up to now, I think that the physics community must decide whether it is worth to continue the research on gravitation, with the use of the equations of GR or it must turn its attention towards other directions for a more accurate formulation of the Newtonian theory, something that was indicated by Richard Feynman when he was saying that the Machinery of Newtonian Gravitation is still unknown, besides of the fact that he had a good knowledge of GR. **He probably was foreseeing that this last theory is not sufficient to explain gravitation.** He had not proposed certain machinery, something that made me to try finding one and I hope that I managed to carry out this task, in the present work. And it is true that other people too, tried to show that the Newtonian theory covers all problems of gravitation, but nobody managed to discover Machinery in the way Feynman had in mind.

APPENDIX B

The Deeper Meaning of the Constants *c, h, G.*

* The equivalence of the inertial and gravitational mass has been indicated in the main text of the present work since the total mass of the particles is turned gradually to gravitational mass and is exchanged by them via the emission and absorptions of the barytons.

When I wrote for the first time the four "First Principles" as in page 18-19, upon which I based the model that would explain the Machinery of Newtonian Gravitation, I had the impression that these principles were well chosen for the development of my theory. After a long time, however, by reading again and again this book, I realized that something was missing from some of these Principles. The first principle may be taken axiomatically acceptable for various reasons. First, because a point-like space and a durationless time cannot be physical entities not to mention the obscure mathematical meaning of them. Also the existence of a maximum elementary particle mass can be acceptable since otherwise no limit to the mass of elementary particles would lead to the absurd idea that somewhere in the universe exists an elementary particle with a mass equal to that of Earth and why not of a galaxy. Such a mass would destroy the well-established theory of quantum mechanics. So taking the first principle true I feel standing on solid ground. I come now to the second "First Principle" This Principle as it stands, is correct, and is verified from observation, so acceptable. We all know that in Quantum Electrodynamics the carriers of the electromagnetic interactions are the (virtual) photons, in the case of the nuclear forces the carriers are various types of mesons, the week nuclear forces (now called electroweak forces) are mediated by the heavy $W^{\pm}$ and Z^{0} bosons plus the photon, and in quantum gravity (an unsuccessful theory) the graviton was proposed as the carrier of the gravitational interactions and so on. Nowhere, however, I managed to find an answer why the elementary particles require communicating one way or another with each other. The answer that this is due to the fact that from observation we are persuaded that a communication does happen is an a posteriori imposed reason. But the use of the word need was inappropriate, for a basic reason. Needs may have only living creatures and these are expressed by various ways depending on the extent of intelligence they posses and the complexity of their organism. As far as we know, we, beings of the higher amount of intelligence on Earth, have innumerable needs of any kind (material or mental), but all of them may be characterized as Biological needs since only living matter expresses them. The universe, however, is not a biological being. The fact that in the universe one or (perhaps) billions kinds of biological beings on various planets have been developed, cannot characterize the universe biological as a whole, so that it

cannot have needs. We, humans, who observe and examine the universe, by saying that it has a need, we did so a posteriori, i.e. after having discovered many laws that govern the happenings in the universe and because we accepted that the universe is unique so that it has to act as a whole using its laws. Without them the universe would probably be that we use to call chaos. The question is what or who imposed this need to the universe in order to work as a whole. This question is similar to the question "why did the universe come to existence a few billion years ago?" The usual answer to both the above questions is: Some (unknown) entity imposed the need of communication of its various parts. This is the point of view of most monotheistic religions and/or of the various versions of the so-called Anthropic Principle. Looking for an answer based on scientific terms is not an easy task. In various books I searched, I did not find something like: "The elementary particles communicate with each other by various manners because….". But in my book under the title: "THE FIRST 10^{-35} SECONDS) I have developed a scenario of how the universe came into existence in the first place. I shall try to give a very brief (only verbal) description of my cosmological (in fact cosmogonical) model in order to explain why the need for communication of the various parts of the universe was the result of the way the universe came into existence.

There are two different kinds of space that are in immediate contact with each other. One is the 3+1 space we live in and extends in three dimensions of space and one of time (infinitely or not we really have no idea for the time being), and the other is an abstract space with dimensions of the order of magnitude of the Planck length in which the time is imaginary, so undetected by us and in this space develops the probability for the appearance of an amount of mass, of the order of the Planck mass as I have shown in my works[10,11,12]. As far as I know, it is I only that gave the above characteristic features to the space with dimensions about equal to the Planck Length. For the official physics the only that is attributed to this space is that in it the known laws of physics do not hold. Some people, however have tried to investigate the nature of this space[8]. It has to be emphasized that when I say dimensions of the order of the Planck length, the real meaning of this definition should be understood as follows: When we descend to sorter and sorter dimensions of our ordinary space, it comes a point at which a sudden, tremendous and basic difference occurs in the properties of our space. In fact it ceases to be 3-dimensional

and becomes dimensionless. For this reason I characterized this space **abstract** where the concept of **probability** for the appearance of an amount of mass outside of this space develops in imaginary time[10,11,12]. Apart from the development of the above probability, this space is governed by the imaginary unit {i} in both time and mass (proto-mass as I called it after it appears outside of a mini white hole, since before its appearance it is the probability for its appearance that develops in this peculiar space). As I have repeatedly shown elsewhere, the imaginary unit is the geometrical mean of the (+) and (-) real unit since $i^2 = (+1) \times (-1)$ and as I have said elsewhere too, the mathematical relation of the geometrical mean occurs many times in both micro-cosmos and mega-cosmos[*]. So because the mass that appears out from a Mini White Hole[10] (MWH) carries with it the + and – real unit in a latent state thanks to the above expression of the imaginary unit (i), it is expected that the appearance of this mass out of the abstract SubPlamckian Space (SPS) as I called it, where the time starts having its real meaning, will split the imaginary unit in its +1 and –1 real components. Searching in the 3+1 space of ours, the only basic concept of physics that appears in two opposite forms, is the plus and minus electric charge[**]. So the emerging mass may split in two charged elementary particles with + and – electric charge with appropriate transformations that are described in detail in my book[12]. The fact that the emerging mass, according to the other work of mine[10], is turned to up or down quarks, that have fractional electric charges is covered by the other fact I have also shown in the same work, i.e. that the masses coming out from the SPS appear simultaneously in triplets, so that the formatted finally particle may have a total charge of +1 or zero. This is the case of the proton and the neutron. But as I have also analytically

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[*] As a matter of fact I considered of utmost importance to present the role played by the "law", as I called it, of the geometrical mean in both microcosmos and megacosmos, at the end of this appendix because the geometrical mean supports the present theory and this theory may be shown that it is another example of the geometrical mean law. So we will see that the first supports the second and vice versa.

[**] My book[12] was published first in English (ISBN: 960-630-425-6), in Athens. I decided to give the opportunity to everyone who might be interested in this work of mine to have an easy access to it. So I put the whole book in the site of the vixra organisation and I added one more chapter in it where I gave a complete explanation about the origin and nature of the concept ELECTRIC CHARGE that is missing from rather all the textbooks of Electricity , Electromagnetism and the similar.

shown in my book[12] too, each proto-mass splits in fact into two other particles. One is the quark and the other is another particle of equal mass but opposite charge to that of the quark, to which I gave the name para-quark. Three such paraquarks constitute the electron with charge –1. All these new ideas have been developed analytically and mathematically in my book, however strange may appear at first glance that the electron too is not a point-like particle but a composite particle out of three paraquarks. I think that it is easy to say that "*this particle has a charge +1 or –1, but if somebody asκ, what is electric charge I really doubt whether we shall be able to give an "a priory" original explanation".* Of course, according to this opinion the electron neutrino too is a composite particle out of three paraquarks, but with zero electric charge. So the two electric charges express the principle of the first discrimination in our universe. This principle of discrimination introduced by me for the first time in another book of mine[31] is closely related to both the Pauli Exclusion Principle and the entropy of the universe. The whole story of the generation of quarks, protons, neutrons, electrons and neutrinos, is given in extended mathematical detail in my book[12] as I said above. The strong nuclear forces too are explained completely in the other work of mine[10] by using two basic principles. One is the new metric of the MWH I proposed in replacement of the up to now ridiculous acceptance that the metric of the white holes is the same to that of the black holes thanks to the fact that $(dt)^2 = (-dt)^2$. I said ridiculous because in this case neither black nor white holes could exist since one would cancel the effect of the other. So all the charged particles were connected with the electromagnetic forces, which are due to the exchange of (virtual) photons (c.f. Feynman ref. (22) e.g.). But apart from the charged particles, neutral particles were created during the above-mentioned transformations, as neutrons and neutrinos. All particles contain either three quarks or three paraquarks as I called the constituents of leptons. As a matter of fact I hope that I have adequately shown in my book[12] that the leptons are composite particles like the baryons, but due to the peculiar motions of their components, at low energies, present themselves as point-like particles. More on this subject can be found in my book[12]. Since the neutral particles (neutrons and neutrinos and perhaps more baryons and leptons) do not interact (i.e. communicate) via the electromagnetic field they would disperse in the first moments of creation, thus not permitting the creation of nuclei and atoms. But as I showed in the

present work, the performance of the peculiar motion of Zitterbewegung, which is basically due to the Uncertainty Principle*, determines the rate at which the barytons are emitted not only by neutral but also by almost all elementary particles. So the Uncertainty Principle may be considered as the main cause of the gravitational interactions between the elementary particles, as our model, developed in the main text, has shown. At short distances the baryons apart from their gravitational interaction, interact via the much stronger nuclear forces, following the new central nuclear potential I have found in the other work of mine[10] that is also due to the way the appearing from a MWH protoquarks are coming in triads as I explained in the above work. So it seems that all basic laws of nature are somehow hidden in a latent state in the SPS, (Sub Planckian Space or Space of Probability). The existence of this space that can also be treated mathematically may be considered as the new and scientific expression of the space in which the IDEAS, according to Plato, were embedded. I understand that the above assertions may be difficult to be swallowed by any one who has not red my previous works mentioned in the foregoing development, but these works are published either in journals of physics or in my book[12]. The Zitterbewegung is usually referred to the case of the electron as it is treated by the Dirac theory, where negative energies are also present in a wave packet. I do not find any reason that the Zitterbewegung would not be performed by the baryons too as well by the uncharged leptons, which are also half spin particles and therefore they obey the Fermi-Dirac statistic. A question

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* I base this assertion following certain characterizations given in books of Quantum Mechanics. So e.g. in Messiah[13] (p.952) the Zitterbewegung is characterized as "…a **curious** effect related to negative energies….". To my opinion, the important thing is that the period of this peculiar motion is equal to $\hbar/2mc^2$. If we insert the time of the period in the relation of the uncertainty Principle in place of Δt and mc^2 in place of ΔE we obtain: $\Delta E \times \Delta t = mc^2 \times (\hbar/2mc^2) = \hbar/2 \geq \hbar/2$. It is obvious that in this case the equality of the left and right hand of the above relation is only valid. So the Zitterbewegung of any mass m is caused by the existence of the Uncertainty Principle (in the limiting case of equality of the left and right hand) that does not permit not only the simultaneous measurement of the two incompatible magnitudes with zero uncertainties but even the measurement of one of them with zero uncertainty. In fact e.g. if $\Delta E=0$ and $\Delta t\neq 0$ then $\Delta E \times \Delta t = 0$ so that $\hbar$ will be zero, hence no universe could exist as we know it. This is the correct statement instead of the one according to which $\Delta t = \infty$ since division by zero is not mathematically acceptable.

remains of what happens with the particles of zero or integral spin. Do they perform Zitterbewegung?

Although this subject is not mentioned when the Zitterbewegung is discussed, in Messiah (and elsewhere) I have the feeling that an analytical discussion would reveal that even integral or zero spin particles should perform Zitterbewegung since even the photons with spin 1 interact gravitationally with the elementary particles as it is inferred from the case of bending of light rays passing near strong gravitational fields and the test of the radar signals[*]. One may argue of course that since the photon rest mass is equal to zero the period of the Zitterbewegung will be infinite. But if we replace m by $E/c^2 = hf/c^2$ where f is the frequency of the light beam, we obtain $\hbar/2mc^2 = 1/4\pi f$, and this must be the period of the Zitterbewegung in the case of the photon. Thus far we have connected gravitation with the Zitterbewegung, which in turn is due to the Uncertainty Principle that seems to be the cause of the Zitterbewegung. But somebody may ask whether this principle is a genuine first principle to be used for the explanation of existence of gravitation in the universe. The answer to this question may be found by extending the research to the end.

In my previous work[(10)] I investigated the way a certain amount of mass may appear out of a white hole[**]. Although this analysis is given in detail in my previous paper, I will give here a very brief description of how this is done and what may be inferred:

Let us examine first the role played by the basic constants of nature i.e. the c, $\hbar$, G

Are these the result of a fine tuning as the various versions of the anthropic principle assert or they are the result of the way mass emerges from the SPS in our 3+1 space?

I will summarize here my position that this "fine tuning" is inevitably a result of the way the Big Universe (the one and unique before the inflation) as I have shown in my book[(12)], came into existence. The new basic element that I introduced in this investigation was the new metric I found in my previous work[(10)] which holds for the Mini White Holes (MWH)[*]. This metric that

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[*]That the bending of light is due, according to GR, to the curvature of spacetime near gravitating masses, will be proved a blunder, when the physics community will decide to abandon GR as the best theory for gravitation (after reading this book). This will be clear in the ensuing development.

[**] In fact out of a Mini White Hole with ~Planck length dimensions

[*] Otherwise we would have a continuous emergence of mass from the SPS even in our bedroom perhaps.

determines the radial motion of an amount of mass from the centre of the WH outwards has the expression of relation (B1):

$ds^2 = +c^2 (1 + r_s/r) dt^2 + (1 + r_s/r)^{-1} dr^2$ (B1)

and differs basically from what was acceptable up to now by the physics community.

We have talked before about the ridiculous idea that the metric of a white hole is the same as that of a black hole. Since the phenomenon of the appearance of mass from a WH is a quantum-mechanical one, the WH has to be a mini one of the order of Planck dimensions.

The new metric B1 comes from the Schwarzschild metric for BH by replacing the time dt by idt, i.e. its imaginary counterpart (for only radial motion). So the Mini WH may violate the law of mass-energy conservation since the uncertainty relation permits the existence of an amount of energy (or the corresponding mass), for as long as this principle is valid. Of course as I showed in my previous works[10,11,12] the described in detail transformations of the emerging masses made their existence permanent as the basic ingredients of matter (more specifically the quarks and the before mentioned paraquarks).

In my previous work[10] from the relation B1 I obtained relation (B2);

$dr/dt = c(r_s /r)^{1/2} (1+r_s/r)$ (B2)

Integration of the above equation with initial conditions t=0, r=0, leads to an expression of the time t as a function of r from the centre of the MWH.

$$t = (2r_s / c)\{(r / r_s)^{2/3} /3 - (r / r_s)^{1/2} - \tan^{-1}(r_s / r)^{1/2} + \pi / 2\} \quad \text{(B3)}$$

The time t is obviously the real time needed by the spherical surface of the MWH to cross the distance r with an average velocity c. In my work[10] I identified the above time t with the time Δt of the expression B4 below. In B3 r_s is the Schwarzschild radius of the emerging mass and r_q its quantum radius.

$\Delta t = \hbar/(2m_x c^2)$ (B4)

This defines according to the Uncertainty Principle the time needed for a mass m_x to cross the distance r_q as in relation B5:

$r_q = \hbar/(2m_x c)$ (B5)

with average velocity c, as we said above. What I derived from the above calculations are the following:

The mass

$$m_x = \frac{1}{2\sqrt{x}}\left(\frac{\hbar c}{G}\right)^{1/2} = 5.0437884\cdot 10^{-9}\, kg = \frac{1}{2\sqrt{x}} M_{Pl} \quad \text{(B6)}$$

where $x = r_q / r_s = 4.65621955$ that has to be a universal numerical constant. This constant can be connected with a simple formula[10] to another universal numerical constant calculated by M. Feigenbaum[c.f. ref. 44] as equal to 4.669201609. The meaning of this connection may hide some message, something that requires sometimes a further investigation. By using the above value of m_x I found that the r_q is given by relation (B7) and the L_{Pl} by relation (B8) below. So:

$r_q = 3.4871365\ 10^{-35} m = 2.1579\ L_{Pl}$ (B7)

L_{Pl} = Planck length = $\left(\frac{G\hbar}{c^3}\right)^{1/2}$ (B8)

as it is given by definition. Similarly M_{Pl} is the Planck mass given by (B9):

$M_{Pl} = \left(\frac{\hbar c}{G}\right)^{1/2}$ (B9)

The Schwarzschild radius that corresponds to the above mass is given by (B10):

$r_s = 7.4892003\ 10^{-36}\, m = r_q / x.$ (B10)

This radius however is only a parameter that entered in the way of the calculation I followed and it does not play any role in the case of the MWH since it is surpassed by the emerging mass. So it can be replaced by the equivalent radius r_q / x. The above conclusion for the r_q may also be used as the reason why in the interior of a MWH gravitation is meaningless, something that helps the answer to the question about the fate of the mass that falls in the interior of a Schwarzschild black hole. Wheeler et al[32] clearly say in p. 839-840 that: "*….The region r = 0 is a physical singularity of infinite tidal gravitation forces and infinite Riemann curvature. Any particle that falls into that singularity must be destroyed by those forces. Any attempt to extrapolate its fate through the singularity using Einstein's field equations must fail; the equations lose their predictive power in the face of infinite curvature. Consequently to postulate that the particle re-emerges from the earlier singularity is to make up an ad hoc mathematical rule, one unrelated to physics…".* What is important from the

above analysis is that the r_q and m_x are of the same order of magnitude with the Planck length and the Planck mass correspondingly. Since the Planck units were derived by use of dimensional analysis between the physical constants c, $\hbar$, G, whereas the corresponding magnitudes r_q and m_x are the result of the new metric I introduced for the MWH, it is more probable that the r_q and m_x correspond to existing physical magnitudes. As it is known the dimensional analysis cannot determine a possible numerical constant that may multiply the result of dimensional analysis.

Let us see now how the above results may help our basic problem i.e. that of the machinery of Newtonian gravitation.

Relation (B6) expresses the maximum mass that can emerge from a MWH. So this is the mass of the heaviest elementary particle that can be created in the universe. Since $r_q = \hbar / 2m_x c$, replacing relation (B6) in this last relation we obtain (B11) and (B12):

$$r_q = \sqrt{x}\left(\frac{G\hbar}{c^3}\right)^{1/2} = \sqrt{x}L_{Pl} \tag{B11}$$

and similarly

$$t_q = \frac{r_q}{c} = \sqrt{x}\left(\frac{G\hbar}{c^5}\right)^{1/2} = \sqrt{x}T_{Pl} \tag{B12}$$

where T_{Pl} is the Planck time.

From (B6), (B11) and (B12), solving for c, $\hbar$, G, we obtain relations B13, B14, B15.

$$\hbar = \frac{2m_x r_q^2}{t_q} \tag{B13}$$

$$G = \frac{r_q^3}{2xm_x t_q^2} \tag{B14}$$

$$c = \frac{r_q}{t_q} \tag{B15}$$

What expressions B13, B14, B15 say is that the above three universal constants are not basic constants. They may be derived

from some more "primitive" ones, which express the **maximum possible mass of an elementary particle, the minimum length and minimum time that can be measured (in principle),** but for the time been we do not have the appropriate instruments (and energy) for such measurements. It is obvious that the concepts of mass, length and time and particularly as they are expressed in the last three relations, are more basic than the concepts of maximum velocity c, the minimum action $\hbar$ and the gravitational constant G. And these are more basic since a dimensionless space, a durationless time and an unlimited amount of elementary particle mass cannot constitute either the universe we live in or the elementary particles that certainly we know that exist as the ultimate constituents of the matter in bulk.

Additionally the magnitudes m_x, r_q, and t_q were determined from a theory for white holes that contains two basic relations: The new metric I found for the MWH and the Uncertainty Principle. In my books[12,45] for the last principle I give its most general expression, for two non-commuting magnitudes by the relation:

$$\Delta A \cdot \Delta B \geq \frac{1}{2i}\langle[\hat{A},\hat{B}]\rangle \tag{B16}$$

where $[\hat{A}\cdot\hat{B}]=(\hat{A}\hat{B}-\hat{B}\hat{A})$ is the commutator of A and B. If the parenthesis is different from zero the more accurately we measure A the less accurately is measured B and vice versa. If the measured physical magnitudes are the position x of a particle and its momentum p_x then since: $[\hat{x}, p_x]=i\hbar\hat{I}$, we will have:

$$\Delta x \cdot \Delta p_x \geq \frac{1}{2i} i\hbar = \frac{\hbar}{2} \tag{B17}$$

We may now extract the following conclusions: 1) Since we showed in the main text that the gravitation is the result of the fact that (almost) all elementary particles exert the peculiar motion of Zitterbewengung, the period of which is equal to $\hbar/2mc^2$ and this is coming from the uncertainty relation $\Delta E \cdot \Delta t = \hbar/2$ i.e. in the limit of this relation where the (=) is used instead of the (≥). 2) Since the value of $\hbar$ is given by expression (B13) in which the maximum elementary mass and the minimum length and time are present and finally 3) Since the above three marginal magnitudes are due to the fact that there exists the abstract space of probability, then the existence of the gravitational interactions are due to the existence of two spaces, the abstract one and the 3+1

space we live in (which are in contact at any point of the 3+1 space when the lengths and times approach r_q and $t_{q)}$. In other words, the existence of the three basic constants of nature is the result of the existence of a minimum real time, a minimum length in space and a limited maximum mass of an elementary particle. These entities (or concepts) must apply to the whole of the universe as a supreme law that covers all parts of the universe. For this application is needed the continuous communication among all the elementary entities of the universe. Gravitation (G) is the "postman" of the necessary information for action ($\hbar$) and of course the corresponding reaction and (c) is the minimum velocity of the postman.

I will end the last fairy tale of this appendix by the answer I got from my wife when I complained to her that the telephone bill had increased because of the long talks she had with her friends about food recipes, fashion, etc. feminine interests.

By paraphrasing Descartes, she said: "I communicate so I exist" (my answer was: You communicate but I pay). Of course she was all the way right.

APPENDIX C Why the gravitational interactions must be transmitted with superluminal velocity?

In pages 19-21 I mentioned four reasons for which the gravitational interactions must be transmitted with superluminal velocity. Here I want to show that the gravitational interactions **can not be transmitted with velocity c** as it is implied with the introduction of the gravitons as carriers of the gravitational interaction.

Let us consider that a photon is emitted from the Sun mass and is spread in space with velocity c. From the experimental data we know, light (in what follows we will specialize the case in one and only one single photon) is subject to the action of gravity (bending of light rays in the field of the Sun and delay of the radar signals when they pass close the surface of the Sun). Also the red shift due to gravitation has been ascertained observationally and experimentally.

Our photon, according to the principle of STR is itself an inertial frame since it moves with constant velocity with respect to any other inertial system. Of course it may be said that since the velocity of light is constant with respect to any other frame of reference that moves with constant velocity (if do not intervene

forces of whatever nature), a photon in this case constitutes a universal inertial system of reference. Many times is given the classical example of two photons that move in opposite directions with respect to a Σ system of reference. According to the Galilean transformations of coordinates the velocity of the photons with respect to each others is equal to 2c. By the application of the transformation of velocities according to the STR the relative velocity among photons is again c. Let us see however what happens with the photon that started with constant velocity from the Sun and departs from the Sun. Since we accept that the photons (the light in general) are subject to the gravitational actions, our photon, according to an elementary quantum mechanical requirement, must interact gravitationally with the Sun from which started its motion and this is achieved by the exchange of the carriers of the quantum interaction that have been called **gravitons.** The gravitons that were emitted from the Sun after the initiation of the departure of the photon will never reach it to transmit the interaction photon-Sun since they also move with velocity c. What happens however, with the gravitons that are emitted by the departing photon? Before their emission they constituted a part of the conventional mass of the photon $m_{ph} = \frac{h\nu_{ph}}{c^2}$. Of course somebody may object that the graviton has zero mass since the range of the gravitational forces is infinite. This however corresponds to the rest mass of the graviton and not to its conventional mass which is all (like that of the photon) expressed as *Kinetic energy/*c^2. May we apply in this case the velocity transformation of the STR? To the mentioned above example we considered two simple photons that depart from each other from a system Σ with velocity c to opposite directions but **each one** has been emitted from different sources from the two sides of the coordinate system Σ . So we found that their relative velocity was c again, not 2c. At the moment that the graviton is detached from the photon it participates as part of the photon with the same velocity of the photon, i.e. with the velocity of departure from the Sun c. It is however obliged (as messenger of the gravitational interaction) to move toward the Sun (and to any global direction) again with velocity c according to the theories of Quantum Gravity. So to the same graviton apply two equal and opposite velocities. So the graviton will not be detached from the photon and will remain nearby as a hovering and co-transported part of the photon. For the above two reasons the notion of a

graviton with zero rest mass that moves with velocity c and creates the gravitational interaction between the photon and the Sun, is completely wrong. For this reason I postulated axiomatically from the very beginning that the gravitational interactions must be transmitted with superluminal velocities. Of course if instead of the photon we had considered an elementary particle with rest mass $m_0 > 0$ that departs from the Sun with velocity v and emits gravitons too, which are the carriers of the gravitational interactions, the velocity of the emitted graviton toward the Sun will be c-v so that the graviton cannot be carrier of the gravitational interactions as the theories of Quantum Gravity require. Consequently we cannot talk any more for a n inertial system because the particle either would slow down from the attraction of the Sun or it would accelerate if it had enough initial Kinetic energy, i.e. velocity greater than the escape velocity from the gravitational field of the Sun so that in this case the transformations of velocities of the STR are not applicable.

At this point it must be clarified that we identified the graviton with anyone elementary particle that has point like or even small finite dimensions. I think however that even the graviton should be emitted if not like an expanding spherical shell but at least as a spherical wave, so that with certainty will interact gravitationally with all particles that will be found in his way. Let this be taken into account by all that introduced the concept of graviton. To my opinion all particles that transpose interactions through all known dynamical fields with velocities ≥ c should possess spherical shape. For interaction by forces with very short range (as is the case of nuclear forces) this requirement may be not necessary. But R. Feynmann[52] in his book with title "the Theory of Fundamental Processes" writes the following at certain points of this book, that raise some doubts: At p.30: "…*A single free electron cannot emit one photon because of conservation of energy and momentum, but if two electrons* ***are near one another,*** *one may emit a photon which the other immediately absorbs. Quantum mechanics permits the temporary existence of states, which if maintained could not conserve energy …The effect of this photon exchange we recognize in an interaction between the electrons, that is, as the electrical inverse- square electric force…"*

But this law (Coulomb's low) has an infinite range. How the "near" and "infinity" are reconciled with each other The bold letters are put by me. At this point, to my opinion, are posed two more questions: 1) The bold letters above talk about an interaction

of two electrons with emission (by them) photons when the electrons are found near with each other. How each electron is informed that near to it is another electron so that it emits a photon towards the (unknown direction) where is the other electron? 2) Who determines the concept "near" and up to which distance holds this "near"? As a result, we may infer that the photons that are emitted by the electrons must be transmitted spherically to all directions as the proposed by my barytons do.

Before closing this Appendix I wanted to present another opinion of mine relative to a Theory Of Everything (A TOE).

The seeking unification of all known forces of nature, which is aspired some years ago with the theory of superstrings has not yet been succeeded. A general principle that must hold for all known forces is the need of the basic four dynamical force fields (or thee if we consider that the electroweak field covers the electromagnetic and weak nuclear forces) to have their own messengers, which transfer the interactions from one particle to the other. This acceptance is the first step for a TOE. This requirement is achieved in the case of electroweak interactions by some messengers, which are the Z^0, $Z^{\pm}$ heavy bosons and the photon γ. For the strong nuclear forces I have shown[(10)] that they are mediated by the zero spin mesons (either scalar or pseudoscalar ones) and possibly by mesons that have integral spin (although I have not dealt with them). It must be pointed out that for the nuclear forces may hold the "**near**" proposed above by Feynmann, because of the very short range of these forces which is comparable with the dimensions of the nucleons.[*] For the gravitational forces the present theory has shown that the in detail described baryton is the intermediary of these interactions. As I have shown in another work of mine[(12)] in the center of the black holes, the continuously been under strong compression mass that has crossed the event horizon and is constituted by neutrons, never reaches the central singularity but is concentrated in a sphere inside of the black hole which has a radius of the order of 4 to 5 kilometers. The between the neutrons developing repulsive forces which are coming from the repulsive part of the central nuclear potential I determined in two other works of mine[(10,30)] and take place with exchange of mesons as I mentioned above (basically of

[*] This distance increases and decreases because of the quantum harmonic oscillations of the u and d quarks that constitute the nucleons, as I have said in the forgoing discussion.

zero spin mesons) are fed by the Newtonian force field, which transforms the gravitational energy to masses of these mesons.

A simple description for how the gravitational energy which negative (attractive) may feed the creation of continuously heavier mesons that are exchanged among the neutrons, leads them to repulsion between them is in few words the following: The gravitational energy brings the neutrons closer to each other. Then the nuclear potential takes over thanks to its repulsive part and compels the neutrons to exchange between each other heavier mesons, whose mass is determined by the repulsive Yukawa type potential, which is the one term of the total nuclear field. Look my published work[(10)] . The result of this interaction is that we have a *de facto* cooperation that is a kind of unification of gravitational and nuclear force fields since the first feeds the second with energy and this last one prevents the collapse to the central singularity. So it remains the unification of the gravito-nuclear field that develops in the interior of Black Holes, with the electroweek field. For this problem, I may have time enough to deal in another work of mine, although sincerely believe that the unification of the four dynamical fields of nature will never be achieved and in fact it is not necessary. The reason to mention all the above discussion was to support once again that the choice I did for the pattern of the carriers of the gravitational interactions, i.e. the **barytons** as expanding spherical shells was justified. I think that the electromagnetic interactions that have infinite range too, should be studied as expanding spherical object, spherical waves since they are transmitted by photons that have a double appearance either as waves and or as particles (as in the photoelectric effect). And why not the nuclear interactions even though they have small range.

Returning to the subject of superstrings, from the very little I know about this theory, the concept “superstrings” developed in order to be achieved (finally) the unification of all the known dynamic fields in a TOE that covers all the missing knowledge from the infinitesimal small up to the infinitely big in nature. To succeed this subject the various researchers had to introduce more than the 3+1 dimensions in which happen the oscillations of the strings with the Planck order of magnitude and more specifically 10 or 26 dimensions, which probably give solutions for all the dynamical fields. With the present theory I tried to connect gravitation with the concept of Zitterbewegung which is also is the result of quantum harmonic oscillations of the sub-particles that constitute the rest known particles (like the quarks for the baryons,

and the paraquarks for the leptons) but it became necessary to introduce the spherical propagation of the particles that are carriers of the gravitational forces, something that I do not know whether exists as a basic and necessary principle in the theory of superstrings. Let the omniscients examine this case. What is missing from my theory (but also from physics in general) is, I think, **the Machinery of the celebrated law E =mc^2 .** May be this ignorance to be due to the fact that we do not know finally what is "mass", the determination of which as a measure of matter is not enough, since microscopically we do not know what is **Matter.**

APPENDIX D.

Useful relations that result from the named by me, Law of the Geometrical Mean (LGM)

1.Some examples of application of the LGM

I gather some applications of the LGM without detail in this paragraph. Some applications of this Law are useful in the present work.

a. The Planck Length

If the atomic radius is: $r_q = \frac{\hbar}{2mc}$ and the Schwarzschild is: $r_S = \frac{2Gm}{c^2}$ (note.: for the same mass m), then:

$$L = \sqrt{r_q \times r_S} = \sqrt{\frac{\hbar}{2mc} \times \frac{2Gm}{c^2}} = \sqrt{\frac{\hbar G}{c^3}} \equiv$$ L*= Planck length $\cong 1.616\ 10^{-35}$m. (D1)

It is known that the above radii and the Plank length are basic and unquestioned lengths of microcosmos

b. Lengths that are connected in atomic scale

If r_e is the classical electron radius and r_B is the radius of the first Bohr orbit in the Hydrogen atom, the application of the LGM to the above two lengths give the length r_c , which is the quantum diameter of the electron or equivalently the reduced Compton wavelength of the electron. In fact:

$$r_c = \sqrt{r_e \times r_B} = \sqrt{\frac{e^2}{4\pi\varepsilon_0 m_e c^2} \times \frac{4\pi\varepsilon_0 \hbar^2}{m_e e^2}} = \frac{\hbar}{m_e c} \quad \text{(D2)}$$

In the present case the above comment is valid.

c.relation between microcosmos and megacosmos through the LGM

The proton Schwarzschild radius is $r_s = 2Gm_p/c^2$. Half its Compton wavelength is: $r_p = h/2m_pc$. From these two marginal lengths, where both are functions of the proton rest mass, we obtain a length D applying again the LGM as follows:

$r_p^2 = r_s D$, from which we obtain:

$$D = \frac{r_p^2}{r_s} = \frac{h^2}{8Gm_p^3} = 1.7578 \times 10^{23} m = 5.68 \text{ Mpc}^* \qquad \text{(D3)}$$

According to observations by Abell and Zwicky[53] The diameters of the galactic clusters are between 2 and 10 Mpc. So D, as it was calculated above, may be considered as an average diameter for the galactic clusters.

d. <u>The golden ratio</u>

If we consider a length AB and a point C in between A and B then if AC<BC we may define through LGM the relation:

$BC^2 = AC \times AB$ or equivalently: $\frac{BC}{AC} = \frac{AC}{BC}$ (D4)

Relation (D4) defines the so called Golden Ratio, which from the times of ancient Greeks was considered as possessing aesthetic and even mystical meaning.

e. <u>Lengths relative to Earth and Sun connected through the LGM.</u>

The average diameter of the Earth is equal to: $D_E = 1.274\ 10^7$ m.
" " " " " Sun " " " : $D_S = 1.391\ 10^9$ m
" " Earth – Sun distance " " " : $R_{ES} = 1.4961\ 10^{11}$ m

If we apply the LGM to the above first and third important lengths we find the following relation:

$R_{13} = (D_E \times R_{ES})^{1/2} = 1.381\ 10^9$ m (D5)

We observe that R_{13} coincides with an approximation of 0.7% with the average today's diameter of the Sun D_S. For the other planets R_{13} differs significantly from D_S

Is it an accidental coincidence that the only planet for which the LGM gives meaningful results, is the one where intelligent life exists, as far as we know it today, or this coincidence is in fact a necessary (but not sufficient) condition for the development of intelligent life on a planet?

f. <u>The two "spaces" connection</u>

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* Mpc = one megaparsec, is equal to: $3.0857\ 10^{22}$ m.

The equation $x^2 + 1 = 0 \leftrightarrow x^2 = -1$ has no solution in the system of real numbers since in this system the square root of a negative number is not defined, i.e. it does not exist. The mathematicians introduced a new system of numbers the *complex* numbers (x + iy) where x is their real part and iy is their imaginary part. The symbol (i) is the imaginary unit defined by the relation: $i^2 = -1$. What will not be found in the books of algebra is that the above definition of the imaginary unit can be written in the trivial form: $i^2 = (1) \times (-1)$. My interpretation of this last relation is the following: *The product of the positive and the negative unit of real numbers is related with the imaginary unit through the LGM.* It has being suggested by various physicists[2,3,4] that in the space below the Planck length, time may be imaginary. According to my opinion, the use of the above analysis to the problem of extraterrestrial civilisations may be the following: I have reasons to believe that there exists a channel of instantaneous communication through the act of telepathy. The only channel that is offered for this instantaneous communication is the SubQuantum space (below the Planck length dimension) where the passage of imaginary time can not have any effect on our ordinary time. These two times may be the *"parallel"* times proposed by A. Dobbs (c.f. ref. 5). So the events that take place in this space may look instantaneous for us. Is therefore impossible for a civilisation of 1 million years ahead of us, to apply as an every day routine the intrusion in this SubQuantum space for instantaneous transmission of information? The idea about the existence a Sub Quantum abstract space has been discussed extensively in two works of mine[12,20] . The existence of this space is an alternative basis for the development of a new COSMOGONICAL model for a better understanding of the creation of the universe, less arbitrary compared with the false vacuum introduced by Allan Guth et al, for the explanation of the first moment of the universe. About this subject, a paper will be presented pretty soon wherever it would be accepted. The only I will say here is that not only the inflation but the explanation of the nature and origin and of the electric charge will be explained thoroughly.

g. The velocity of light in vacuum

As it is known the velocity of light in vacuum is given by the relation:

$$c = \frac{1}{\sqrt{\varepsilon_0}} \times \frac{1}{\sqrt{\mu_0}} \qquad \text{(D6)}$$

Where ε_0 is the permittivity of vacuum (or dielectric constant) and μ_0 is the magnetic permeability of vacuum. What is important in the present case is that the velocity of light is expressed as the Geometrical Mean of the above two constants of the electric and the magnetic field as they are involved in relation D6.

PART II

THE FOUR TESTS OF GENERAL RELATIVITY

1. Introduction

Before saying anything else about the way I applied my theory of gravitation in the case of the four tests of GR, I must warn the reader that since in my equations appear two parameters whose values are unknown (they are new) the whole derivation will be based on experimentally or observationally known values, so that the unknown ones can be determined. Since, however, I have serious suspicions that some of the values from observations may be presented in a way to conform to the predictions of GR[*], or may have not been measured with sufficient accuracy, my derivation may present differences from the given experimental or observational values. For this reason **I state at this very moment that if and when new more accurate and more reliable measurements will be performed in the future, I or somebody else must repeat my calculations in order to make my results more accurate.** But for now I will work with whichever information is given in books on GR that I had in my bookcase and on published papers connected with the four tests of GR. As the reader will soon realize, the authors of the above sources of information have used various presentations of the subject, so that I had to decide about what information would be the best to be used in my work. Hence a kind of criticism on certain occasions was unavoidable. It is possible that some differences between the sources I used may be due to bias in order to conform with the basic principles of GR such as e.g. the concept of "spacetime" and the "curvature" of this unimaginable concept. I am not sure but most of the experiments and observations made in the case of the four tests of GR conclude also with phrases such as "… in agreement with the predictions of GR…" or similar ones. So my remarks on the works of other people, by no means expresses any intention to criticize their job but to show that what I said in APPENDIX A about the connection of GR with Gravitation is correct and has caused a confusion to the whole of the physics

[*] Other people too[40, 42] have expressed similar doubts about the accuracy, even validity, of the measurements from observation.

community that will lead to nowhere about gravitation if this theory continues to be used as the best theory on this subject.

I will start applying the derived expression (27) of the New Newtonian Law (NNL) as I have called it for the confrontation of the four basic tests that were chosen as an experimental and/or observational verification of GR. These tests are considered classical since the supporters of GR assert that this theory has been proved undeniably correct as the best theory of gravitation (at least in macrocosmos).

As I have already shown in APPENDIX A, this famous theory cannot be considered as a genuine (and authentic) theory of gravitation, since without Newton nobody could characterize it as such.

So in what follows I shall start examining the first test, i.e. the advance of the perihelion of planets, a phenomenon that is not predicted by the Newtonian theory. In this basic theory of gravitation the orbits of the planets are considered as closed ellipses. The astronomical observations however have discovered that the planetary orbits around the Sun are changing in time, after the subtractions of all the rest factors that affect the motion of the planets (such as, the influence of other planets on each other, the quadruple moment of the Sun et al that can be estimated by the classical theory). So the elliptical orbits turn continuously themselves by a tiny amount of arc the value of which is noticeable and measurable for a century because of its smallness.

What we shall really do is the application of formula (27) in every case where the calculation may be done by use of the NLG. In particular in the case of the first test, which is the calculation of the advance of the perihelion of the three interior planets, Mercury, Venus, Earth and the asteroid Icarus, we shall follow the Newtonian approach to the subject but instead of the simple Newton's Law, which does not predict any precession, we shall use the NNL of mine. There, however, enters the unknown expression for the velocity at which the gravitational interactions propagate, which as we said is a function of r i.e. of the distance of the expanding barytonic shell from its emission point, indicated by $v = v(r)$. The basic requirement for any function that will be chosen is, as we said in the previous development, that for any r, v(r) will be greater than c and for r=0 or more accurately at the very moment of the barytron emission only $v = c$. One parameter is also needed to replace the unknown parameter {a}, since as I said earlier this multiplier of L_{Pl} may obtain different values in different

circumstances. The used value of {a} equal to $\sqrt{3}$ was only valid in the case of v=const. =c. Since we have chosen v to be a function of r, the new value of {a} should be found by the trial and error method as we shall see further on.

The basic task of this work is to find **a unique equation that will be capable to solve any problem of gravitation that appears in what concerns to celestial objects of any size and distance among each other, as unique is Newton's equation.** In cases of weak gravitational fields or short distances, the difference between the NNL and NLG cannot be considered negligible, as we shall show further on. As will be shown, the relative velocities of interacting bodies, does not affect the application of the NNL. In fact the characterization of weak and strong gravitational fields, introduced by GR, had never given a sharp distinction where a field stops being weak and starts being strong. The supporters of GR the only they say is that in the case of weak fields the application of Newton's Law and of GR give the same results. Since in my theory Newton's Law is modified, it is reasonable to expect that the results of application in either strong or weak fields of the NNL will give different results from those of the NLG if the NNL does not agree with GR. The distinction of the strength of the gravitational fields is completely unnecessary in my theory. On the other hand since the gravitational interactions, according to my theory, propagate with superluminal velocities the motion of material bodies does not play any remarkable role since the superluminal velocities remain superluminal in all reference frames whichever their motion may be (inertial or non inertial). Other people have confronted the idea that the gravitational interactions propagate with different speed than that of light too[14,15]. Especially the second of the above two authors says something that is among my points of view that the transmission of the gravitational interactions must propagate at superluminal speed but both are studying the case of a constant speed v_g. In my theory, from the very beginning I have accepted a speed $v(r) \geq c$ varying with the distance r from the emitting the barytons body, since as I showed in Part I if the gravitational interactions propagate with a constant velocity this velocity must be the velocity of light c.

About the mentioned above unknowns (parameters or functions) that require determination, or even about some numerical measurements of the velocity of propagation of the baryton there is no information whatsoever. This was to be expected since there is no theory up to now that predicts the existence of barytons as well

as their superluminal motion. For this reason I decided to work by the trial and error method searching for functions as simple as possible that could be used for v(r).

Apart from that, I had to use some astronomical magnitudes given in the literature such as the semi major axis of the orbits of the planets, their period of revolution, the eccentricity of their elliptical orbits, the average velocity of revolution of the planets around the Sun and finally the advance of their perihelion given also in the existing literature. So I had to collect the above elements, something not difficult. By doing so, I realized that having these elements as the data in my equations, I had to decide how to use them*. Turning again to the available in my library books on GR, I found that many mistakes were done by those who tried to solve the problems by use of the equations of GR. I also became suspicious to the manner some authors tried to persuade the people that the problem could only be solved in the framework of GR. For these reasons, before proceeding to my own calculations I felt necessary to make reference to all the above discrepancies I discovered in the derivations by other people, something that would make me to be more careful in the choice I should make of the existing material. So I proceed first to this subject that contains necessarily a careful criticism from which many peculiar things will emerge in various circumstances.

The values in Table I were taken from the Wikipedia free encyclopedia in the Google. These values were taken (mostly) from the International Astronomical Union.

The advances of the planets were taken from several books on GR.

1. Test No 1. Advance of the perihelion of the orbits of the 3+1 Planets

2.Some comments on the writings of other authors

Before presenting the method I followed for the determination of the advances of the above planets, I considered necessary to examine in what way the people that made the calculations of the advance of the three planets and the asteroid Icarus in the

* One may say that Newton to derive his law made use of the observational results from Kepler's laws for the motion of planets around the Sun. So, one may continue, that I have derived the New Newton's Law by using observational data. The difference is that I need the observational data not for the derivation of the NNL but for the determination of some constants that exist in the NNL.

framework of the equations of GR had accomplished this task, in order to have a first approach to this subject.

The existing observational data they used were those given in the three first rows of the Table I below (with some little rounding of the above figures). The last two rows contain also data from observation that will be used in the ensuing discussion.

I will make therefore a very brief reference to some books on GR that happened to have at my disposal (in my bookcase)[*]. I shall follow a chronological presentation of the, under discussion, books. A general remark that must be made by reading the following books is that most of the authors present the final expression of their derivation of the planets precession, **without giving the numerical values of the parameters that enter in their precession formulae** (except of few cases, but again with rounded up numbers). So the reader cannot check himself the result obtained from these formulae. Also the given expressions for the advance differ significantly from author to author. For this reason I will present the final formula of each author because I was confused about which formula represents the best derivation of the advance and which one could be trusted with the least doubts, in order to compare the results obtained by use of the equations of GR with the ones with my theory. The ensuing presentation has not been done as a criticism of the way each author had chosen to do his/her own solution of the equations of GR, but I wanted to be as sure as possible whether my theory is closer or not to the truth in comparison with GR

3. Numerical values for the astronomical elements of each planet.

[*] In fact I had bought these books in an attempt to understand how the problems of the 4 tests as well as other topics, were confronted by GR, since before the idea of developing a new theory of gravitation I was influenced by the general opinion that GR is the best and unique theory of gravitation. Soon however I realized that there were basic discrepancies in the derivations by the authors of the books and then I started thinking about a new theory, which concluded to the present modification of the Newtonian Law.

TABLE I

Planet	MERCURY	VENUS	ICARUS	EARTH
Semimajor axis (m)	57909068000	108208930000	161257000000	149597889030
Eccentricity	0.20530294	0.00677323	0.827	0.016710219
Period of Revolution (days)	87.969098	224.70069	408.778	365.256366
Average speed on the elliptic orbit (m/sec)	47870	35020	22880	29783
Advance of the perihelion per century from observation (sec of arc)	43.11±0.45 and more recently a value of 41.4 ±0.94	8.4±4.8	9.8±0.8	5±1.2

4. Strange things that are contained in derivations by use of the equations of GR by some well known authors.

1) J. Weber : *General Relativity and Gravitational Waves (1961).* In p. 67 the author derives his expression of the advance Δ of Mercury and he uses as a constant average radius of the orbit of the planet the magnitude of $r = a(1-\varepsilon^2)$ where ε is the eccentricity of the orbit and {a} is the semimajor axis. So in the calculation of the advance, this magnitude {r} represents in fact a constant radius which by being constant, describes a circle with perimeter equal to $P = 2\pi r = 3.638534\ 10^{11}$. If we divide this length by the time for one revolution we find the average speed of revolution:

$$v_{average} = \frac{2\pi \times 5.7909078 \cdot 10^{10} \times (1 - 0.20530294^{2})}{87.969098 \times 24 \times 3600} = 45858 m/\sec$$

Since the average speed from the above table is equal to s = 47870 m/sec one could say that this is not a very bad approximation (the difference from the value given in Table I is (only) 4.2%. As I will show further on, my theory predicts a velocity equal to 47363 m/sec, which differs from the given value by only 1.06%. No further comments on this issue. The calculated advance is also in good agreement with observation since the former was found equal to 43 sec of arc and the latter is 42.6±0.9 sec of arc per century. From the above (nearly) successful calculation the author concludes that GR provides a good description of gravitation and that gravitational interactions propagate with the speed of light. This last inference, however, is rather arbitrary since the speed of light was introduced in his calculations through the use of the Schwartzscihld metric and not as an a priori condition that c represents the speed at which the gravitational interactions propagate. That author did not proceed to the advances of the other planets. The reader will probably understand the reason, since most of the authors I will mention below do the same. His final formula is: $\Delta = \frac{6\pi GM}{c^2 a(1-e^2)}$ but how this expression emerges from the preceding development of the subject in his book is hard to be understood.

2) E.P. Ney :*Electromagnetism and Relativity (1962)*

E.P Ney uses in his book a simplified method based on GR for the calculation of the advance of Mercury. Because his equations do not contain the constant radius r = a(1-e^2), he inserts r using a kind of a trick. He says: "*Since the orbit is elliptical the quantity 1/r must be replaced by (1/r) average."* So he finds *the minimum and maximum distances of the ellipse* as he calls them: $1/r_{min}$=1/a(1-e) and $1/r_{max}$= 1/a(1+e).

Of course he did not notice that 1/r is not a distance if r is a distance. Any way by taking the numerical mean value of the above quantities derives finally that the 1/r in his formulae must be replaced by 1/a(1-e^2) and gets about the same result for the advance of Mercury as in case 1 above. For the other planets the only that he mentions is that the advance of Earth, because of the larger (a) (semimajor axis) is equal to 3.8 sec. of arc per century. So the difference from the average advance given in Table I is 24%.

3) Hüseyin Yilmaz: "*Introduction to the Theory of Relativity and the Principles of Modern Physics (1965).* This author after some

calculations derives an expression for the advance: $\Delta\dot{\phi} = \frac{6\pi M^2}{h^2}$ and he says that "…*When evaluated numerically, this correction turns out to be extremely small for all planets except Mercury, in which case it amounts to 43 seconds of arc per century. This is exactly the amount observed experimentally for the orbit of Mercury…..The advances of Venus and of the Earth …and has been seen that the theoretical formula is well substantiated, also in these cases*. I think that he does not offer any new element since he does not present analytical calculations for Mercury and the other planets to persuade the reader for his assertions. The value of *h* is not given and the $a(1-e^2)$ is also absent in the above equation.

4) Ch. Misner- Kip Thorne – John Wheeler. *"GRAVITATION"* : *(1973)* (for brevity MTW) . This book may be characterized as the Gospel of GR and Gravitation. Let us see what we can extract from this book about the precession of the planets. Besides all my efforts, I was unable to find a straightforward calculation of the advances of the perihelia of the four planets. A lot of "advanced" calculations by various methods are given but nothing more. The only information they give is that in p.1113 that the residual shift of the Mercury's orbit is given equal to 42.56±0.94" of arc per century. For the other planets there is not any reference.

5) H.A.Atwater: *Introduction to General Relativity (1974).* In pages 105-107 of his book he examines the advance of the perihelion of Mercury and concludes to a formula: $\Delta\varphi = (3M^2 G^2/c^4b^2)\varphi$. The integration constant b, as called by the author, is given as $b = r^2\dot{\phi}\sin^2\vartheta$. I think that it would be more preferable for the reader, to get the final formula for the calculation of the advance. Really I was unable to discover in his formula the factor $a(1-e^2)$. He concludes: "…*in fact the astronomer Leverrier had discovered in 1845 that Mercury exhibited an "anomalous" precession of perihelion of about 43'' per century…. This is almost equal to the relativistically predicted Δφ ....The precession of the perihelion of Mercury was therefore regarded as an early verification of the correctness of the* GTR….". This last sentence will be encountered many times in the bibliography.

6) Adler-Basin- Schiffer: *Introduction to General Relativity (1975)* (for brevity ABS). In p. 213 the shift is given equal to 43.11" sec. of arc /century and the formula used is:

$$S = \frac{3\kappa^2 M^2 C^{1/2}}{2\pi c^2} r^{-5/2}$$

As the authors say: *"…The perihelic shift as predicted by Einstein's formula thus varies as the -5/2 power of the distance of the planet from the Sun…".* Here we have a new expression that does not appear in the previous references. Now why $r^{-5/2}$, which obviously is varying because of the elliptic shape of the orbit can be equal to the previously used constant distance $a(1-e^2)$ remains a mystery for me. Besides that, the authors give values for the precessions of the three planets plus Icarus, along with observed values without any calculation. I do not continue.

7) Michael Berry: *Principles of Cosmology and Gravitation (1976)*: On p. 84, the shift is given equal to 43.11" ± 0.45 of arc/century. The author also gives a table for the predicted and observed shifts for the 3+1 planets. He also gives the formula: $\Delta\varphi^{100} = 6\pi GMN/c^2 r_{min}(1+e)$, which seems to be the most clearly stated expression allowing to any one to calculate the shift,. But this author to arrive at the previous formula uses the following argument:

He uses the equation: $\varphi(1-3GM/c^2 r_{min}(1+e)) = 2\pi n$. As he says "…This may be written as $\varphi = 2\pi n + 6\pi nGM/c^2 r_{min}(1+e)$…". It was impossible for me to understand how this transformation may occur. The author too uses as the distance of the planet from the Sun the $r = r_{min}(1+e)$ which is equal to $a(1-e^2)$ as most of the previous authors ($a=r_{max}$) use. This is absolutely correct. To arrive however to the above formula several other simplifications have been done as well as omissions of some zeroth-order terms and of trigonometric approximations. He also gives the results of the theoretical prediction with his formula for the other 2+1 planets and the results from observation. About his results I shall present my objections later. Of course he could not omit to say that: *"…This group of results forms a most impressive verification of the predictions of GTR…".*

8) D.F.Lawden*: An Introduction to Tensor Calculus, Relativity and Cosmology (1982):* The author starts with the statement that: *"…Thus, relative to spherical polar coordinates having their pole at the centre of the sun, the gravitational field will be assumed determined by the Schwarzschild metric…. The planets will be treated as particles possessing negligible gravitational fields, whose world-lines are geodesics in space time…."*. He then proceeds to his calculations. He finally derives the expression: $\delta\tilde{\omega} = \frac{3\mu}{c^2 l}\phi$. He gives the numerical values of μ, c and *l* for Mercury, but not the value of φ and obtains an advance equal

to 43'', which, as he says is in agreement with the observed value. He then concludes that the advances for the other planets are too small to be observable at the present time (1982). My comment is that although this author has published this book in 1982 (To this year is referred the copyright by John Wiley and Sons) and the last reprint of the book was in 1975, considers immature to compare the predictions of GR with observation for the three other 2+1 planets because their advances are too small. I really wonder how the authors of 6,7 paragraphs in 1975 were giving predictions and observed values for the 2+1 other planets and Lawden expressed his reservations about these observations? Whom can I trust then? I say this, because as the reader will soon realise, my theory is based on the values of the advances of all four planets given by observation, because with these values I may determine the velocity at which the gravitational interactions propagate at the position of each planet. Then I can construct the one single equation that gives the advances for all 3+1 planets and for any other planet as well as for the advance of the periastron of any other celestial body. Even more, my expression for the new Newtonian force, as will be derived here, can be applied for any case where the NLG can also be applied. This will be shown in the examination of the next three tests of GR, but for reasons I will explain later the NLG gives correct results for distances among the interacting bodies smaller than a certain limit that will be determined. Finally:

9) Bernard F. Schutz: *Book, under the title: A First Course in General Relativity (1985).* The shift is given at p.284 by the formula: $\Delta\phi \approx 6\pi \frac{M}{r}$ and as he says, the perihelion of Mercury is measured and was found equal to 43'' of arc/century. All other planets are farther from the Sun and therefore under the influence of significantly smaller relativistic corrections to Newtonian gravity.

Apart from the above 9 books, which are written in English, I will present one more book written in Greek that happened to have in my bookcase and it is the most recent one compared with the others. It was published in 1989.

10) Spyrou, N.K: *Book, under the title: Introduction to General Relativity.* The author presents a formula for the precession of the planets, which is the same with the one contained in the E.P. Ney's book (case 2 above) but derived in different way. The author for the first time says that although the application of this formula

gives 43.03 sec of arc/century he presents an observational value equal to 41.4 ± 0.94. This same perihelion shift (advance) is also given in MTW book p. 1113. For this reason (doubled reference and probably most recent observational value that happened to have at my disposal), I decided to use this value in the calculations with my theory. For the rests of the planets he gives only the results of the calculations, which are exactly the same with the ones given by the author of case 7 above.

At this point I end the references to derivations of the perihelion advance of the 3+1 planets by other people, since the only thing I wanted to show was that apart from Mercury for the advance of which all agree one way or another, for the other planets a serious confusion exists among the above authors, about the validity of the predictions and of the observational data and for this reason most of them avoid to deal with this subject. As a matter of fact I performed the calculations with the formula of M. Berry and I found that his results had some deviations from the observational values as follows: For Mercury 0.3616%, for Venus 2.67%, for Icarus 2.28% and for Earth 23.23%. As I will show, the result for Icarus is far away from the correct one for reasons I will explain further on and this fact affects the calculations of all the other planets. Finally the reader cannot disregard the fact that **the final formulae for the advance of the 3+1 planets given by the above authors, present serious differences with each other. This makes the reader to wonder how these formulae can be compromised and how give the same numerical results. Are really all correct solutions of the basic equations of GR for the advance of the perihelion of the planets?**

5. Calculation of the precessions of the Perihelia of the above 3+1 planets with my theory.

In what follows, I shall use as a guide the best values given in bibliography on GR, about the advance of the perihelion of the planet Mercury and the other planets. I must say that I keep serious reservations about the given observational results. As a matter of fact the precession of Venus from observation has an observational uncertainty of ±57% whereas the ABS authors when they derive their precession formula say that one of their approximations is not valid for some of the minor planets with large eccentricity, e.g. Icarus.

As I have already said, I will try to solve the problem by use of the NNL as it is expressed in formula (27). In this formula the velocity enters at which the gravitational interactions propagate i.e. a new concept never being presented till now as a varying speed, because the totality of the physics community has bogged down with the velocity of light as the maximum velocity for any kind of information transmission. So the first I had to think of was to find an expression for the above velocity as a function of the distance r from the point of emission of the baryton. Of course I had already in mind that the lot of the possible functions is innumerable. One restriction for this function was the requirement that the velocity should start from the point of emission of the baryton with a value greater than or equal to the velocity of light c, which gradually should be increasing and at infinitum, when the total mass of the baryton would have turned into kinetic energy, the velocity would tend to an infinite value. Then the baryton would not have mass any more to transfer the gravitational interaction and the force would be zero, something that is also valid for the NLG since at infinity the gravitational force becomes zero. Another requirement was that since in (27) enters the time t that is the time needed for the baryton to cross a distance r with variable velocity v(r), this time should be given by the integral: $t = \int \frac{dr}{v(r)} + A$ where A is an integration constant determinable by the initial condition that for r=0, t=0. So 1/v(r) should be an analytically integrable function. The third requirement was of course that the v(r) would lead to a derivation of the advance of any planet, for a comparison with the given (uncertain) values from observation. If the function I would chose for the v(r) could not solve the problem of the advance of even one planet then I had to try a new one. In general the v(r) function should be as simple as possible to facilitate the calculations, which had to be done by mostly numerical methods with the appropriate computer programs. Of course it must be emphasized here that the final form of the NNL derived for the advance of the perihelion of the planets should give acceptable results for the other tests of GR too.

Another problem I had to solve was the determination of the constant {a} that is a multiplier of the Planck length in the present case. As the reader may remember I had said previously that if $a = \sqrt{3}$ and v=const. =c then formula (27) leads to the NLG without the handicap of the instantaneous action at a distance. But since this value was leading to a constant velocity v=c for the

gravitational interaction, was not the appropriate one if the velocity v was a function of the distance r. So I had to turn again for the value of {a} to the trial and error method to achieve the best results in my calculations. Here another clarification must be made. The application of my equations started with Mercury and at least two arbitrary parameters had to be determined. They were reduced only to one as will be explained further on.

Before starting to describe the method I had to work with, it was one more thing to be defined before starting the calculations. This was the determination of the length r i.e. the constant length I had to use in my calculations which is the average constant radius of the planet as it orbits around the Sun. As I already noticed previously, I had some doubts about using $r= a(1-e^2)$ as did most of the above mentioned authors in their solutions. The reason was that this length in the case of Icarus (and less for Mercury) did not give the correct value of the average velocity of the asteroid in its orbit around the Sun. So I started thinking what to do again and after a while I concluded to use the radius of a circle the perimeter of which should be equal to the perimeter of the corresponding ellipse. I found this choice more reasonable than the previously mentioned one and as I will show at the end of the calculations, I was right and the others who used the $r= a(1-e^2)$ were wrong and for this reason their calculations of the advance of the perihelion of the planets are in error, at least for those planets with a considerable eccentricity.

So I started a long trip in testing various expressions of v(r) and solving the appropriate equations.

The method I used is the following:

Since formula (27) was a New Newton's Law, I had to work in the same way one would do with the NLG.

If w is the angular velocity around the sun of any planet, then in the case of the NLG we have:

$$mw^2 r = \frac{GMm}{r^2} \qquad \text{(w is the angular velocity)} \tag{II.1}$$

So the angle described in one revolution is

$$\Theta_N = 2\pi = wT = \frac{(GM)^{0.5}}{r^{1.5}} T \rightarrow w = \frac{(GM)^{0.5}}{r^{1.5}} \tag{II.2}$$

where M is the Sun Mass, m is the planet mass, $\Theta_N = 2\pi$, T is the period of one revolution and r is the radius of the corresponding circle. This radius in the application of the NNL is calculated with the help of a complete elliptic integral of the second kind, which

gives the length of the elliptical orbit (if multiplied by the semimajor axis):

$$I = \int_0^{\pi/2} (1 - e^2 \sin^2 \varphi)^{1/2} d\varphi \qquad \text{(II.3)}$$

An appropriate computer program that is given in APPENDIX C calculates the above integral numerically.

So the radius of the equivalent circle i.e. the one with the same length of its perimeter as the ellipse, is given by:

$r=4aI/2=2\alpha I/\pi$ (II.4)

where {a} is the semimajor axis of each planet orbit and e is the eccentricity.

If we write now (II.2) using the NNL instead of the NLG we will have:

$$\Theta = w_1 T = \left(\frac{GM}{r^3} \times \frac{a^2}{3} \times \frac{v}{c} \times (\frac{2vt}{r} - \frac{dv}{dr} t - 1) \right)^{1/2} T \qquad \text{(II.5)}$$

So the precession in one period will be given in radians by:

$z = \Theta - \Theta_N = (w_1 T - \Theta_N)/T = (w_1 - w) =$

$$\left(\frac{GM}{r^3} \right)^{1/2} \left[\left((\frac{a^2}{3} \times \frac{v}{c} \times (\frac{2vt}{r} - \frac{dv}{dr} t - 1) \right)^{1/2} - 1 \right] \qquad \text{(II.6)}$$

Now we turn the value of z that is in radians, to seconds of arc as follows:

$w=z\times 360\times 3600/2/\pi.$ (II.7)

and the total precession in one earth-year would be equal to:

$w_1 = w \times T/T_1$ (II.8)

where T is the period in days of earth (1 year == 365.256366 days. and T_1 is the period of revolution of the planet.

This quantity w_1 is the precession of the planet in one earth year. The w_1 result therefore must be multiplied by 100 for one century.

I started with Mercury the precession of which is supposed to be the best one known from observation and I tried to derive the observational value by changing the values of x and q as they are defined bellow. As I said above I used the value 41.4 sec of arc for the same period (one century). By placing in the calculation the advance of Mercury equal to 41.4 arc sec that corresponds to one century the obtained results for the other planets will correspond to one century too.

But wait: Before proceeding to any calculation we have to define the function v(r) and the parameter {a}.

From now on to determine this expression we must work by the trial and error method. The function v(r) of course must satisfy the requirements I mentioned above.

As I said before, one unknown in the relation (27) was the speed v(r) at which the gravitational interactions propagate in space (i.e. the speed at which the barytons expand) and this speed, as it was stated in the main text, should be a function of r, with marginal limits v($r \cong 0$) =c and v(r$\rightarrow\infty$) =∞[*]. The first limit is in fact a step function as I explained in PART I between the values 0 and c at r=0. But since the smallest length is $r \cong L_{Planck}$, we may use indifferently the value of the velocity at r =0 or $r \cong L_{Planck}$ equal to c in our calculations. In comparison with astronomical distances that will be used in the calculations, the above approximation is completely legitimate and immaterial. In the main text I explained the reasons for which the velocity, at which the baryton expands, has to be greater than c, increasing as the barytonic shell departs from the point of its emission, i.e. from the mass centre of the celestial body.

Of course, if we had a function v(r) from a theory or from observation (from experimentation too), we could use it in our (27) relation and then we could apply this expression for a straightforward calculation of the precession. Such a function however does not exist. In Part I and in APPENDIX A, I explained why relativistic acceptance of the value c (for light in vacuum) is not correct in gravitational interactions. With the above thoughts in mind, after about one year of testing a rather not negligible number of functions, I concluded to one (very simple indeed following the Occam's razor) that satisfied the posed requirements and also gave acceptable results for the 3+1 planets and for the other tests. It was the following:

$v(r) = c(1 + xr)^n$ (c = the velocity of light in vacuum) (II.9)

The above expression for v(r) presented a peculiar behaviour when I used the computer program for the determination of the

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[*] The derivation of expression (27) was done between two elementary particles. Its use in astronomical events where the celestial objects are stars, planets and even greater concentrations (galaxies etc.) is allowed as a good approximation thanks to the huge difference between the distances that separate such objects compared to their sizes. So the centre of emission of the barytons from a star or planet is taken conventionally as the mass centre of these astronomical objects. And this mass centre of course is the geometrical centre of all the elementary particles (photons included) that constitute the total mass of the celestial body.

parameters x and q. It was giving solution only for the value of the exponent n equal to 2 whereas for n≠2 it was unsolvable. I am not in a position to say whether this was due to the peculiarity of the used program or this preference of the exponent was imposed by the physics of the problem. If this last case is true then it may represent a new law of nature for the transmission of the gravitational interactions.
The unknown x is a determinable parameter with dimensions length^{-1}.

At first glance, it looks reasonable for any one to conclude that for r=0 v = c (for $x \neq \pm\infty$) and for r=∞ v = ∞ again with ($x \neq 0$ as required). The factor x is a parameter that will be determined by solving numerically an equation leaving as a determinable unknown the value of the parameter q only, which is equal to $a^2/3$ as it is put in (27). The above restrictions obviously are not necessary if we work at distances $r \neq \infty$, even up to the maximum radius of the observable universe, which is of the order of 10^{26} m.

Now, I had to work in the space of our planetary system. All four planets (and the four tests of GR) should be calculated with the same value of q and x. But instead of using two arbitrary values for x and q I worked as follows: I accepted as the most reliable result for the advance of Mercury the value of 41.4 sec of arc per century and I based all the rest calculations on this result. Then writing the basic equation as it is given with the help of II6, II7, II8, II9 and (27), I chosen a value for q and I imposed to the basic equation to give a result equal to 41.4 arc seconds (for Mercury) by using a program of equations solution by numerical method. The determinable unknown of the equation was the parameter x. So by inserting various values of q the corresponding x was calculated giving the accepted advance of Mercury equal to 41.4 arc sec. Then with these values of q and x I calculated the advances of the rest 3+1 planets, but also the bending of light that grazes the Sun surface, the delay of the radar signals between Earth and Mercury at superior conjunction and as a prediction, the advance of Mars and some more interesting things. The programs are given in Appendix C where is easily understood how I worked and any one may use these programs to verify my calculations. The time t that expresses the time needed for the gravitational interaction to cross the distance r was determined from:

v(r) = dr/dt =c(1+xr)^2 $\rightarrow$dt= $\frac{1}{c}\int \frac{dr}{(1+xr)^2}$ so the time $t = \frac{1}{c}\int \frac{dr}{(1+xr)^2} + A$ where the integration constant A is determined from the condition t=0 for r=0.

By performing the integration we find: t = (1-(1/(1+xr))/c/x = r/c(1+xr).

The phases of the calculations are the following:

Phase 1. With the help of computer program in APPENDIX C under the code name aadvanc8.bas in Quick Basic programming language taking into account the expressions for v(r), of the derivative dv/dr = 2cx(1+xr) and of the expression of t as above, that are contained in (27), I derived the values I considered as the best ones, by giving to q various values. All the above expressions and constants were inserted in relation II6 with the constants q and x determined finally and were found equal to: x = 4.50742987283132 10^{-9} m^{-1} and q = 0.05140419.

I observed whether the value of the velocity of propagation of the gravitational interaction increases as r increases. If this was not achieved, I had to alter properly the given value of the advance of each planet (except of Mercury of course) until getting the satisfaction of this requirement too. Of course expression II.9 was a guarantee that this requirement would certainly happen. The obtained results are shown immediately below (Table II):

TABLE II

Values of r (in meters)		Values of the advance/century
Mercury	5.7293952213 10^{10} 41.4''	dif . 0.0%
Venus	1.08207688923 10^{11} 11.868''	dif. 41.29%
Icarus	1.28443466600 10^{11} 5.9946''	dif. -38.83%
Earth	1.495875937 10^{11} 6.2219''	dif. 24.44%

Phase2.

As I said above, the choice of the constant length for each planet as equal to a(1- ε^2) where {a} is the semi-major axis and ε the eccentricity was proved wrong in the case of the average velocity of Icarus as it is clearly indicated in the table III below:

TABLE III

Planet	Speed from GTR calculations m/sec	Speed from observation	Speed from my NNL theory
Mercury	45858	47900	47368
Venus	35019	35020	35020
Icarus	9067	22880	22850
Earth	29783	29783	29783

Now let us see what the above Table III can say to us:

a) The calculation of the average velocity of the planets around their orbits was made by the simple formula: $v = 2\pi R/T$ where R is the constant radius that is supposed to give the perimeter of the orbit (in meters), which radius in my theory was calculated with the use of the elliptic integral etc. whereas in the case of the relativistic calculations this radius was expressed by $a(1- \varepsilon^2)$ as I said above.

b) It is absolutely clear that my results are equal or very close to the observational ones in every case of Table III. For the Venus and the Earth both calculations coincide with observation because the orbits of these planets are almost circular with very small eccentricities. But in the case of Mercury and even more in the case of Icarus we have serious departures from the values of observation with the relativistic data. So the relativistic calculations for Mercury and Icarus must be repeated but instead of the $a(1- \varepsilon^2)$ must be used the values of R I used in my calculations.

I will proceed therefore to calculate the advances of the 3+1 planets by using the already mentioned formula from M.Berry's book. The formula is:

$\Delta\varphi^{100} = 6\pi GMn/c^2a\,(1-e^2)$ where {a} is the semimajor axis and $a(1-e^2) \equiv r_{min}\,(1+e)$ as it is easily shown. The results were:

TABLE IV

	$a(1- \varepsilon^2)$			Observation	Eliptic integral
Mercury	42.973613	Dif. 3.8%	41.4±0.95	41.4	Dif. 3.74%
Venus	8.6245806	Dif. 2.67%	8.4±4.8	8.624	Dif. 2.67%
Icarus	10.06456	Dif. 2.28%	9.8±0.8	4.74	**Dif. 51.62%**
Earth	3.8386949	Dif. 23.226%	5.0±1.2	3.837	Dif. 23.266%

Let us see now some important points comparing the two calculations: For Mercury it was accepted as observational advance the 41.4''. In the case of Venus there is no difference between the two calculations. This is due to the orbit of Venus being almost a circle so the eccentricity does not play any important role. The same applies in the case of Earth. **For the Icarus however the difference is dramatic.** Why? As the authors of ref. 21 say in the derivation of the relativistic formula (p. 212) "…(*note that this (*i.e. their formula) *is not valid for some of the minor planets with a large eccentricity, e.g., Icarus).* But although their final formula, according to the above notation, must not be valid for the case of Icarus, they apply (?) this formula and calculate the advance of Icarus. And curiously enough the obtained value does not differ significantly from that derived from observation. So although the relativistic formula cannot be applied for a reliable result for Icarus, the application gives a very good result. To my opinion, from this fact but also from the fact that all who present in their books results for the 3+1 planets and not only for Mercury, give exactly the same results although as I mentioned earlier they work with different formulae, two things may happen. Either their results are mostly wrong, or the given experimental values have not been measured with sufficient accuracy. I cannot even imagine that the observational results have been adjusted appropriately to conform to the calculations based on GR. I consider a serious omission of all the above authors to make no reference to those who observed using astronomical methods and gave the advances of the 3+1 planets as above. These scientists (rather astronomers) are not mentioned even in one of the above books.

It must also be said that among the 10 authors mentioned in the foregoing discussion only three give values for the advances of the perihelia of the 2+1 planets beyond that for Mercury. Table V below makes this assertion clear:

TABLE V

Author	Calculations for Mercury only	Simply gives the results for Mercury only	Gives results for the 2+1 other planets
J.Weber	Yes	Yes	No
E.P.Ney	Yes	Yes	No
H. Yilmaz	Yes	Yes	No
Misner-Thorne-Wheeler	No	Yes	No
H.A.Atwater	Yes	Yes	No
Adler-Basin-Schiffer	Yes	Not only	Yes
M.Berry	Yes	Not only	Yes
D.F.Lawden	Yes	Yes	No
B.F.Schutz	Yes	Yes	No
Spyrou N.K.	yes	Not only	yes

I think that the above table is clear. Nine of the 10 authors have calculated the advance of Mercury analytically; one gives only the result of the calculation and only three give results for the other planets without analytical calculation. I think, although the sample of authors is restricted to only 10 (the ones I had their books in my bookcase) that it is nevertheless indicative that none was certain enough to present an analytical calculation for the three outer planets. And in fact all of them expressed doubts about the ability of observation to give reliable results for these advances except for Mercury. For this reason, when I came to the position to calculate the results of all the planets I did not retreat because my results were differing from the values supposed that have been given from observation. On the contrary I had serious doubts, for the validity of these observationally given values, since by the same people who made calculations had been expressed doubts about the exact position of the perihelion particularly of Venus and Earth because of their orbits being close to circular. This fact is clearly indicated in the case of Venus since as it is said it is difficult to find its perihelion with observation.

So I may say that since for Mercury I accepted the value derived from observation as correct (I accepted the value 41.4 arc sec. given in the book of the author in the last row of the above table instead of 43.11 arc sec. because this book is chronologically the

most recent one among the other books) I continued the next calculations with the same values of q and x in my equations.

So the conclusion is: 1) The choice I made for the constant radius that must be used in the calculations of the advance of the perihelia, gave excellent agreement in the test of the average velocities of the planets, so that these radii must be used in all calculations in both the GR and NNL.

2) To my opinion, the calculated advances of all the 3+1 planets require a new measurement for a solution of the problem. This proposal comes also from the reservations of the authors mentioned above, which were very conservative to start dealing with the other planets except Mercury. Then, perhaps, it will be proved that the values I derived for Venus and Earth are closer to the true ones than those obtained by the GTR. The final results of my calculations are presented in Part III, as they were obtained by running the computer program.

6. Test No 2: Deflection of light in the Sun gravitational field

Before starting again any effort for the solution of the problem of the deflection of light that comes from a distant star and just grazes the Sun surface during a total eclipse, we must decide about the real trajectory of the light ray that is finally observed from Earth during a total eclipse of the Sun. As it will be shown immediately below, this decision is of uttermost importance because the acceptance of a false choice of the trajectory will lead to deceptive results.

But we shall first comment on the way the relativistic derivations present certain ambiguous points that have to be cleared by those who have done their calculations with the help of the equations of GR. This is absolutely necessary, as the reader will soon realize. When these points will be clear with certainty, then we shall be able to apply our method too.

To investigate these ambiguities in one of the basic tests i.e. in the deflection of light near gravitational fields, I will appeal again to almost all books on GR that happened to be available in my bookcase and I will present my questions on the points of doubt as I did in the case of the planets precession. Because most of my questions have to do with the simple graphs presented in each of the above books, it is necessary to sketch roughly the figures used in the books and then put my questions. So I will leave the simple geometry to talk. In fact two basic forms are used of the trajectory

of the light that comes from a distant star, touches the limb of the Sun and finally bends and is observed from Earth. These two types of trajectory are indicated bellow in fig. 5 and 6. I will start presenting progressively the position of the Star, Sun and Earth before and at the end of the deflection. The Sun-Star distance may be several light years, but I shall use one of the closest to the Sun position Star at a distance equal to about 5 l.y. since in all my sources of information I did not find some reference about the chosen Star and its distance from the Sun. The Earth-Sun distance is about 500 l. seconds, i.e. the Sun-Star distance is about 3.15 10^5 times greater than the Earth Sun distance.

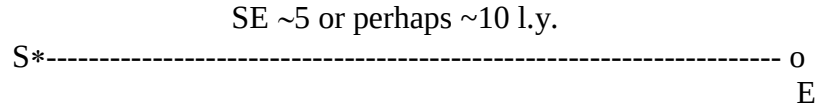

Fig. 5

In Fig. 5 the position of the star is indicated as it is viewed from Earth in the absence of Sun in between them (during the night of course).

Now suppose that the Sun comes between Star and Earth when the Sun has a total eclipse. The ray from the star is supposed to follow a bending due to the attraction of the Sun and nothing else. In Fig. 6 the position of the three celestial bodies is presented simply for a rough indication of the distances between them. Of course the figure is completely out of scale.

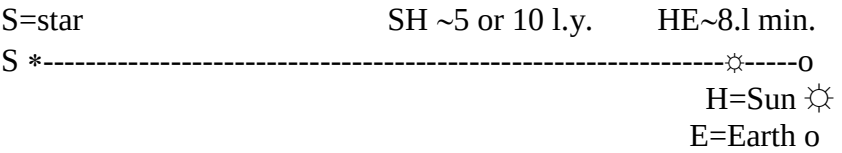

Fig. 6

How can we find geometrically the path of a light ray from the star to the Sun when this ray just grazes the Sun surface? The drawings below indicate what we are looking for.

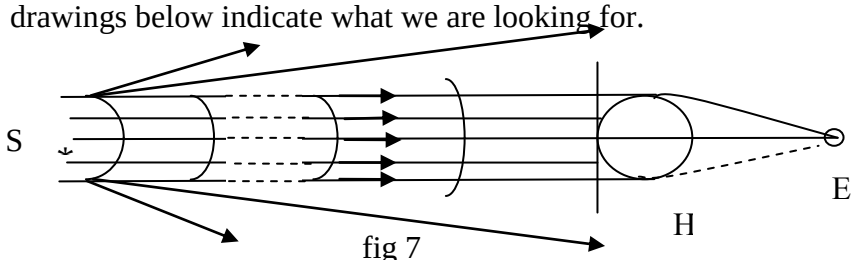

fig 7

The star S (Fig. 7) illuminates the space around it in all directions. So the wavefront of the starlight propagates around the star in a continuously expanding spherical shape. For this reason when a tiny, I can say, part of this wave-front reaches the Sun, may be considered with enough accuracy as a flat surface, due to the long distance of the star from the Sun. All the rays contained in the cylinder with a base equal to the diameter of the sun are indicated graphically by arrows, and are absorbed by the Sun except the outermost ones that finally graze the Sun limb. It is obvious that at least one of the rays coming from the star will graze the Sun limb. The parallelism of the rays from the star to the sun can be proved easily by use of the Fig. 8 below:

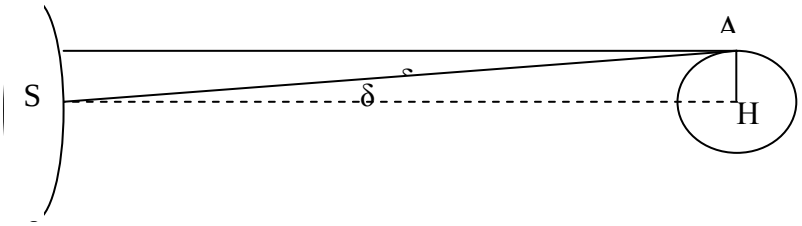

Fig 8

From a consideration of the triangle SHA where S denotes the star, H denotes the Sun centre and A is the point on the Sun limb where one of the rays touches the Sun. We have:

$SA \approx SH = 5$ l.y $= 4.73\ 10^{16}$ m.

$HA = 6.961\ 10^{8}$m = the Sun radius

So $\delta \approx \tan\delta = SA / HA = 1.43673\ 10^{-9}$ rads $= 2.96\ 10^{-4}$ sec of arc.

From the smallness of this angle it is easily inferred that the SA line practically coincides with the line SH, i.e. it is parallel to the x axis. From the Star the Sun is another star with point-like dimensions since the radius of the Sun as viewed from the Star is completely negligible. This point has been totally forgotten by the authors that treated the problem of the bending of light and the reader will immediately understand why I insist upon its importance.

The observation indicated that the ray SA is bent at the moment it just grazes the Sun limb and can be observed from Earth at a total eclipse of the Sun. Of course there are many more other rays too that pass near the sun but only one will reveal the maximum deflection which is of our interest. The question is to find at what angle φ (Fig. 9) we can observe the star from Earth. It is obvious that if the Earth-Sun distance was longer, φ would be smaller and the opposite if this distance was shorter. We come therefore to examine this problem with the help of Fig. 9.

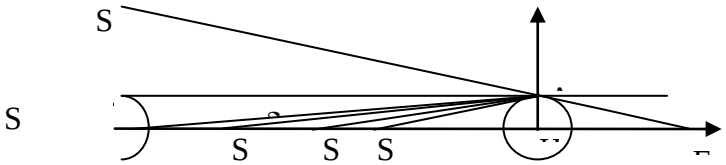

Fig.9

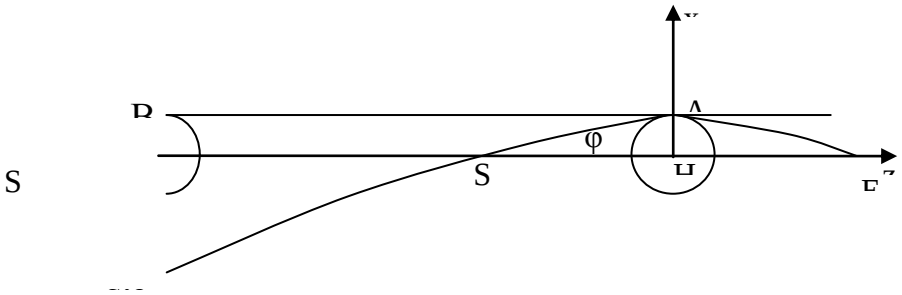

Fig. 10

There are two choices to work with. One is that of fig.9 and the other is that of fig.10

In both the above figures 9 and 10 is S_1H = HE = Earth-Sun distance. The above two choices are those mostly used in the calculations for the angle φ by various authors. It is however the second path S_1AE that is mainly used by many authors. As a matter of fact, some other authors use different shapes from the above two, which are rather obscure to be followed.

The path BAE is used in the case of Soldner's method presented in E.P.NEy's book mentioned above based on the Newtonian law but also in Misner-Thorne-Wheeler (MTW) book[32] where the

calculation is done in a linearized theory (p.p. 184, 185) as the authors state. My comments of this derivation are the following:
a) The solution for the deflection angle $\Delta\varphi$ by use of the GR method, with the same path BAE as in the Soldner' s method gives a result that is exactly 2 times greater than the same result derived by Soldner's method. In the other tests of GR the departures of the Newtonian theory from GR are very small* whereas in this particular test the difference is 100%. Most authors on GR have ignored this fact that the difference is the round number 2. For me however it may hide a serious error connected with what is being said in relation with fig.10. Indeed, suppose that this exact doubling of the Newtonian prediction is coming from the way the relativists determine the shape of the trajectory of the ray. Since the relativistic value is twice the Newtonian value a simple question is raised: If the Newtonian value was e.g. 0.6'' of arc instead of 0.875''what would be the relativistic value, 1.75''or 1.2''? We must not forget that the Newtonian derivation is based on simple well-known rules of physics. This double result is enigmatic first because it is a round number {2} showing that somewhere a serious mistake may be hidden most probably in the GR derivations. To be more precise, in the case of the advance, Newton's Law does not predict any advance whereas GR predicts an advance but only a tiny part of arc of the perimeter of the orbit and not e.g. half of this orbit.
b) The linearized theory that has been applied to the case of the bending of light in the MTW book has been applied to the perihelion precession too (p.p. 183, 184) of Mercury, but gives wrong result compared with the one produced by GR in p. 1110 eq. (40.18) since the former is the 4/3 of the latter. Any reader of this book cannot also ignore this fact. As I will show, my theory uses the same equation in the case of the four tests, which of course is only modified with the same way, as the Newtonian theory would do, according to the data of the problem. On the contrary we see that GR in the previous case does not yield acceptable result for the precession of Mercury whereas the supporters of GR believe that the result for the bending of light rays is correct, only because they accepted the Eddington's observational results as absolutely correct. About these

* As a matter of fact Newton's Law does not predict either advance of the perihelion of planets or time delays as in the fourth test of GR, but the results in the case of the advance are very small perturbations of the perfect elliptical orbit.

observations it is worth to read a paper by P.Marmet and C. Couture[40].

c) The integral in page 185, rel. (13) of the same book gives the result 2 with limits $-\infty$ to $+\infty$ so that the final result is $4GM/c^2R_s$ that is correct with GR but how this integral has been introduced in the calculation is rather obscure, at least for me who I am not familiar with the mathematics of GR and possibly for other physicists too.

d) In p. 1101 of the same book another derivation of the deflection of light problem in the vicinity of the Sun that keeps the same path BAE is given. But now I come to the final question:

e) All the above derivations that gave a deflection angle 1.75'' of arc used the S_1AE path. The question is obvious:

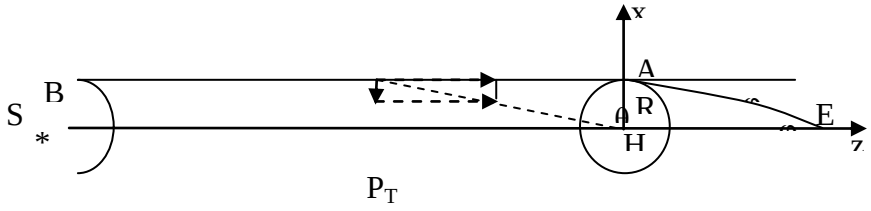

Fig.11

The majority of the authors that made the calculations with the GR formulae used the S_1AE path (c.f. Fig. 10) of the deflected ray and received the same result as the one of the MTW linearized method where the BAE path was used. So the question is clear: Why the MTW authors derived the same result with those who used the S_1AE path?

From Fig. 9 it is obvious that the more far away from the Sun is the star the smaller is the angle δ and this ray to a very good approximation for a star 5 l.y. away from the Sun that just grazes the Sun surface, is parallel to the SHE line i.e. it comes to the position BA. In fact the angle δ is about 0.0003'' of arc. So the diagrams 8 and 9 seem to approach in a better way reality than the Fig. 10. As a matter of fact if the diagram 10 is correct the simple and immediate question that is raised is: Where is the star? In position S or in position S'? To some people I put this question either verbally or in a letter their answer was ambiguous. They

could not say with certainty. To my opinion if the star is at the extrapolation of the ray S_1 A i.e. somewhere at the position S', then this path is not prevented from the presence of the Sun during the Sun eclipse. It could be seen from Earth at the same position at night and of course not during the eclipse if the Sun is in position of Fig 6. As a matter of fact, those who used the path S_1AE, calculated the angle of deflection to the right of A and for symmetry reasons (as they say or as they have accepted it silently) doubled their result to conform to the relativistic result. One would expect that the position of the Earth would be at a point E say on the same straight line Star-Sun center in the opposite position relative to the Sun where the star is supposed to be. Curiously enough the position of the Earth is placed in almost the majority of the diagrams at an arbitrary point of the curved ray and mostly its position is not shown in the diagrams. I leave the authors or any other "relativist" to give the answers.

Since I work basically in the same way as in the case of the simple Newton's law I have chosen the Soldner's method, to write the equations for the deflection of light by use of the NNL (eq. 27). In the case of Soldner's method the appropriate diagram is that of Fig.11 considering that the ray from the star comes near the Sun in a line parallel to the line that joins the star and the Earth without the intervention of the Sun. The necessary equations are given in the already mentioned Ney's book[47] at p.108-109. These are given below in detail.

The transverse momentum P_T imparted to an object of mass m at point P is given by:

$$dP_T = \frac{GMm}{cr}\cos\theta \cdot d\theta \qquad \text{(b1)}$$

Proof: We use fig. 11:

Let P the momentum of the photon in the direction PH i.e. in the direction of application of the attraction due to the Sun on the photon. It will be:

$$dP = \frac{GMm}{r^2}dt \quad \text{(Since F=dP/dt)} \qquad \text{(b2)}$$

The force F_T perpendicular to PA will be equal to:

$$F_T = F\cos\theta \qquad \text{(b3)}$$

So: $$dP_T = \frac{GMm}{r^2}\cos\vartheta dt = \frac{GMm}{r^2}\cos\theta\frac{dt}{d\theta}d\theta \qquad \text{(b4)}$$

But AH=r = R/cosθ and $\frac{dt}{d\theta} = \frac{1}{\frac{d\theta}{dt}} = \frac{1}{\omega}$ (b5)

where ω is the angular velocity of the photon about H. But $\omega = v_T/r = c\cos^2\theta/R$ ($v_T = c\cos\theta$). So:

$$dP_T = \frac{GMm}{R^2}\cos^2\theta\cdot\cos\theta\frac{R}{c\cdot\cos^2\theta}d\theta = \frac{GMm}{Rc}\cos\theta\cdot d\theta \quad \text{(b6)}$$

To find the transverse momentum P_T we integrate (b6) with limits from $-\pi/2$ to $+\pi/2$.

$$P_T = \int dP_T = \int_{\theta=-\pi/2}^{\theta=+\pi/2}\frac{GMm}{cR}\cos\theta\cdot d\theta = \frac{2GMm}{cR} \quad \text{(b7)}$$

But P, the momentum of the photon is constant and is on the direction of PA equal to mc, where m is the conventional mass $h\nu/c^2 \neq 0$ of the photon. So from the triangle PAH it is:

$$\tan\phi = \frac{P_T}{P} = \frac{\frac{2GMm}{cR}}{mc} = \frac{2GM}{c^2R} \quad \text{(b8)}$$

and since φ is taken to be a small angle it will be:

$$\phi \cong \tan\phi = \frac{2GM}{c^2R} \quad \text{(b9)}$$

At this point it is perhaps interesting to mention the point of view of Einstein himself, expressed in his book under the title: "RELATIVITY THE SPECIAL AND THE GENERAL THEORY". Unfortunately I red this book from a translation in Greek. So the ensuing quotation may be not reproduced exactly in English. At the paragraph for the deflection of light it is written: "*…Let us add, that according to the Theory, this deflection is due for the one half of it to the attractive (Newtonian) field of the Sun and for the other half to the geometrical deformation of space (curvature) that comes from the Sun*…". From the above quotation it is obvious that the mathematical theory for the existence of curved space (or spacetime as it is more frequently called), is attached arbitrarily to the concept of the physical space about the structure of which we know very little till now. It must be also a very strange coincidence that the curvature of spacetime near the Sun region has the same effect as the Newtonian force of gravitational attraction. My proposition about the structure of space is expressed in my book of ref. 12 (and in other works of mine) and is based on the way the universe came into existence. The only I will say here is that matter, in a super-dense state and time, appeared first from the SPS (Sub Planckian Space) and after

a minutest while, space started to develop as a close packed accumulation of empty space bubbles, which are the remnants of mini white holes that did not managed to appear as masses of the order of Planck dimensions (~10^{-35} cm). Can you imagine of a quantity of sand to be curved in a fourth dimension?* What is important in the above quotation is that, according to my paper on the relation of GR with Newton's law[3], this law has already been taken into account once in order the theory of curved spacetime to be connected with gravitation, by use of the Newtonian potential, the introduction of the gravitational constant G in the equations of GR etc. So when the equations of GR are used for the solution of the problems of the four tests, already contain the Newtonian Law. The curvature of space is a hypothetical situation or quantity for which there is no equipment or instrument to measure it separately (and really which are the physical units this curvature is finally expressed?). So the Einstein's half and half from the above quotation is not possible to be proved and the only solid treatment of gravitation is by use of Newton's Law (up to a certain distance between the interacting bodies as I will show later on) and beyond this as this law has been modified in the present work. In APPENDIX C is presented a computer program that solves the problems of the four tests of GR, so that I consider it unnecessary to write each part of the program separately. In this Appendix I give all the information needed so that the reader will understand completely how the basic relation (27) for the expression of the New Newtonian force works either as the well known simple Newton's Law or as the NNL.

Now I shall give the values of some constants necessary for the calculations as well of some necessary expressions that will be used in the solution of the problem:

G= gravitational constant=6.672521799 $10^{-11}m^3\ kg^{-1}s^{-2}$

r=R= Sun equatorial radius = 6.961 10^8 m.

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* The idea of space as an infinite collection of dimensionless points is self-contradictory. Such points are simply a mathematical approximation to the physical idea that a point may be as small as we wish but not dimensionless. If space is defined as the "something" in which everything may be embedded or everything may happen, although this idea is easy to be understood by any one, the nature of this "something" will escape any attempt to be captured by our mind. On the contrary everything in nature must have an end either in its spatial dimensions or its time duration. What for the time being we know is the existence of a limit downwards to the spatial dimensions but we still do not know whether there is a limit also upwards to infinite spatial dimensions. I have discussed this problem in the first chapter of my book[12] .

v(r) is the velocity of the barytons at any distance r from the Sun (and more generally from any distance from the point of their emission).
c is the velocity of light in vacuum =2.99792458 10^8 m/s
π = 3.14159265359
The chosen function for the v(r) is: $f \equiv v(r) = c\ (1+xr)^2$. The value of x is determined from the data for the precession of Mercury and is used for all the other planets and for the other tests of GR.
b is the derivative of v with respect of r. b= dv/dr (df/dr in the computer program)
t is the time taken for the baryton to cross a distance r with varying velocity v
F_{12} is the gravitational force between two interacting bodies
w_i is either the perihelion shift (precession) of any planet or the deflection angle in seconds of a degree in the case of the bending of light.
It is not necessary to say that the derivatives and the integrals for the determination of t were done for any distance r from the Sun as r was determined by use of relation II.3 and II.4. All the details for both the perihelia shifts of the 3+1 planets and of the bending of light are clearly shown in the basic computer program of Part III.
The running of the computer program in Part III gave the value of the deflection equal to 0.764'' seconds of one degree. This result is even smaller than the least value obtained from the simple Newton's Law and even smaller of the GR result and of that supposed that resulted from observation. Every one could say at first glance that my theory is wrong from only this result. When I read the paper of ref. (38) I was impressed from the arguments presented by the two authors of this paper against the methods of observation by Eddington at Sobral and Principe during the total eclipse of May 29 1919. So I sent a letter to the first author, asking to have his final opinion about the value of this deflection. His answer surprised me further since he said that there is no deflection. Since I was puzzled after all the above controversial points of view I searched for more information on this subject. An element about this problem was finally found in one paper by Irving Shapiro, when I was studying 4 papers by Shapiro et al[48,49,50,51] , about the delay of light in the case of the fourth test of GR. The one paper connected with the present 2nd test is found in ref.(48). The other papers will be presented in the examination of the fourth test (below).

The title of this paper is: "New Method for the Detection of Light Deflection by Solar Gravity". I will not comment on certain points of this paper and I restrict the attention of the reader to one only sentence. So Shapiro writes: "…*Because of the finite planet – observer* ***the maximum deflection of $4r_0/d$ (≈1.75 arc sec) is not attained*** *separation, Thus with Venus the target and with the signal grazing the limb of the sun, $\eta \approx 0.73$ arc sec.* I put the bold lines for obvious reasons. What one can think from the above quotation? Shapiro and everybody else who accepts the GR predictions correct, rejects any other result that does not conform to GR even if the author himself (Shapiro) found something that was different from the predictions of GR. It is astonishing that non-obedience to GR Law is censored by others or by the observer himself. But as I showed in the development of the second test with my equations, I obtained a result of 0.764 arc sec for the deflection, which is pretty close to the Shapiro's rejected result. And as I will show in the examination of the fourth test (time delay) this result was obtained if simultaneously the time delay is equal to $1.91\ 10^{-4}$ sec in the case of the Earth- Mercury superior conjunction. If the delay is $2.4\ 10^{-4}$ sec as (incorrectly) the GR equations yield, then the value of the deflection with my theory gives 0.805 arc sec. More will be said in the case of the fourth test below. But I cannot help it saying how hard almost the majority of the physics community has tried to support the GR theory by closing the ears to any voice that does not accept this theory as a real theory of gravitation.

I come now to surprise the reader by saying that the calculated value for the deflection of light with the application of the NNL is not correct and I will explain in what follows why I say this. Before doing so, however, I shall state in advance that the correct solution is that obtained by application of the NLG, but only for the case of the deflection and perhaps for the red shift of light in strong gravitational fields too. The other two tests are solved with the NNL.

The reason that led me to the above distinction of the two laws (NLG and NNL) has as follows:

This work started as an attempt for a theoretical derivation of Newton's Law of gravitation. So I concluded, by the development of the concept of the Barytons as the carriers of the gravitational interactions, to expression (27) from which the NLG may be obtained with some simple modifications. The simplest and easiest modification contains two restrictions only: a) The speed at which

the gravitational interactions propagate is constant. b) The multiplier of the Planck length is: $a=\sqrt{3}$. Although I have already shown that by simple substitution in expr. (27) of v by c and by setting $a=\sqrt{3}$ we obtain the NLG, I will prove the above statement by a more elaborate way, immediately below:
We shall examine the special case where the velocity of the barytonic shell is constant, let us say c_0. Using the usual terminology, if the force F of (27) is obtained from a potential f(r), we shall have:

$$F=-\frac{\partial f}{\partial r} \tag{b10}$$

IF $v = c_0 = const.$ then $dv/dr = 0$, $t/r = 1/c_0$ and the (27) becomes:

$$F=-\frac{GM_1M_2}{r^2}\frac{a^2}{3}\frac{c_0}{c} \tag{b11}$$

From (27) and (b11) we deduce that:

$$f=-\frac{GM_1M_2}{r}\frac{a^2}{3}\frac{c_0}{c} \tag{B12}$$

Since we suppose that the velocity with which the B2 moves is $v = c_0$ const it has to satisfy the time independent equation D' Alamber:

$$\nabla^2 f-\mu^2 f=0 \tag{b13}$$

with μ = const. in order the invariance of the STR is preserved.
The above expression in the case of only radial dependence of f from r, may be written as follows:

$$\frac{\partial^2(rf)}{\partial r^2}-\mu^2(rf)=0 \tag{b14}$$

where:

$$\mu=\frac{(m_k)_0 c}{\hbar}=\frac{m_k c}{\hbar}(1-\frac{{c_0}^2}{c^2})^{1/2} \tag{b15}$$

The above expression for μ is coming from the solution of the free wave of the time dependent D' Alamber equation $\Box^2 f - \mu^2 f = 0$ that leads to the established relativistic expression that connects the total energy, momentum and rest mass of the particle along with eq. (19) if we put $m_0 = m_r (1-v^2/c^2)^{1/2}$.

If we replace (b12) and (b15) in (b14) we find that $1-c_0/c = 0 \rightarrow c_0 = c$. This means that if the velocity at which the gravitational

interactions propagate is constant then necessarily it will be equal with the velocity of light c.

So expression (27) is reduced to:

$$F = -\frac{GM_1M_2}{r^2}\frac{a^2}{3} \qquad \text{(b16)}$$

By putting again the determinable parameter (a) equal to $\sqrt{3}$ we are left with the NLG of universal attraction without the handicap of the instantaneous action at a distance. On the contrary the derivation of the NLG with the above way, led to the mathematical proof that the velocity of the gravitational interactions is c in the case of the NLG. As it is known, the above requirement was imposed in gravitation by the STR (and GR) as a consequence of the constancy of the velocity of light in vacuum **without any theoretical or experimental proof. I repeat once again that the velocity at which the gravitational interactions propagate in empty space** (and generally in space) **has not been measured by any kind of experiment or observation.** The simple assumption of GR that the gravitational interactions must be transmitted with the velocity of light at the same way of the transmission of the electromagnetic interactions with velocity c, (since in both cases the wave equations have the same form) is wrong for the following reason: The wave equation of the gravitational field in the linearized theory yields the result that gravitational effects propagate with velocity c because the Riemann tensor, which gives an absolute criterion for the existence of a gravitational field, itself obeys the wave equation (c.f. ref. 21). But this wave equation refers to the propagation of gravitational waves that arise e.g. from the collapse of big stars. This is, however, a completely different case from the propagation of the gravitational interactions between any two bodies or particles with big or small masses. The velocity of these interactions has never been measured experimentally, as I said above. The tangible proof I gave above for this issue needs no assumption whatsoever.

I come now to the surprise mentioned previously.

Well. So far so good. However may I use this popular expression in the present case? I put this question to myself when I arrived at this point. The answer was: Something is missing. Think. I started to derive NLG using a certain model for the gravitational interactions and I derived indeed a new expression for the NLG. The NLG is finally a special case of the derived expression I called NNL. The NNL becomes NLG when the speed at which the

gravitational interactions propagate is put equal to the speed of light rejecting the erroneous instantaneous action at a distance. But from the very beginning I had declared that the gravitational interactions must be superluminal with a speed varying with distance from the point of the baryton emission. So the dilemma was about like this:
The NLG works very well on Earth and in its immediate neighborhood. Also the reader will have already realized that the NNL gives reasonable results in the tests of planets advance and time delay of the radar signals. The question is: Which of the two versions of the gravitational force may cover all the cases either on earth or among whichever astronomical distances? At this moment I remembered that GR should be normally applicable in the case of strong gravitational fields whereas for the gravitational fields in general is not made a **sharp distinction** between weak and strong. Most authors I looked at[(21 et al)], start the development of the GR solutions with weak fields where the metric tensor differs only slightly from the flat-space metric tensor. I did not spot in my few books on GR a solution that involves strong gravitational fields. Only in the book of MTW is referred (p.p. 839,840) that for a mass that arrives at the central singularity of a black hole the Einstein's field equations must fail, because of the infinite tidal forces and the infinite Riemann curvature[*].

So all the solutions in the neighborhood of our solar system are based on the assumption that the gravitational field is weak. Another requirement of GR is that the speed of the gravitational interactions cannot exceed the velocity of light, refusing therefore the instantaneous action at a distance. My basic assumption about the speed of the gravitational interactions is that they must be transmitted with continuously increasing superluminal velocity, i.e. with neither the velocity of light nor constant infinite velocity. So since GR does not give a definite limit that separates the application of its equations in the case of weak fields from the strong ones[*], I thought that it would be an omission by me to let undistinguished the cases where the NLG and the NNL must

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[*] At this point I will return later since as I have shown in another work of mine[(12)], the collapsing mass of a black hole never reaches the central singularity.

[*] The Sun, for example, may be considered that it has a strong gravitational field compared to that of Earth, but a weak field in comparison to that of a black hole. So we cannot be sure when we work with the solar gravitation field whether we must follow a solution of any problem by use the complete equations of the GR or with convenient simplifications of these equations as most authors did.

apply. What would be the subject of this problem is the determination of the distance between the interacting particles at which the NLG ceases to give acceptable results so that the application of the NNL should start applying and vice versa.

This problem is simple, since what is needed is to put the expression:

K = $\frac{a^2}{3}\frac{v}{c}(\frac{2vt}{r}-\frac{dv}{dr}t-1)$ from (27) equal to 1 and solve for r. To do this I had to use the expressions of v, t, q= $a^2/3$ and dv/dr as these are determined in the second part of this book (and gave acceptable results for the advance of the planets and the delay of radar signals).

By doing so (using an appropriate computer program) I found that for r_a = 7.6063727 10^8 m expression (27) gives exactly the NLG. It is obvious that for $r < r_a$ the application of the NLG must be valid whereas for $r>r_a$ the NNL must be applied for the solution of any problem. As a matter of fact I was in front of two different cases so that I had to think which is the right one.

The first case was the one I presented at the end of page 61.

Although the acceptance of a value of $a=3^{1/2}$ (q=1) yields the classical Newton's Law of gravitation (NLG) for any value of r this choice contradicts our basic assumption that v must be $\geq$ c where the equality is valid only at the initial moment of the expansion of the baryton B1. So the only that was left was the second determination of q as it is determined in the computer programs by the trial and error method, since this value covers the requirement for superluminal velocities of the barytons. On the other hand, however, the determination of r_a as above, keeps the same form of expression 27 but determines a certain interaction distance at which the NLG and NNL give the same results and imposes the condition that for $r<r_a$ the NLG should be applied whereas for $r>r_a$ the NNL must be used. I will present two examples as a proof of the correctness of the above conclusion:

a) In the first page of the calculations of the four tests, by the use of computer programs at the end of this PART II, I calculated first the advances of the 3+1 planets so that by using the Mercury's observational data I determined the two parameters that enter in the solution by use of the NNL i.e. the value of q and of x. So I proceeded next to the bending of light that grazes the Sun limb with the NNL again. The result I obtained was 0.764 arc seconds with the sun radius r_a the same as above. I had however calculated

the same case by using the NLG with the Soldner's method. The result was 0.875 arc sec. I ask: Which result was correct? According to the foregoing discussion the distance of the gravitational interaction between the light photons and the centre of the Sun mass was equal to 6.961 10^8m = the Sun radius < 7.6063727…10^8 m. So the application of the NGL should give the right answer. I made also another calculation by taking the Sun radius equal to 10^7 m. < 7.606…10^8 m but without changing the Sun mass. The result for the deflection angle was 3.39'' arc sec, totally unacceptable. So the final conclusion is:
If the distance between the interacting bodies **in cases that can be treated by the NLG** is less than 7.6063727…10^8 m we must use the NLG. Among the four tests of GR the bending of light rays and the red shift must be solved by the NLG. The advance of the planetary orbits and the delay of radar signals must be solved by the NNL even though the distance of interaction may be less than the above limit since the NLG does not accept advances or delays in the motion around the Sun thanks to the acceptance that the orbits of the planets are perfect ellipses. So I leave the relativists to show what is the limit between the strong and the weak fields in the theory of GR. Is it connected with the distance of the interacting bodies or the limit is characterized only by the strength of the field? As I said in the Preface the gravitational field of the Sun e.g. is strong compared with that of Earth but it is weak compared with that of a Black Hole

On the occasion, it is worth to give an explanation why the relativistic effect is exactly twice that obtained by the Newton's Law. **Here is the great fallacy**. In reference to Fig 10, all those who calculated the deflection of light using the GR equations, found the deflection angle of the right-hand side of the figure 10 equal to the Newtonian value and implicitly and sometimes even explicitly said that for symmetry reasons there is another equal angle to the left-hand side. So they duplicated the correct result. But they did not think that the trajectory of the ray as it is presented in Fig. 10 is wrong as I showed previously.
A little more investigation, which leads to a peculiar result, may be interesting.

The value of the limiting distance that determines the application of the NLG and the NNL was found equal to 7.6063727 10^8 m. A question that was normally raised was: What is the meaning of this, otherwise, indifferent number? Why this and not another one?

Thinking upon the above questions, the first thing I thought that may be of some interest was that the above value was near to values of distances that exist in our planetary system. I will give some examples of these distances:
a) The Sun radius is equal to $6.961\ 10^8$ m. a_1
b) The mean distance between Earth and Moon is $3.844\ 10^8$ m. a_2
c) The radius of the semimajor axis of Earth is $3.378388\ 10^6$ m. a_3
d) The Moon radius is $1.741\ 10^6$ m. a_4
I started searching whether with the above four distances the separation limit of $7.6063727\ 10^8$ m may have some relation. I will not give my unsuccessful efforts and I will not insist that the relation I finally found has something to say or it is a mere numerology. I leave the reader to derive his/her own conclusions.
The following result was found:
$2 \times a_2 - 2 \times a_3 - a_4 = 7.6030222\ 10^8$
The proximity of this distance with the separation limit is apparent. Does this mean that the Earth and the Moon dictate over the determination of the separation limit of gravitation **or even vice versa?** I really cannot say. Let us not forget that either in the past or in the future the above values a_2, a_3, a_4 might or may be different in such a way that they satisfy the $7.6063727\ 10^8$ value. Indeed, if a_2 was equal to $3.8456752\ 10^8$ i.e. 0.044% greater than a_2 the required equality would be perfect. A thrust of the moon by a big meteorite would probably be enough to make the difference. It is the job of the astronomers to search the case. Closing this second test, I confess that I am greatly interested to learn from those who work with the equations of GR what is the point, either expressed in strength of gravitational fields or in distance between interacting bodies or else, where the application of the equations of GR and of Newton's Law cease to give the same results.

7) Test No 3. The Gravitational Red Shift.

I quote here what P. Ney[47] says about this test:
" *….The astronomical measurements of this quantity have not been convincing. The reason for this is that the gravitational shift is masked by large and uncertain Doppler shifts. This effect has, however, been established with high accuracy (within several per cent) by the experiment of Pound and Rebka on light falling in the earth's gravitation.* ***Unfortunately the red shift is not a true test of general theory but of the principle of equivalence.*** *One will recall that all that was required to derive the red shift was this*

principle together with special relativity….". (I put the bold letters). He also gives a simple way to show why light receding from a gravitational source becomes redder.
From $E=mc^2 = h\nu$ we get $\Delta E = mgl = -\Delta mc^2$. Hence $\Delta m/m = -gl/c^2$ (for light receding upwards in the earth's gravitational field). And so $\Delta\nu/\nu = \Delta m/m = -gl/c^2$ from which we obtain that: $\nu' = \nu_0 (1-gl/c^2)$ which formula expresses the change in frequency by going against the gravitation. (ν_0 is the frequency without the presence of the gravitational field and ν' is the frequency in the gravitational field. $\Delta\nu/\nu_0 = (\nu'-\nu_0)/\nu_0 = -gl/c^2$). In the case of the gravitational force on the surface of Earth the NLG must be applied as I explained earlier. This is enough in the case of the experiment by Pound and Rebka (1960) and Pound and Snider (1964).

8) Test No 4. Radar Echoes from Planets

This test was the last one from the famous four tests for the examination of the validity of the General Theory of Relativity (GTR) in solving problems of our planetary system by an appropriate application of its equations. As I showed in the first test, the solutions from the GTR had certain basic faults in their predictions that were not met in the derivation of the same results with my NNL theory. Before starting the examination of the radar echoes of signals sent from Earth to Mercury and back to Earth, that presented a small, but easily measurable (as the experimenters say) delay in the to and fro travel of the signal, I red some methods for the treatment of this problem by the GTR equations. Because I am not (obviously) so keen to the GTR* I considered for this reason the systematic study of this theory a loss of time. Reading the treatment of this problem by various authors, I simply located certain points that raise some questions. I start again with some of the books it happened to be in my poor bookcase.
1) Ch. Misner- Kip Thorne – John Wheeler: *"GRAVITATION"* : *(1973).*
The authors of this famous book write in p. 1048 that time delay between radar signals between Earth and Venus is 1×10^{-4} sec. In p. 1103 they present some calculations but they do not give an estimate of the time delay either with Venus or with Mercury. In pages 1106 -1109 the included calculations make certain

* The reader who red APPENDIX A will understand why I am so absolute in my attitude against GR.

acceptances as e.g. that a straight-line path may replace the actual beam path that just grazes the Sun limb. Also they do not give the lengths of a_T and a_R i.e. the distances between transmitter and Sun and reflector and Sun. Do they have taken into account that the transmitter and the reflector are on the surface of the two planets or the above referred distances are between the centers of the three bodies? So the reader cannot carry out the calculation of Δt. They simply say that the experimenter does not need to measure a_R , a_T and b with high precision. And they give an explanation for this assertion. My question is: The experimenter may not need accurate values for the above quantities. The theoretical prediction, however, needs the precise values, I suppose.

2) Michael Berry: *"PRINCIPLES OF COSMOLOGY AND GRAVITATION" (1976).*

This author in his book derives an (approximate) formula for the time delay ΔT, which is different from the formula of the above authors, but he also does not give the values of a_R , a_T and b, with which his formula should be evaluated. He presents, however, a formula for the time delay, as this is calculated by application of Newton's Law, and he concludes that Newton's Law predicts a time advance (because the solution is negative) rather than a time delay, by considering that light is a stream of material particles, whose speed is c at $r=\infty$. At this point I have a query. In the case of the advance of the planets perihelion the solution of the equations of GR yielded positive values for the advance. Now in the case of the time delay they also yield positive values whereas as the above author says, the Newtonian solution is negative so it predicts an advance. So the same equations i.e. those of GR when they present positive results indicate an advance and when they present again positive results indicate a delay. Difficult to be accepted. Also their result for the delay differs by about 25% from the supposed correct observational delay.

The other authors I have mentioned in the case of the perihelion precession do not make any reference to this fourth test, perhaps because their books were written before or at the time of the execution of the radar observations.

For this reason I turned to three original papers[49,50,51] by Irwin Shapiro and Shapiro et al. These authors present some formulas for the calculation of the relativistic time delay (which differ from those used by the authors in (1) and (2) above and between each other in the first two papers (49,50) but they also do not give the values of the distances between the two planets from the Sun. In

the two papers 49,50 above it is written in the first paper that x_e is the distance along the line of flight from the earth-based antenna to the point of closest approach to the sun, x_p represents the distance along the path from this point of the planet and d is the distance of the closest approach to the center of the Sun. But the numerical values of the above distances are also missing.

I also had a book written in Greek under the title: Introduction to the GTR. By N.K. Spyroy(. There the distances are defined as one A.U (distance Earth-Sun) and 0.37 A.U., distance between Mercury and Sun. In fact the last one is given in the McGraw-Hill Encyclopedia of Science and Technology (1960), equal to 0.387 A.U. But the A.U. implies that the radar signals are exchanged between the mass centers of the planets and not between the surfaces of the planets.

With the above comments in mind, I put to myself the following question:

In the case of the advance of the perihelion of the planets, in the relativistic formulae the mass of the planets is not included. So this mass may have any value, at least not exceeding significantly the mass of the Sun. So in the GTR formulae the mass of the planets is not present. From the famous law of special relativity $E=mc^2$ we know that to any amount of energy may correspond an amount of mass $m=E/c^2$. For this reason in addition, the GTR has expressed the idea that the energy contained in a system is also subject to gravitation (through the energy-momentum tensor T_{ik}) . On the other hand from QM we know that the energy of an oscillating system is given by $E=h\nu$, where ν is the frequency of oscillation. So the corresponding mass of the oscillation is equal to $m=h\nu/c^2$. An electromagnetic wave is characterized by its frequency, and for this reason it has to be subject to gravitation. We must not forget that the light in certain circumstances has a particle-like behavior (Photoelectric effect). For this reason the Newtonian material particles in the case of the light or of any electromagnetic wave have a total mass $h\nu/c^2$ and this should be taken as a conventional mass of the photons in this particular case. From the second test we saw that the light rays from a distant star bend when they pass near the Sun in either a relativistic or a Newtonian way. So I tried to calculate the time delay of a photon that revolves around the sun by using the formula given in M.Berry's book:

$\Delta\varphi^{100} = 6\pi GMN/c^2 r_{min}\ (1+e)$

I considered a circular orbit with total length equal to the length of the to and fro journey of the radar signal from Earth to Mercury

(with the Sun in between them) i.e. at superior conjunction, so that the radius of the circular orbit was constant. We must not forget that in all cases for the calculation of the advance of the perihelion by the GTR formulae, is used a constant radius equal to $a_{max}(1-e^2) \equiv a_{min}(1+e)$, where a_{max} is the semimajor axis of every planet, a_{min} is the semi minor axis and e its eccentricity. By use of the above formula and by taking the total length of the journey of the radar signal equal to $2(ES+SM-r_e-r_m)$ where ES is the distance between the earth center and the Sun center, SM= the corresponding distance for Mercury, r_e = the equatorial radius of Earth=$6.37814\ 10^6$m and r_m the equatorial radius of Mercury =$2.4\ 10^6$m, I proceeded to the calculation of the advance (or delay) by taking $ES=a_e(1-e^2)_E = 1.4955611\ 10^{11}$ m and $SM=a_m(1-e^2)_M= 5.5468241\ 10^{10}$ m. So I was applying exactly the constants used in the calculation of the advance with the formula of GTR. The velocity of revolution was taken that of light at infinity equal to $c=2.99792458\ 10^8$ m/sec. By finding $\Delta\varphi^{100}$ it was a simple mater to get the distance crossed by the photon in one revolution, so advance if the result was positive or delay if the result was negative. Upon dividing this distance by c I would have the time Δt of the advance or delay. The result was: $\Delta t = 2.479383\ 10^{-5}$ sec. So there was time advance instead of delay. As I saw, in the case of the application of the solution of the GTR equations the expressions for the Δt delay are different in the papers of Shapiro and Shapiro et al mentioned above with each other and with the expression derived in the mentioned Greek book. In the first paper by Shapiro, it is written that "…*The right-hand side of Eq. (1) is due primarily to the variable speed of Light…".* Perhaps in the same way one could say that since the speed of light was permitted to vary in a straight-line path, in a circular path what varies is not the speed but the direction of its velocity only.

So I repeated the calculations with my NNL where instead of using the above values for ES and SM I used the values of the same lengths derived with the different method I used in the calculation of the perihelia advances i.e. $ES=1.495875937\ 10^{11}$m and $SM=5.7293952213\ 10^{10}$ m. The result was again an advance of time in one revolution equal to $\Delta t = 2.646235\ 10^{-5}$ sec. I also calculated the delay of Mercury. The value of the NNL theory is only 6.73% greater than that of the GTR, but the impressive thing is that both predictions are of the same order of magnitude and both predict an advance and not a delay of a photon that is the

mediator of the electromagnetic interactions* and generally in QM the photon is the quantum of the electromagnetic field. So you may keep any value between the two calculations (remembering that the NNL gave better results in the case of the perihelia than the ones of the GTR) as explained above. I also calculated the delay by the N. Spyroy formula and the given by him values and I found that the delay in the case of Mercury was equal to 2.229717 10^{-4} sec. The detailed calculations were done by a simple computer program.

. I consider instructive to present the formulae derived by Irwin Shapiro and N. Spyroy in the case of superior conjunction. The Shapiro formula is.

$$\Delta t_r \approx \frac{4r_0}{c}\left\{\ln\left(\frac{4x_e x_p}{d^2}\right)-\left(\frac{3x_e + x}{2x}\right)\right\} \quad ; \mathrm{d}<<\mathrm{x_e}\,\mathrm{x_p}$$

And Spyroy formula is:

$$\Delta\tau_{extra} = \frac{2R_s}{c}\left[\frac{1}{2}(1+\frac{a_\Delta}{a_\Pi})+\ln(\frac{4a_\Delta a_\Delta}{b^2})\right]$$

It is obvious that the above expressions present significant differences. I am not competent to find why.

The questions that are raised from the above development are the following:

1) Why a photon, of any frequency, behaves differently when it moves to and fro in a straight line, than the same photon that moves in a circular orbit of the same length as that of the to and fro motion, where in both cases the gravitational field of the Sun is present? Logically a sprinter should run faster in a straight line than in a circular one. I suspect that the supporters of the GTR will say that in the to and fro motion the photon passes nearer to the Sun than in the case of circular motion. This answer is not satisfactory in view of the next question:

2) In the case of the application of the NNL we work with one and the same equation whatever the gravitational problem may be. Only the data to this equation change. In general relativity, however, one has to solve the equations of this theory differently for each case, i.e. not only the data but the

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* As R. Feynman says(21) : "…The effect of this photon exchange we recognize in an interaction between the electrons, i.e., as the electrical inverse-square repulsive forces.

form too of these equations is different in the cases of the planets advances and the radar signals delays. So it is reasonable for any one to ask: The equation applied in the advance of a perihelion is correct or the equation that describes the radar signals delay is in error or both are in error? And further on, in each case one has to solve the basic equations of the GTR in a different manner. But then the number of solutions may be infinite. Is it a disadvantage or not of the GTR in comparison to the NNL? If for any particular problem, a theory of gravitation has to adjust the form of the final equation into which the data will be inserted, then this theory cannot be called General Theory. In the case of the NLG and NNL once the corresponding expressions have been derived, they are applied to any case unaltered.

3) One must not forget that the basic equation (27) of the NNL theory is based on a model for the gravitational interactions that had not need of the NLG, i.e. even if we did not have the Newton's Law we could get it completely theoretically as a special case of the NNL, whereas the GTR with its model of curved spacetime would never could be a theory of gravitation if Newton's Law did not pre-exist, as I have shown in APPENDIX A. If someone comment that I used the Planck units that contain the gravitational constant G, in deriving the NNL, my answer is given in another work of mine[12] (chapter 5) where I explain that the primitive constants of nature are not the *G,h,c* ones but the minimum length, the minimum time and the maximum mass of an elementary particle (approximately the Planck units) and if we had the means (i.e. the necessary energy) for a straightforward measurement of them, then the *G,h,c* units would be easily derived. This proof is also presented at the end of APPENDIX B of the present work.

4) Since the above sources of information did not present the distances between the three bodies, it is not clear whether these distances were the semimajor axes of the orbits of Earth and Mercury, whether the eccentricities had to be taken into account and whether in the one way trip of the radar signal the actual distance was from the surface of one planet to the surface of the other.

The final solution of the problem of delay of the radar signals in the to and fro journey between two planets at superior

conjunction was obtained by use of my theory and after the following analysis:

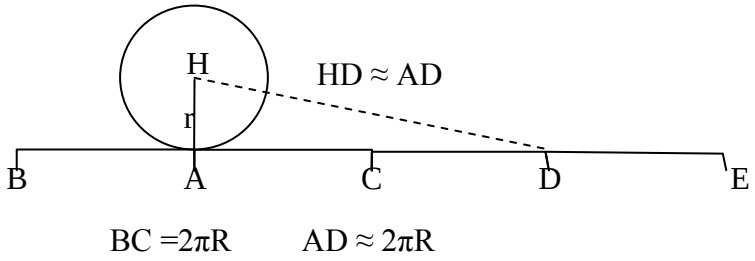

Fig 12

With reference to Fig. 12, I considered that the path of the radar signal is just grazing the Sun limb at point A. Then the following thoughts guided me to the solution of this problem: In the case of the advance of the planets I already had found the way to calculate this advance. In my calculations the mass of the planets was not included in the necessary equations and the same happens in the GR solutions. Only the constant radius that is used in the GR solution and in my solution were different and were used in each case in the way I have already described earlier. So I had the mathematical tool to calculate advances of the planets with my theory. A photon with total mass equivalent to $h\nu/c^2$ may be considered as a minute planet that travels at a constant speed either in a straight line or in a circular path thanks to the constancy of the speed of light. So if I chose a length equal to the perimeter of the Sun I may imagine a photon going around this perimeter, which is equal to $2\pi r$ (r= the Sun radius) and I may calculate whether it presents an advance or a delay in the same way as in the case of the planets. A positive value represents an advance as in the case of the planets and a negative value should correspondingly represent a delay. With the above preliminary notations I solved this problem with use of my equations using as constant radius the radius of the Sun. In the computer program the advance (or delay if exists) is denoted by the letter z. So if for an angle 2π the time needed for a photon to cover this angle is $2\pi r/c$ we find that for an angle z (in radians) the time will be equal to zr/c. This time is the advance (or delay). So in the to and fro travel covered by a photon

in time $4\pi r/c$ the advance or delay will be equal to $2zR/c$, where R is the radius of the SUN. By running the program for this case using again my equation (27) as it is written in the program under the name AADVANCE7.bas it was found (to my surprise) that for the two passages of the photon from the distance BC (i.e. BC and CB) the advance or delay would be equal to $2zR/c=-1.8853\ 10^{-4}$ sec. So this method of calculation gave almost the exact delay measured by I.Sapiro. The result I considered more reliable to start with was the advance of Mercury or of Venous and the observational delay of the radar signals as these were presented in a graph contained in the fourth paper by Shapiro et al. (ref. 51) that refers again to the fourth test of GR is supposed to be the best. From the above graph that is in scale, may be inferred that the solid line that represents the delay at various times before and after the superior conjunction of Earth-Venus of 25 Jan 1970, has a peak for the delay that graphically measured must be about $1.8\ 10^{-4}$ to $1.9\ 10^{-4}$ sec. **So my calculation is probably the best ever obtained theoretically.** This can be checked by anyone. To see whether there could be a further delay, I repeated the calculation with the same method. I considered another length CDE equal to BAC the average distance of which from the center of the Sun is approximately $2\pi R$ as it is inferred from fig. 12. So with this distance as a radius, I calculated the possible delay of the radar signal as in the above case and I found that for this greater part of the path the signal has an advance equal to $6.8\ 10^{-4}$ sec. It was useless to continue to longer distances from the Sun since they would also yield advance rather than delays. From the use of the above method of calculation the obtained delay has a minus sign while the advance has a positive sign. At first glance one could say that if we add all the advances and delays in the to and fro round the final result would be an advance and not a delay. This is so but a conclusion like this is wrong. According to Special Relativity the maximum velocity of the electromagnetic signals cannot be greater than that of light in vacuum. The advance of a photon as above requires a greater than c velocity of the photon something that is prohibited. On the contrary in many cases the velocity of the light can be less than c (in cases of refractions, Cerenkof radiation etc). **So in special cases (close approach to the Sun) only delays are acceptable.** The other parts of the round trip have neither delay nor advance.

Conclusion: The radar signals do delay when passing near the Sun but the total delay that is observed from Earth by sending

radar signals, is produced only in the little part of the signal in the nearest vicinity to the Sun and is the same whichever planets are used for observation from the Earth. For curiosity, I will make a comment on the value of the delay on the basis of GR. Most of the authors that have calculated the delay, used various formulae each, for the calculation of the delay. I have already mentioned two such cases previously. In the fourth Shapiro's et al paper (ref.51) is presented another formula that really surprised me. The formula for the delay is:
$\Delta t \approx (4r_0/c)\ln[(r_e+r_p+R)/(r_e+r_p-R)]$ *where* Δt*, expressed in harmonic coordinates, is the coordinate-time retardation,* $r_0 \cong 1.5$ *Km is the gravitational radius of the sun, c is the speed of light far from the sun,* r_e *is the Earth-sun distance,* r_p *is the planet-Sun distance, and R is the Earth- planet distance.* I really was unable to understand how r_e+r_p-R is not zero. No further comment on this point. Apart from that, the formulae for the delay used by the various authors yield a positive value for the delay. Since their formulae for the advance of the perihelia of the planets give positive values for the advance one should expect the results for the calculation of the delay even by different formulae to be negative. No one has noticed this point. If one reads this paper will understand that all efforts of the authors was, by inserting an *ad hoc* multiplicative parameter λ on the right side of the above eq. (1) in Shapiro's paper, to prove that the results of their observations were in agreement with the prediction of GR. In the other references of Shapiro that are given at the end of this book, the same attitude for the support of GR is obvious and phrases like: "*In the computations* ***we assumed that general relativity is correct*** *and that the sun's gravitational quadrupole moment is negligible*[(49)]*."*, are repeated frequently.

My theory agrees with the result of observations given in ref. (50) as I showed above. But this agreement holds for any case of superior conjunctions between any two planets and under the assumption that the radar signal passes in contact with the sun surface. In the case of inferior conjunctions I suppose that there is zero delay since the path of the signal is away from the vicinity of the Sun so that it cannot be influenced by the very feeble solar potential. The references 49, 50, 51 that deal with radar signal delays, all are referred to superior conjunctions. To my opinion at inferior conjunctions delay must not exist, since the round trip of the signal does not approach the Sun at distances shorter than the Mercury orbital radius. Another point I want to mention is that in

my calculations of the delay I did not use the distances between the planets and the Sun or those between each other since these distances do not enter in the way I calculated the delay.

Before closing this subject I think that it will be interesting to discuss the case of the delay, in the way I calculated it. I explained the reason for which I used the method of the calculation of the advance of the planets for the calculation of delays and this decision I suppose that is absolutely right. So the photon running around the Sun was just a deduction that though correct does not probably happen in practice. But I will make here a simple suggestion only that may be or may be not valid. Suppose that as the photon coming from the left in fig. 12 at the moment of its closest approach to the Sun at point A, is captured by the gravitational attraction of the Sun and instead to follow the straight line toward the planet (from Earth) is starts going around the Sun changing continuously the direction of its momentum vector, keeping constant its speed. When after a whole round it reaches the point A again and thanks to the momentum conservation law it continues its travel on the straight line again to the planet. The same happens to the backward trip. This case cannot be ignored as a possible situation but I will not continue more on this subject.

Apart from the above applications, I calculated the advance of Mars as a prediction of my theory. I found that the advance of the perihelion of Mars is equal to 3.19 arc sec. Also for curiosity I tried to find the delay of the radar signal if in the place of the Sun was a Black Hole (BH) with only two Sun masses so that its Schwarzschild radius is equal to 5930 m. The delay of the signal that grazes the BH surface was found equal to -1.0907787 sec. but again for a distance from the BH equal to one BH radius. If we consider a part of the round trip at the distance of Mercury then we find an advance equal to 5.21 10^{-3} seconds but as I said above advances of photons are prohibited since the speed of light cannot be surpassed by the light itself. At this point I end this long story about GRAVITATION since I hope that my theory gave what could give for the time being.

Now I beg the pardon of the readers, but at the last moment before sending this book to the printer's, upon reading and rereading my writing I had a new surprise, which if it is not a numerology again, it is certainly a very strange (in my country we use the word "diabolic") coincidence. As I said when I was explaining the way I would construct the necessary computer programs for the calculation of the tests of GR I had to work with

trial and error for the determination of some unknown constants that were necessary for the numerical solution of my equations. There were three such constants, the n, the x, and the q and of course the form of the speed v(r) of the transmission of the barytons in space. I managed to reduce these constants to only one as it is apparent in the programs at the end of this book and the only unknown one was the value of $q = a^2/3$ as in the basic equation (27). I started by using arbitrary values for q and finally I concluded to the value q=0.05140419. The decimal figures were put gradually to give better agreement with the experimental values. Then I thought that it would be an omission not to give the value of {a} too: To my surprise the value of {a} was found equal to:

a = 0.39269908 = $\boldsymbol{\pi / 8}$!!! ??? You must not forget that {a} was put as a determinable multiplier of the Planck length L_P. In the case of the simple pendulum (small angles) the period of oscillation is: $P = 2\pi\sqrt{\frac{l}{g}}$ (The number π appears in many other formulae of physics as e.g. in the radii of the electron orbits etc.). I think that no more comment is necessary. Only Thinking.

EPILOGUE

The presented theory is the result of two prejudices of mine: First I reject something that cannot be captured by the human mind without the use of mathematics alone. This something is the concept of **spacetime and even more the concept of curved spacetime.** These concepts led to the geometrization of physics, at least in the case of gravitation, which in spite of all efforts made by innumerable people (physicists and mathematicians) has not yet enjoyed its unification with the other dynamical fields of physics. The idea that in nature there are many concepts that cannot be understood by the human mind (such as the concept of "infinity", of "dimensionless point", of "the existence of more than the 3+1 dimensions", the concept of "no space" and why not the concept of "God") does not mean that Gravitation may be put in the above mentioned concepts in brackets, as another example. If a rock falls upon my body I suppose that this is due to a force that acts on the rock by the gravitational attraction of Earth and not to the curvature of spacetime caused by the presence of the mass of the Earth. And also I know that if my muscles were strong enough I could get rid of the weight of the rock. On the other hand from what I have studied about Quantum Mechanics, I was persuaded that any communication via the known fields of nature requires some messengers that transmit information from one object to another or more specifically create what we call **interaction**. Although the "gravitons" had been introduced as messengers of the gravitational interactions and although some people have possibly managed to renormalize it to get rid of the infinites of this theory, I have already developed my reservations about the capability of gravitons to do what they were invented for. Another reason for which I could not accept GR as a genuine theory of gravitation has already been developed in APPENDIX A. My second prejudice is that some people who support GR have declared to me that they do not accept even to discuss any comment that may offend GR. This behavior reminds me the case of dogmas and I declare that I am against dogmas of any kind because dogmas are the parents of fanaticism. This is my second prejudice. In few words: I do not accept that everything in the universe, like elementary particles, force fields, interactions of any kind and anything that up to now has not found an explanation as well as the universe itself, can be achieved by the mathematical concepts "curvature", "spacetime" "dimensionality",

"supersymetry", and generally by a geometrization of Nature. All these concepts refer to the concept of "SPACE", the nature i.e. its structure of which is still unknown. The situation is similar with the commonly used words: "psychiatry", "psychology", "psychotherapy" and so on, the main ingredient of which is the unknown nature of the concept "PSYCHE". In my previous works and especially in my book[(12)] I have given a description about how space came into existence in a certain beginning, which is the initiation of the inflation, and how space grows up continually since then i.e. after the end of inflation when the Big Bang occurred in our little universe and in its sister universes. Details can be found in my mentioned book. The basic conundrum however remains: MAY WE TALK ABOUT THE EXISTENCE OF NO-SPACE? If yes we may understand some more basic elements relative to the origin of the universe

For the present work I spent more than five years, two of them for the development of the first part of this book and about three for the second part. Besides however this not negligible time of work, I do not believe that this theory has solved the problem of gravitation definitely. Perhaps, somebody else may find a better way to develop this theory more accurately, since some elements in it may exist that can be treated in a better way, particularly in the second part of it. So this theory may generate new ideas to other people for a better understanding of the problem of gravitation. I want also to declare that the criticism I did sometimes upon the treatment of the four tests of GR, by no means it was done against any scientists who wrote a book or a paper. The criticism was against the theory of GR itself, neither against the developer of it who deserves any admiration for his other offers to physics nor against any one else who had the courage to work with this false theory. Although this theory opened the way for the development more and more

END

ADDENDUM

After certain thinking I decided to present twelve (12) QUESTIONS some of which are connected with gravitation one way or another. For these questions I will give very brief answers, since the complete answers can be found in the various works of mine already contained in the references of the book in hand:

1. Why the nucleons in the deuteron nucleus and in general in all nuclei repel each other when they come at distances ≤ 0.5 Fermi?

The answer is given in ref. 10 and ref. 30.

2. Why we cannot take free quarks? Why the quarks are characterized by asymptotic freedom and infrared slavery?

The answer is given also in ref. 10.

3. What is the fate of the mass falling towards the central singularity of a Schwarzschild Black Hole?

The answer is given in detail in the second part of ref.12 under the title "COSMOLOGY 2". In few words, the mass never reaches the central singularity. It is compressed in a sphere inside the Black Hole of maximum radius 5931.354 m for a B.H of 2.00456 Sun Masses (the least mass for the formation of a Schwarzschild Black Hole) and of minimum radius 4167.398 m for a mass of 6.264879 10^{22} Sun masses (equal approximately to the alleged mass of the whole Universe). In fact there exists a factor, never taken into account that resists to the gravitational attraction of the Black Hole.

4. May the GTR characterized as a genuine theory of gravitation if by no way it will take into account Newton's Law of gravitation?

The answer is given in ref. 3 and in a brief presentation in APPENDIX A of the present book.

5. According to the Big Bang Theory and also to the theory of Inflation, the total mass of the universe appeared simultaneously in a superdense state with dimensions of a proton or even of Planck Length. Continuous or even random creation of matter after the big bang is completely rejected. According to the Schwarzschild metric, any mass M determines an event horizon with radius $R=2GM/c^2$. An approximate estimation of the mass of the "observable" universe is equal to 10^{53} kg with a radius r= 1.5 10^{26} m or 15.8 billion light years. When the ascertained expansion of the mass in the universe comes to the above distance, the borderline of this expansion will penetrate the above horizon, will be inverted, or will come to a halt? Answer: NOTHING LIKE THIS WILL HAPPEN.

The answer is suggested in some of my writings but in a future work I will present in detail the complete solution. In

few words I will summarize here very briefly the basic idea. In my works[10,11,12] I have examined thoroughly how matter appeared in non-existing 3-dimensional space from a sub-quantum abstract space with dimensions of the order of Planck Length from a Mini White Hole (MWH). The description of this process is given clearly in ref. 10 and supposes that initially real time and matter in a superdense state appeared and this determined the beginning of inflation. By the very fast expansion, the MWHs started to separate from each other and the continually appearing new ones were sending back to the abstract space their mass leaving behind an empty bubble of Planckian dimensions too. The totality of these bubbles constitutes our 3d space we live in. The inflation stopped after $3.136145\ 10^{-35}$ sec from the real time zero after 117.26419 doublings of its size, and the initial mass was equal to $5.6\ 10^{65}$ kg. This mass is the mass of the big Universe and it was disrupted to $6.028\ 10^{12}$ little universes with mass of each one of them equal to $9.29\ 10^{52}$ kg and radii equal to 0.20716289 m. Then the big bang occurred in our universe and to her 10^{12} sister universes. The expansion started in our universe with a much milder rate. During the first 2 or 3 billion years big stars were turned into huge black holes in the center of which the density approached the conditions of the appearance of the big Universe so that the endlessly appearing MWHs were again turned into matter in the central region of these black holes, thus increasing the initial mass of the universe. This increase of mass resulted to an increase of the radius of the initial event horizon in such a step that the expansion of our universe would continue forever since stars will continue to turn into Black Holes. The above solution of the cosmological problem given very briefly has been described analytically in my previous works. In fact it is a reconciliation of the Big Bang and the Steady State theory. OUR UNIVERSE, THE ONE WE LIVE IN, IS A CONTINUALLY EXPANDING BLACK HOLE.

6. In the quantum theories of gravitation (Supergravity, Superstrings etc.) as messengers of the gravitational interactions are defined the gravitons that are transmitted at the velocity of light. How they escape from the interior of a black hole, since the photons that move with the same speed cannot escape?

I discussed this problem in extension in the main text of this work.

7. Are there elementary particles in the so-called "desert of masses" from about 100 GeV/c^2 up to 10^{17} GeV/c^2?
8. The answer is YES. I have already determined in my book of ref. 12, the masses of 24 zero spin mesons the smallest mass being equal to 114.76 GeV/c^2 and the heaviest being equal to 1.2305662 10^{12} GeV/c^2. My theory also suggests the existence of two more quark flavors heavier than the top quark called by me Extra and High. This case suggests also the possible existence of 97 more baryons heavier than the already known ones. To the above baryon masses that wait their experimental determination may be added the maximum mass of any elementary particle that can exist, equal to 5.0437884 10^{-9} kg. This is the mass that emerges from a Mini White Hole
9. The masses of the u and d quarks have two characterizations; "Bare" and Effective" with a ratio between them ~1/70. What is the cause of this difference?
   Answer: The bare mass is the equivalent mass of the energy of a quantum simple harmonic oscillation executed by the u and d quarks inside the nucleons and the effective masses are the ones of the u and d quarks when the nucleons are at their maximum separation inside the nuclei. The first ones are equal to: m_u = 4.0878257 MeV/c^2 and m_d = 7.3817957 MeV/c^2 as they were calculated in my book of ref .12. In the same book the effective mass of the u and d quarks was found equal to ~365.6 MeV/c^2.
10. What is the cause of inflation that started 2.37 10^{-37} sec before the big bang and ended at the 3 10^{-35} sec?
    The answer is given in my book (ref. 12), in the part under the title "Cosmology 4" and it is too lengthy to be presented here.
11. Is it absolutely certain that the electrons and the electron neutrinos are point-like particles? May they have an internal structure?

Answer: In my book of ref.12 in the fourth part of it under the title Cosmology 4, I have developed a theory in a mathematical formulation, according to which these elementary particles are composite by three more elementary ones called by me paraquarks. The relevant calculations support a very strong probability that indeed the above particles are not point-like.

12. According to Steven Weinberg the number of protons in the universe is equal to the number of the electrons. The

question is: Who measured these particles one by one and concluded to the above equality?

Answer: The usual answer given in this case is that the universe is electrically neutral. But this is (obviously) a mere hypothesis. The answer is given in my book (ref. 12) and is a consequence of the way the protons and electrons (as well the neutrons and electron neutrinos) are created simultaneously from the quarks and the paraquarks.

END of the "QUESTIONS". Of course their number may be innumerable. However I put them, to indicate that beyond the answers that can (or cannot) be given by the established theories on gravitation, elementary particles and cosmology, there are opinions that may give also answers to some of the up to now not completely solved problems of physics and cosmology by different ways. It is up to the reader to decide which solutions satisfy him/her in a better way. So the reader is called to think once again.

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PART III

In the few next pages are presented the computer programs in Quick Basic 4, I used to solve the equations of the present work that did not accept analytical algebraic solution. So

1. Page 157 .The computer program for the computation of the radius of a circle the perimeter of which is equal to the perimeter of the ellipse described by each planet. The presented example is used in the case of Mercury.
2. Page 158-159 Program for the calculation of the distance r up to which holds the NLG and beyond that the NNL under the presuppositions that have been mentioned in the main body of this work. At the end is given the result for the distance r and for the velocity of the baryton at this distance, which is greater than c.
3. p.p. 160-168. The computer program for the calculation of the results of the four tests of GR by use of the equations of the NNL.
4. p.p. 168-169. Here are given the obtained results as they raised straight from the running of the program

```
'Computer program under the name TRAPEZOI'
       'In Quik Basic4.0'



       DEFDBL A-Z  'mercury'

       INPUT "Give lower lim"; x0
       INPUT "Give Uper lim"; x1
       INPUT "Give Number of subintervals"; n

       h = (x1 - x0) / n:


       DEF fnf (x)
       fnf = (1 - .205630294# ^ 2 * (SIN(x)) ^ 2) ^
.5

       END DEF
       h = (x1 - x0) / (n - 1)
       u = 0
       FOR i = 1 TO n - 2
       u = u + fnf((x0) + h * i)
       NEXT i
       u = (u + (fnf(x0) + fnf(x1)) / 2) * h

       k = 4 * u * 57909175000# / 2 / 3.141592654#
       LPRINT "u="; u
       LPRINT "k="; k
       END
```

```
     'Determination of the distance at which the NBN
or the NNB are valid'
 DEFDBL A-Y
 DEFDBL Z
 OPTION BASE 0
INPUT "n="; n
INPUT "x0="; x0
INPUT "x1="; x1
ap:
 c0 = 299792458#

 DEF fnv (x)
 h = 4.489605235084097D-09
q1 = .05140419#
f = c0 * (1 + h * x) ^ n
b = n * h * c0 * (1 + h * x) ^ (n - 1)
t1 = (1 - 1 / (1 + h * x) ^ (n - 1)) / h / c0 / (n -
1)
z = ((q1 * f / c0) * (2 * f * t1 / x - b * t1 - 1)) -
1
fnv = z
END DEF

in: y0 = fnv(x0)
  y1 = fnv(x1)
  IF (y0 * y1) > 0 THEN
  x0 = x0 - 1E-19
  GOTO in
  ELSE g = 1E-19
  c = 2 * x1 - x0
  END IF
lp: x2 = x1 - y1 * ((x1 - x0) / (y1 - y0))
  IF ABS(x2 - c) < g THEN
  t = x2
  GOTO xx
  ELSE GOTO ct
  END IF
ct: y2 = fnv(x2)
  c = y2 * y1
  IF c < 0 THEN
  x0 = x1
  y0 = y1
  ELSEIF c > 0 THEN
  y0 = y0 * y1 / (y1 + y2)
  END IF
  x1 = x2
  y1 = y2
  c = x2
  GOTO lp
xx:
x = t
LPRINT "The required distance r="; t
```

```
LPRINT "f=";f
END
```

The result by running this program is:
r= 759672836.9545054 m
f= 5.832062678 10^9 m/sec > c

```
    'Computer Program used for the calculation of the
Perihelia''advances of Mercury, Venus,Icarus and
Earth '
     'This is a QUICKBASIC 4.0 program. The code name
is AADVANC7.bas'
     'Also the deflection of light by the Sun and the
delay of radar'
     'signals too between Earth and Mercury at
superior conjunction'
     'are calculated. Prediction for the advance of
Mars is made too'
     'Also Delay calculation if in place of the Sun
was a two Sun mass'
     'Black Hole
 DEFDBL A-Y
 DEFDBL Z
 OPTION BASE 0
 x0 = .0000000001#
 x1 = 1000000#
 INPUT "q="; q
 INPUT "n="; n
ap:
 c0 = 299792458#
 r1 = 57293952213#           ' Radius of
Mercury'
 r2 = 108207688923#           '  "    "       Venus'
 r3 = 128443592265.4#         '  "    "       Icarus'
 r4 = 149587593700#           '  "    "       Earth'
 r5 = 160904675864#           '  "    "       Mars
 r6 = 696100000               '  "    "       Sun
 r0 = 6378140#          'Semi-major axis of Earth'
 g1 = 1.3270978D+20     'G2*Sun Mass'
 g2 = .00000000006673#  'G'
 m2 = 5.9749D+24        'Earth Mass in kg'
 p = 3.14159265359#
 m = 87.969098# 'Time for one revolution by  Mercury
in days'
 v = 224.70069# ' "    "   "       "      "  Venus
"   " '
 i = 408.778    ' "    "   "       "      "  Icarus
"   " '
 e = 365.256366#' "    "   "       "      "  Earth
"   " '
 a = 686.98     ' "    "   "       "      "  Mars
"   " '
 m1 = 41.4   ' precession of Mercury from
observation'
 v2 = 8.4   '     "       "  Venus    "        "
'
 i1 = 9.8   '      "      "  Icarus   "        "'
 e1 = 5     '       "     "  Earth    "        "'
 DEF fnv (x)
```

```
r = r1
q = q
f = c0 * (1 + x * r) ^ n
b = n * x * c0 * (1 + x * r) ^ (n - 1)
t1 = (1 - 1 / (1 + x * r) ^ (n - 1)) / x / c0 / (n -
1)
 k1 = ((q * f / c0) * (2 * f * t1 / r - b * t1 - 1))
^ .5 - 1
z = ((g1 / r ^ 3) ^ .5) * k1
w = z * 360 * 3600 / 2 / p
w1 = w * e / m
v1 = m1 - w1
fnv = v1
END DEF
in: y0 = fnv(x0)
  y1 = fnv(x1)
  IF (y0 * y1) > 0 THEN
  x0 = x0 - 1E-19
  GOTO in
  ELSE g = 1E-19
  c = 2 * x1 - x0
  END IF
lp: x2 = x1 - y1 * ((x1 - x0) / (y1 - y0))
  IF ABS(x2 - c) < g THEN
  t = x2
  GOTO xx
  ELSE GOTO ct
  END IF
ct: y2 = fnv(x2)
  c = y2 * y1
  IF c < 0 THEN
  x0 = x1
  y0 = y1
  ELSEIF c > 0 THEN
  y0 = y0 * y1 / (y1 + y2)
  END IF
  x1 = x2
  y1 = y2
  c = x2
  GOTO lp
xx:
x = t
LPRINT "Mercury advance with AADVANC7.BAS"
   LPRINT "r="; r1
   LPRINT "q="; q
   LPRINT "n="; n
   LPRINT "x="; t
   LPRINT "f="; f
   LPRINT "t1="; t1
   LPRINT "k1="; k1
   LPRINT "m="; m
   LPRINT "m1="; m1
```

```
   LPRINT "w1="; w1
r = r2
q = q
x = t
f = c0 * (1 + x * r) ^ n
b = n * x * c0 * (1 + x * r) ^ (n - 1)
t2 = (1 - 1 / (1 + x * r) ^ (n - 1)) / x / c0 / (n -
1)
k2 = ((q * f / c0) * (2 * f * t2 / r - b * t2 - 1)) ^
.5 - 1
z = ((g1 / r ^ 3) ^ .5) * k2
w = z * 360 * 3600 / 2 / p
w2 = w * e / v
L2 = ABS((v2 - w2) / v2) * 100
   LPRINT "Venus advance with AADVANC7.BAS"
   LPRINT "r="; r2
   LPRINT "q="; q
   LPRINT "x="; t
   LPRINT "f="; f
   LPRINT "t2="; t2
   LPRINT "k2="; k2
   LPRINT "v="; v
   LPRINT "v2="; v2
   LPRINT "w2="; w2
   LPRINT "L2="; L2
r = r3
q = q
x = t
f = c0 * (1 + x * r) ^ n
b = n * x * c0 * (1 + x * r) ^ (n - 1)
t3 = (1 - 1 / (1 + x * r) ^ (n - 1)) / x / c0 / (n -
1)
k3 = ((q * f / c0) * (2 * f * t3 / r - b * t3 - 1)) ^
.5 - 1
z = ((g1 / r ^ 3) ^ .5) * k3
w = z * 360 * 3600 / 2 / p
w3 = w * e / i
L3 = ABS((i1 - w3) / i1) * 100
   LPRINT "Icarus advance with AADVANC7.BAS"
   LPRINT "r="; r3
   LPRINT "q="; q
   LPRINT "x="; t
   LPRINT "f="; f
   LPRINT "t3="; t3
   LPRINT "k3="; k3
   LPRINT "i="; i
   LPRINT "i1="; i1
   LPRINT "w3="; w3
   LPRINT "L3 ="; L3
r = r4
q = q
x = t
```

```
f = c0 * (1 + x * r) ^ n
b = n * x * c0 * (1 + x * r) ^ (n - 1)
t4 = (1 - 1 / (1 + x * r) ^ (n - 1)) / x / c0 / (n -
1)
k4 = ((q * f / c0) * (2 * f * t4 / r - b * t4 - 1)) ^
.5 - 1
z = ((g1 / r ^ 3) ^ .5) * k4
 w = z * 360 * 3600 / 2 / p
 w4 = w * e / e
 L4 = ABS((e1 - w4) / e1) * 100
   LPRINT "Earth with AADVANC7.BAS"
   LPRINT "r="; r4
   LPRINT "q="; q
   LPRINT "x="; t
   LPRINT "f="; f
   LPRINT "t4="; t4
   LPRINT "k4="; k4
   LPRINT "e="; e
   LPRINT "e1="; e1
   LPRINT "w4="; w4
   LPRINT "L4="; L4

LPRINT "Bending of light, calculation with
AADVANC7.BAS"
r = r6
x = t
q = q
f = c0 * (1 + x * r) ^ n
b = n * x * c0 * (1 + x * r) ^ (n - 1)
t5 = (1 - 1 / (1 + x * r) ^ (n - 1)) / x / c0 / (n -
1)
k5 = ((q * f / c0) * (2 * f * t5 / r - b * t5 - 1))
w = 2 * g1 * k5 / c0 ^ 2 / r
w5 = w * 360 * 3600 / 2 / p

LPRINT "Bending of light from a distant star during a
Sun eclipse"
LPRINT "The code of the program is AADVANC7.bas"
LPRINT "The deflection angle w5 in sec of arc"
LPRINT "r="; r



LPRINT "x="; t
LPRINT "q="; q
LPRINT "t5="; t5
LPRINT "k5="; k5
LPRINT "f="; f
LPRINT "w="; w
LPRINT "w5="; w5
LPRINT "Delay calculations with AADVANC7.BAS"
r = r6
```

```
x = t
q = q
f = c0 * (1 + x * r) ^ n
b = n * x * c0 * (1 + x * r) ^ (n - 1)
t6 = (1 - 1 / (1 + x * r) ^ (n - 1)) / x / c0 / (n -
1)
K6 = ((q * f / c0) * (2 * f * t6 / r - b * t6 - 1)) ^
.5 - 1
LPRINT "K6="; K6
z = ((g1 / r ^ 3) ^ .5) * K6
LPRINT "z="; z
u = 2 * z * r / c0
LPRINT "r="; r
LPRINT "q"; q
LPRINT "x="; t
LPRINT "f="; f
LPRINT "Delay in seconds u="; u
LPRINT "Delay calculations with AADVANC7.BAS"
 r = 2 * p * r6
LPRINT "r="; r
q = q
 x = t
 f = c0 * (1 + x * r) ^ 2
 b = n * x * c0 * (1 + x * r)
 t8 = r / (1 + x * r) / c0
 k8 = ((q * f / c0) * (2 * f * t8 / r - b * t8 - 1))
^ .5 - 1
 z = ((g1 / r ^ 3) ^ .5) * k8
 LPRINT "z="; z
 u1 = 2 * z * r6 / c0
 LPRINT "Advance (not delay) in seconds u1="; u1
LPRINT "Prediction for Mars advance with
AADVANC7.BAS"
 r = r5
 q = q
 x = t
 f = c0 * (1 + x * r) ^ n
 b = n * x * c0 * (1 + x * r) ^ (n - 1)
 t7 = (1 - 1 / (1 + x * r) ^ (n - 1)) / x / c0 / (n -
1)
 k7 = ((q * f / c0) * (2 * f * t7 / r - b * t7 - 1))
^ .5 - 1
 z = ((g1 / r ^ 3) ^ .5) * k7
 w = z * 360 * 3600 / 2 / p
 w7 = w * e / a

LPRINT "Mars with AADVANC7.BAS"
LPRINT "r="; r5
LPRINT "q="; q
LPRINT "x="; t
LPRINT "f="; f
LPRINT "t7="; t7
```

```
LPRINT "k7="; k7
LPRINT "a="; a
LPRINT "w7="; w7

r = 5930 'in meters'
 q = q
 x = t
 f = c0 * (1 + x * r) ^ n
 b = n * x * c0 * (1 + x * r) ^ (n - 1)
 t10 = (1 - 1 / (1 + x * r) ^ (n - 1)) / x / c0 / (n
- 1)
 k10 = ((q * f / c0) * (2 * f * t10 / r - b * t10 -
1)) ^ .5 - 1
 z = ((2 * g1 / r ^ 3) ^ .5) * k10
 u0 = 2 * z * r / c0
 LPRINT "r="; r
 LPRINT "delay in seconds u0="; u0
 LPRINT "delay calculations with aadvanc7.bas"
 LPRINT "for a round trip in a length r at"
 LPRINT "a distance equal to the Mercury radius from
the Sun"
 r = 3576891731.67143#
 q = q
 x = t
 f = c0 * (1 + x * r) ^ n
 b = n * x * c0 * (1 + x * r) ^ (n - 1)
 t10 = (1 - 1 / (1 + x * r) ^ (n - 1)) / x / c0 / (n
- 1)
 k10 = ((q * f / c0) * (2 * f * t10 / r - b * t10 -
1)) ^ .5 - 1
 z = ((2 * g1 / r ^ 3) ^ .5) * k10
 u2 = 2 * z * r / c0
 LPRINT "r="; r
 LPRINT "delay in seconds u2="; u2

LPRINT "******************** "
LPRINT "Synopsis of results with aadvanc7.bas"
LPRINT "w1="; w1
LPRINT "L1="; 0
LPRINT "w2="; w2
LPRINT "L2="; L2
LPRINT "or 3.6<w2<13.2 "
LPRINT "w3="; w3
LPRINT "L3="; L3
LPRINT "Look in the main text"
LPRINT "w4="; w4
LPRINT "L4="; L4
LPRINT "w5 in sec of arc,bending ="; w5
LPRINT "Delay in seconds="; u
LPRINT "Advance in seconds="; u1
LPRINT "for Mars the advance w7 is prediction"
LPRINT "w7 in sec of arc="; w7
```

```
LPRINT "For the delays u0 and u2 look in the main
text"
LPRINT "delay in seconds u0="; u0
LPRINT "Advance in seconds u2="; u2
LPRINT "q="; q
LPRINT "n="; n
END
```

```
Mercury advance with AADVANC7.BAS
r =57293952213
q =0.05140419
n =2
x =4.489605235084097D-09
f =19990551181663.87
t1 =0.7400925724800764
k1 =57.54654793416847
m =87.969098
m1=41.40000152587891
w1=41.40000152587652
Venus advance with AADVANC7.BAS
r=108207688923
q=0.05140419
x=4.489605235084097D-09
f=71045952270278.55
t2=0.7414435649181176
k2=109.3719151702362
v=224.70069
v2=8.399999618530273
w2=11.86830285991368
L2=41.28932617725815
Icarus advance with AADVANC7.BAS
r=128443592265.4
q=0.05140419
x=4.489605235084097D-09
f=100038422521683
t3=0.741683597119987
k3=129.9701503390054
i=408.7780151367187
i1=9.800000190734863
w3=5.994622198102557
L3 =38.83038692417572
Earth with AADVANC7.BAS
r=149587593700
q=0.05140419
x=4.489605235084097D-09
f=135619000174068.8
t4=0.7418651250657402
k4=151.4927434542892
e=365.256366
e1=5
w4=6.221929189457144
L4=24.43858378914287
Bending of light, calculation with AADVANC7.BAS
Bending of light from a distant star during a Sun
eclipse
The code of the program is AADVANC7.bas
The deflection angle w5 in sec of arc
r=696100000
x=4.489605235084097D-09
q=0.05140419
```

```
t5=0.5628652360265137
k5=0.8747652634982835
f=5101685845.398363
w=3.711174832683243D-06
w5=0.7654847578124589
Delay calculations with AADVANC7.BAS
K6=-6.471113366068371D-02
z=-4.05903711253915D-05
r=696100000
q=0.05140419
x=4.489605235084097D-09
f=5101685845.398363
Delay in seconds u=-1.884967856021583D-04
Delay calculations with AADVANC7.BAS
r=4373725292.327998
z=1.46512972320396D-04
Advance (not delay) in seconds u1=6.80388564226173D-
04
Prediction for Mars advance with AADVANC7.BAS
Mars with AADVANC7.BAS
r=160904675864
q=0.05140419
x=4.489605235084097D-09
f=156882998297065.3
t7=0.7419427115833389
k7=163.0124624356465
a=686.97998046875
w7=3.190789255992269
r=5930
delay in seconds u0=-1.091387642728475
delay calculations with aadvanc7.bas
for a round trip in a length r at
a distance equal to the Mercury radius from the Sun
r=3576891731.67143
delay in seconds u2=5.211357491057508D-03
**********************
Synopsis of results with aadvanc7.bas
w1=41.40000152587652
L1=0
w2=11.86830285991368
L2=41.28932617725815
or 3.6<w2<13.2
w3=5.994622198102557
L3=38.83038692417572
Look in the main text
w4=6.221929189457144
L4=24.43858378914287
w5 in sec of arc, bending =0.7654847578124589
Delay in seconds=-1.884967856021583D-04
Advance in seconds=6.80388564226173D-04
for Mars the advance w7 is prediction
w7 in sec of arc=3.190789255992269
```

```
For the delays u0 and u2 look in the main text
delay in seconds u0=-1.091387642728475
Advance in seconds u2=5.211357491057508D-03
q=0.05140419
n=2
```

END