POSTULATING ETHER

AS SOURCE FOR PARTICLES AND MEDIUM FOR WAVES

TAPIO KULMALA

"The present study is to clarify and update the role of ether hypothesis among novel and evolving theories of physics. This may help us in getting a better understanding of the world where we live, including the universe."

Author's message to the readers of the booklet

Forty years ago the author as a young researcher of electromagnetism and physics was facing with the following situation: Electron was a discrete point-like particle surrounded by an "empty" space, ie. without any explicitly defined physical interaction mechanism. Most of the scientists at that time seemed to be happy with such an absurd situation - the author was not. More than twenty years later the author decided to make his best effort in order to clarify the case and to find and suggest the hidden mechanisms behind electromagnetism and other physical phenomena, such as gravity and inertia. The present booklet is a compact collection of author's major findings. The author understands quite well that many items may cause confusion in reader's mind. Whatever is the case, the author wishes to receive responses from the readers, as author's target is to stimulate constructive discussion concerning the physical reality where we live.

Disclaimer:

The opinions expressed in this manuscript are the opinions and thougths of the author and do not necessaryly represent the opinions of the colleagues the author has interviewed while preparing this manuscript. However, the author wants to thank the following persons for their feedback in the course of this study: Professor Arto Annila at University of Helsinki, professor Lauri Kettunen at Tampere University of Technology, doctor Tuomo Suntola, doctor Cynthia Whitney as editor of Galilean Electrodynamics, and last but not least doctor Milo Wolff as a creator of WSM concept.

POSTULATING "ETHER" AS SOURCE FOR PARTICLES AND MEDIUM FOR WAVES

CONTENTS:

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PREFACE

I started my career in telecom business quite early in the 60s when I was still a "school boy". Open wires and copper cables were the technologies of telephone networks at that time. Later on I studied in Tampere University of Technology; electronics and physics were my major topics. When I was in army (1975-76) I had an opportunity to become familiar with a radio technology operating at HF frequencies, including the amazing propagation effects in the rural (forest and lake) areas of East Finland.

After completing my service in the army I joined the Telephone Laboratories of the Finnish PTT where I first developed measurement techniques to be used in telecom applications, including radio and optical frequencies. At the same time I completed my postgraduate studies in Helsinki University of Technology. The topics of my postgraduate (Lic tech) thesis was how to use superconductivity (SQUID) for measuring electrical quantities at radio frequencies; in this context my role as a combination of an Electrical Engineer and Physicists was quite fruitful.

Furthermore, I made long lasting (1984-89) propagation studies on the microwave radio network of North Finland; the aim of those experiments was to investigate the quality of the existing transmission networks for synchronizing the evolving digital networks. After developing optical metrology for fiber optics and investigating non-linear distortion in cable TV networks I moved to ETSI (European Telecommunications Standards Institute) where I joined Project Team PT29 (1993-94). The task of PT29 was to support standardization work of TETRA digital mobile radio networks. Due to my background as a radio expert my area of specialization was Air Interface and preparing radio conformance testing spesifications for TETRA.

My recent experience of working in a "multicultural environment" led me, once again, into a new area of telecom business, ie. planning and operating international telecom networks as "biggest manmade machine" on the globe. The major technology employed by large telecom networks was, and is still, fiber optics; satellite technology as an alternative means for fibers lost the game since the 90s..

The story above is to describe the route I have travelled through different technologies used in telecommunication applications from the 60s until today (2012). As I already had some background also in physics research since the 70s, it was my personal interest to update my knowledge from time to time regarding this central area of the natural sciences. In this context I had to keep in mind the fact that even in the 20th century the foundation of the electromagnetic theories as well as the quantum mechanics were still based on the ideas derived from the classical mechanics exhibiting a world of "point-like particles" (and particle-wave dualism). The emergence of the "wave nature of matter" theories since the 80s is setting new challenges not only to theoretical physicists, but also to scientists and engineers working with the applied physics, like electromagnetism that provides foundations for all technologies employed by both wired and wireless applications today.

To build a physical bridge between the electromagnetism and novel (and still evolving) physical theories, I have made my own experimental and theoretical investigations since the 80s.:
Although I have used a "wave based" electron model instead of the classical point particle model while considering phenomena of electromagnetism, the final outcomes from the discussions should not deviate in a drastical way from those ones we have proved in numerous experiments carried out since the 19th century and are also manifested in appropriate mathematical formulas, including welknown Maxwell's equations. Even the well known principles of Huygens and Fermat, as well as Snell's law are applicable as postulates in this context. The major change as compared to the

classical electromagnetism is that the electron is now extended spherically (as Albert Einstein visioned) to occupy also some space around the high density "particle-like" wave center. This occupation of the space medium, called also the "ether", is done by the Inward and Outward waves ("quantum waves") which comprise the "wave structure" of the electron, and, thus provides a means to interact with other matter (electrons, atoms, molecules) surrounding the electron. This new point of departure has led to some new interpretations of electromagnetic phenomena I have discussed in my studies, including references to the appropriate research done elsewhere. It shall be noted that most of the postulates (just a few) used in my studies I have borrowed from the theories established by the others in the course of centuries until now; the latest of the postulates are based on "wave nature of matter" concepts .

A specific finding obtained as a result of my own research is an estimate for the ratio of Electric Force / Gravity Force (1.2×10^{40}); this estimate is based on my experiments and theoretical studies on propagation of microwaves (7GHz) in turbulent troposphere in real climatic conditions of North Finland, ie. outside laboratories. This finding led me to investigate the "interface" between electromagnetism and gravity in more details, and I found the idea of common physical background connecting the areas of those major phenomena in physics: "quantum waves", polarized or scalar ones, that propagate in "ether" exhibiting local density gradient.

As a summary, what is new and also interesting (I wish) in my studies: First, "wave structure" of electrons to accomplish a diversity of electromagnetic as well as gravitational interactions, and secondly, the "ether" as a medium where those interactions take place and propagate within space at a speed close to the velocity of light ($c = 3 \times 10^8$ m/s), thus interlinking all material particles, such as electrons, atoms and molecules there in a way that will accomplish all phenomena we can observe in our universe. It is noteful that there is no charge or mass substance in this concept. As an example concerning "relativistic" effects on particles and atoms, the hypothesis of "ether" provides a means to explain the observations, such as "why a moving atomic clock goes slow ?".

As the role of "ether" as fundamental substance of space is crucial in the context of my studies, I have prepared the "booklet" as enclosed herein to describe (postulate) the properties the hypothetical ether concept should have to meet the requirements I have envisioned in the course of my investigations since the 70s. To make my ideas more understandable I have presented below the specific terminology and appropriate definitions used in this booklet.

It will be interesting to compare the results of my studies to those of Modern Physics and Standard Cosmology...

December 2013 ,Tapio Kulmala
Pohjoispellontie 1B5
06450 Porvoo, Finland
tapio.kulmala@saunalahti.fi , tel. +358 40 5028088

TERMINOLOGY

Space: The space around us is not empty. Space is quantum wave medium ("ether") of spherical quantum waves. The energy density of space is due to the sum of waves from all matter in the universe.

Quantum Waves: The waves in space that form the structure of all matter as resonant inward and outward wave pairs (ie. electrons, protons and neutrons). They are a part of Quantum Theory.

Scalar Waves: The quantum waves in space have a single number amplitude at each point in space and are termed scalar waves.

Spherical inward wave: A wave converging spherically towards a wave center. It is formed from

the combination of the ouward waves of all other matter in the Universe.

Wave Center: The center point of converging /diverging inward and outward waves. The wave center is the apparent location of energy transfers that appear as a "particle".

Spherical outward wave: A wave diverging from a wave center. It is a rotation /reflection of the inward wave.

Space Resonance: A spherical standing wave composed of a superimposed inward and outward wave. This wave is the basic structure of electrons and other charged particles.

Spin: The result of an inward wave rotating at the center to become an outward wave. The rotation is 720 degrees and the spin angular momentum produced is +/- $h/4\pi$. It can only occur in 3D space.

Charge: Charge polarity of the spherical structure (electron, eg.) depends on whether there is positive (+) or negative (-) amplitude of the inward wave at particle's center.

Ether: Fundamental ("invisible") substance of space.

Energy: Expression of ether's capability to create wave motion and also material structures (fundamental particles) under appropriate conditions. Observable only when energy transfers occur.

Energy Transfer: This occurs if both source and receiver wave state are resonant, ie. have the same frequency.

Matter: Matter is "trapped" energy.

Mass: Particle's capability to "trap" free energy of space.

Space energy density: The energy density of space is equal to the sum (squared) of wave amplitudes from all the resonances in the universe.

Universe: Consists of all the matter we can observe contained within a Hubble sphere. It is finite spherical universe within an infinite space.

Velocity of Light (c): The velocity of quantum waves in space is about 3×10^8 m/s. c depends upon the density of space.

Time measure: The basic "clock" of the universe is the frequency of quantum waves. Time depends on the density of space. It varies very little in the universe because matter is spread widely.

Length measure: The basic measurement "rod" of the universe is the wavelength of quantum waves. It depends on the density of space. It varies very little in the universe because matter is spread widely.

Matter Waves: The scalar quantum waves of electron, proton or neutron.

Electromagnetic Waves: Transversally modulated (polarized) quantum waves of electrons.

SQUID: Superconducting Quantum Interference Device; a very sensitive device to measure electromagnetic quantities.

TETRA: Transeuropean Trunked Radio System; a digital mobile radio system for authorities and utilities (eg. "Virve" in Finland).

Introduction

Since the time of the antique philosophers have thought that there exist an invisible substance providing everything we have in our observable universe, Greek "apeiron" was an example of such hypothetical concept, although without any exact definition. Much later in the 19th century Maxwell and other scientists at that time assumed the existence of so called "luminiferous ether" as a medium in space while developing the theory of electromagnetism and propagation of respective waves. When Michelson-Morley interferometer experiments since 1887 gave a null result for "ether wind" on earth's surface, most of the scientists abandoned that "static" and "mechanical" ether concept. All scientist were not happy with the absurd idea of an "empty" space for many philosophical and physical reasons: An empty space can not provide any distance scale, motion, energy and time. On the other hand, since the beginning of the 20th century scientists have described physical phenomena (observations) by using almost solely mathematical formulas, such as Maxwell's equations eg., and all this happened without referring to any ether-like substance filling the space. To understand the "trick" done by the scientists I take an analogous example from the world of art: When an artist makes a painting, he/she needs a fabric (or paper eg.) as a base material. When the painting is complete, we can describe the content (shapes, colors...) without mentioning the fabric behind the painting, although the fabric is there, as nobody can make a painting on "emptiness". Hence, in the framework of this study the existence of ether-like fundamental substance of space is assumed. Referring to the analogy above we could consider our universe as a large "piece of art" that is created by the nature using the ether substance as building material.

To proceed, we need an idea of a modern ether that provides the source for all matter and the platform for all gravitational, inertial and electromagnetic phenomena. Personally, I am developing my own "wave based" approach to explain electromagnetic phenomena. As a starting point for my "Wave Based Electromagnetism" concept I have used "Wave Structure of Matter (WSM)" model created by Milo Wollf et al since 1985 [3], [4], [5], [6]. A brief description of WSM model is given in Appendix 1. In the WSM model all particles and their interactions in the observable universe are created by waves, ie. there are no discrete point-like particles in this concept. It is clear that in WSM , as well as in other "wave nature of matter" theories [7], [9], [10], [11], [13], the space is not "empty", although all properties of the space medium are not explicitly defined (Reference [13] may be an exception here). Hence, the objective of this document is to postulate and describe the ether meeting the requirements given above. Although my own interests are in electromagnetism and related phenomena, my aim is to consider the ether as a universal substance of space to cover all physically observed things and interactions, including gravity and inertia too. It shall be noted here that my purpose is not to give any definitive internal structure for the ether, just to tell how the ether should behave from observer's point of view.

Given the existence of ether as hypothetical substance of space, I present the following vision to tell how matter and related interactions could be established in the universe:
In the beginning, inhomogenities in the ether caused turbulent flow of ether substance that led to a creation of very small but intense "eddies". In some cases those eddies could form spatially periodic wave structures that we call "elementary particles", ie. protons, neutrons, electrons, positrons...
Those elementary particles provided building blocks for the atoms; first Hydrogen atoms and later also more massive ones. This is the birth of matter from ether substance I have envisioned herein.
Postulates 1-4 together with Appendices 1-6 below are to characterize the ether in the framework of the present study.

1. Postulate:

Ether is fundamental source for all elementary particles and, hence, for all matter in the universe. All material bodies in the universe are "immersed" in ether substance, and all "empty" space between the bodies is filled by ether. In addition, ether provides transmission medium for all waves propagating in the universe.

2. Postulate:

Ether is inaccessible and transparent (invisible): Ether can not be manipulated by any technical means, as ether itself does not exhibit any definitive mass, electric charge or cause dissipative friction. This means that we can not remove or add ether in space. We can not cause any chemical reactions to ether (eg. we can not burn it). Those extraordinary features of ether make a clear difference in comparison to an ordinary (structured) matter. The properties of ether are governed by its internal laws that are not known to us (for the present), although we may observe indirectly its behavior in many interaction events (energy transfers). Thats why we have to consider ether mainly as a hypothetical entity that itself is unseen by us.

3. Postulate:

Creation process of elementary particles from ether is considered here on the basis of the WSM model that gives the wave structure of an electron as an example case, as shown in Appendix 1. A brief description of a standing wave structure of an electron in the ether is given as follows:

Wave Based Electron: A standing wave structure of an electron, as proposed by Milo Wolff et al is presented schematically in Figure 1. of Appendix 1: Spherical waves in space converge to and diverge from a wave center where the inward waves change direction and rotate to become the outward wave. This rotation produces the "mysterious" spin of particles, as well as a small amount of propagation delay. **Charge polarity of the spherical structure (particle) depends on whether there is posive (+) or negative (-) amplitude of the inward wave at the center. A more detailed explanation of electron's wave structure and its consequencies as a whole is given in the next item "main principles of WSM model".** If two electrons (or positrons respectively) are near one another, their identical waves add together producing maximum amplitude and causing them to move apart seeking a minimum. These changing amplitudes appear as forces dependent on total wave amplitude that changes with distance r as $1/r^2$ thus matching the empirical Coulomb law. Similarly, there will be an attractive force between charges of different polarity. These waves exist all around us, but are unseen. Energy exchange occur at the center, so laboratory measurements appear like a "point particle".

It shall be noted here that scalar inward /outward waves are propagating longitudinally at speed of ligth (c) and at a Compton frequency of electron $f = mc^2/h$. Hence, they are not electromagnetic (vector) waves itself.

The following three **main principles of WSM model are considered as part of postulate 3.**:

Principle I: The Wave Equation $\quad \blacktriangledown^2 A - 1/c^2 \, \partial^2 A/\partial t^2 = 0$

- The governing equation of matter waves traveling in space at velocity c

where A is the amplitude of the wave. This wave equation has two solutions: **Inward wave (propagating towards wave center) and outward wave (propagating from wave center):**

  inward wave $A_{in} = (1/r)A_{max} \exp(i\omega t + ikr)$
  outward wave $A_{out} = (1/r)A_{max} \exp(i\omega t - ikr)$

where A_{max} is scalar wave amplitude, r is radius from the wave center, angular frequency $\omega = 2\pi f$, wave number $k = 2\pi mc/h$ and energy of the electron $E = mc^2 = hf$.

Superposition of those two waves produces standing wave, so called "space resonance", around the wave center of the particle. When inward wave reaches the wave center of the particle it rotates the wave center clock wise (CW for electron) or counter clock wise (CCW for positron) and encounters a phase shift of 180 degrees to become outward wave; this rotation is to create a quantised spin for the particle.

Principle II: The Wave Density Principle
The propagation property of the space "ether" can be described as proportional to a density of space. The density of space at a given point is proportional to the sum of the densities of all the waves from all the particles in the universe which have arrived at that point, in accordance with **Mach's Principle**. The wave amplitude of any particle at that point shall be included. The frequency (or mass m x $c^2 = hf$) of the waves of an electron is proportional to the space density:

    Space density is proportional to: constant x SUM $[(amp_n /r_n)^2] = mc^2 = hf$

where r_n and amp_n are the distance and amplitude of each particle wave center.

Principle III: Minimum Amplitude Principle (MAP)
The total amplitude of particle waves in space at every point always seeks a minimum. As a result, wave centers move or undergo frequency exchanges (energy exchanges) to approach a minimum value. Eg. particles of opposite charge move together because total wave amplitude is decreased:

        SUM $\{[A1 + A2 + A3 + ...+ An]\} = minimum$

where A1 – An are the wave amplitudes at a given point due to the particles 1 – n, respectively.

        Particles of an atomic nucleus (ie. protons and neutrons) are assumed to exhibite also a standing wave structure, with a higher Compton frequency and mass, of course, than in case of an electron.

4. Postulate:

        Ether has a capability to support propagation of waves. Two kinds of waves are considered in this context: a) Scalar inward /outward waves as stated in postulate 3. above; those longitudinal waves are also called "quantum waves" (or matter waves). The quantum waves provides for elementary particles a means to interact with other matter in the observable universe (ie. within Hubbles radius of about 13×10^9 light years). b) Electromagnetic waves (including light) that are composed of transversally modulated (polarized) quantum waves, as demonstrated in Appendix 2. The propagation speed (c) of the waves is inversely proportional to the local density of ether. Gravitational potential is suggested to be used as a measure for ether's local density. Hence, the speed of waves (c) is not absolutely constant in space, although its value is assumed be about 3×10^8 m/s in a free space. Appendices 2-4

demonstrate how the quantum waves enable gravitational and inertial forces between bodies throughout the universe.

Major consequencies of the postulates 1-4

As elementary particles are standing wave structures in ether, it means that atoms, molecules and larger bodies are composed of ether, ie. all matter is in fact created by ether and no discrete point-like particles are needed for constructing our universe – its all waves without wave-particle dualism.

Electromagnetic phenomena can be explained as interactions between quantum waves and electron's wave center. Electron's spin, charge and mass are not "mysteries" any more. There is no charge or mass substance in this concept. Faraday induction is a basic mechanism in electromagnetism. Electric and gravitational fields can be interpreted as gradient of ether's local density, as demonstrated in Appendix 2.. "Magnetic field" is not to exhibite such a physically measurable feature, ie. magnetic field remains as an "illusion", although it is still useful in mathematical formalism and in illustrating electromagnetic phenomena as a whole. On the other hand, deformation ("symmetry breaking") of electron's wave structure, as caused by a nearby electric current, can be regarded as a "magnetic" phenomenon that is effective in electric motors and generators we use in our everyday life. In Appendix 5. I have summarized the major findings of my "wave and ether based" approach. I have also presented a table for comparing the major features (merits) of Classic Electromagnetism and four "Wave Based Electromagnetism" concept theories.

Mach's principle is mentioned in postulate 3 above; it tells that "everything affects everything" in our observable universe. In addition, WSM model manifests also so called "zero energy principle" as presented by Edward Tryon (1973): It tells that the gravitational energy of a mass particle is equal to the negative of its mass energy [6]. This a bit amazing zero energy principle was predicted also by Richard Feynman in the 60s, and it is used as a postulate in Dynamic Universe model created by Tuomo Suntola [11]. As each particle has a mechanism (quantum waves) to interact with other particles in the universe, it explains naturally why Mach's principle and zero energy principle work with WSM model [6]. Appendix 3. gives an example of applying zero energy principle between an electron and the rest of universe. Mass (m) of a particle can be interpreted as particle's capability to "trap" free energy from space, ie. $E = mc^2$. Quantity c^2 denotes here gravitational potential produced by the universe.

Until now I have not discussed any "expansion" of the universe. If we take a look into electron model of WSM, we find that converging inward waves and diverging outwards waves accordingly are to create a system of particles that is not a "static" one in a conventional sense. In fact this system is a "dynamic" one, as convergence-divergence cycles of each particle are repeated in every 10^{-20} second, as determined by the Compton frequency ($f_c = m_e c^2 /h$) of electron, and this is assumed to happen throughout the observable universe within Hubble's radius (R). On the other hand, I don't exclude the possibility that Hubble's universe is also encountering an expansion process as a whole; I have proposed an expansion mechanism in Appendix 4, section F.

"Frame dragging" is an effect where a rotating body, such as earth, drags the "space-time" surrounding the body. In the framework of an ether based theory this means that a certain amount of ether in the near space of earth is rotating with earth, as demonstrated in Appendix 4. The frame dragging effect could be used to explain why Michelson and Morley obtained a "null result" in their interferometer experiments since 1887: there is no (noticeable) "ether wind" on earth's surface, as the ether there is rotating with earth (!). It is reasonable to assume that also other rotating celestial bodies behave like earth concerning the frame dragging. This scenario leads to an ether-body structure where each celestial body could have its own near space ether "cloud", and those clouds

are to form larger "clusters" of "invisible" ether clouds accompanied by their (visible) "materialized" celestial bodies respectively in the universe. In Appendix 4. I have speculated that an interface between two ether zones (clouds) may induce electromagnetic effects, ie. a perception of electric (E) and magnetic (H) fields, respectively (?). The density of ether is assumed to be highest close to massive bodies, as indicated by the magnitude of local gravitational potential (GM/r); this seems to be in agreement with Mach's principle too. The existence of ether "clouds" in the near space of celestial bodies sounds natural if we think that those bodies were created by the ether. Furthermore, it is interesting to note that ether's density gradient close to massive bodies is to explain the "curvature" of space, ie. the property manifested in General Relativity (!).

Given that the universe is composed of materialized bodies (including also smaller particles, and so called "black holes"), very large clouds and clusters of ether between the bodies and a huge amount of energy carrying waves (scalar ones and electromagnetic "photons") travelling throughout the space, there should be no need to hide mysterious things, such as "dark matter" or "dark energy", in our universe. Different appearances of ether energy are discussed more in Appendix 4, section F. Mechanisms of Quantum Entanglement and Teleportation as "mysteries" of quantum mechanics are discussed in Appendix 4, section E. "Higgs field" and "Higgs boson" of current models in particle physics are interesting scenarios that will deserve more attention also in the view of my ether hypothesis. Some kind of synergy between Higgs and ether /wave based concept may be useful, as the Higgs mechanism alone can not explain gravity, to take an example [16]. Synergy aspects of the "Higgs" and the "ether" are discussed more in Appendix 6.

To summarize, "ether" has been a mystery for more than 200 years, today ether is a hypothetical concept needing further studies. In Appedix 4. I have presented some experiments made since 1976, and I have interpreted the results of the experiments in order to explore the existence of the ether itself. The speed of light (c) is not constant, as it depends on the propagation property (ether density) of the local space. When an atom moves in ether, its internal medium density (ie. mass) increases; this explains why the frequency of an atomic clock is lower in motion than at rest and, hence, solves Einstein's "clock paradox" and enables the use of universal time without time dilation and length contraction. On the other hand, the concept of an "empty space" is definitely a paradox. "Magnetic field" as a concept seems to exhibit illusion-like features, although it is mathematically useful and an illustrative tool. The wave-particle duality is considered herein to be a paradox and an illusion, as everything can be explained by using just waves, as well as ether as a hypothetical medium.
Given the existence of an ether-like substance of our universe, we can state that nature , as well as manmade technology, works by creating /eliminating gradients (variations) in ether's (energy) density and respective forces. Furthermore, we can give a a new definition for the concept of field: "Field is ether's density gradient." High ether density manifests high potential energy for creating wave motion and even fundamental particles under appropriate conditions. Hence, "energy" and its gradient is the crucial property of ether, and every time we observe an energy transfer in nature, or "curvature" of space, we have got an indirect evidence that the fundamental substance of space (ie. ether) is there.
By this end, I have to emphasize that although I am using ether and wave based concepts throughout this booklet, ether-like substance of space and an idea of "wave nature of matter" are not my personal inventions. What I have tried to do is to refine those two concepts to describe the mechanisms behind the physical phenomena, such as electromagnetism, inertia and gravity, inc. "curvature" of space that is postulated in General Relativity theory.
The major results of this ether/wave based study are compiled in the Table below where a comparison is made with Modern Physics and Standard Cosmology (whenever applicable). However, there is still one question without final answer: "Who has created the ether, as well as the entire universe ?" In the meantime, we can use tentative answers, such as "Nature", "Big Bang", "God"...

Table: Comparison of modern physics/ standard cosmology and ether/wave based model

Item	Modern physics/ standard cosmology	Ether/wave based model
1.	Medium of space is initially assumed to be "empty" space of vacuum – with the exception of unknown concepts such as "dark matter" and "dark energy" hiding in the universe. The concept of "Higgs field" may open new views to medium of space (?)	Medium of space is assumed to be a fundamental substance called "ether", ie. space is not empty. Ether and its wave motions can be used as means to explain "dark matter" and "dark energy", as observed in the universe.
2.	The velocity of light (c) is postulated to be a physical constant.	The velocity of light (c) depends on the local density of ether. Gravitational potential is proposed to be used as a measure of ether's density.
3.	The substance of fundamental particles is not defined (it is unkown).	Fundamental particles are wave structures created by ether.
4.	The origin of "energy" is not clearly defined. (Higgs concept may provide some help ?)	"Energy" is ether's capability to create wave motion and fundamental particles.
5.	"Mass" is a form of "energy" ($E = mc^2$). In particle physics "Higgs boson" is assumed to mediate mass from "Higgs field" to particles	"Mass" of a particle describes particle's capacity to "trap" free energy from ether of space ($E = mc^2$)
6.	Does not explain the origin of charge and spin of fundamental particles and how they generate electromagnetic and gravitational fields and waves.	Explains the mechanisms of generating charge, mass and spin for fundamental particles and how electromagnetic and gravitational fields and waves are generated.
7.	"Fields" are more abstract mathematical concepts than definite physical quantities, although we can measure impacts of "fields" via gravitational and electromagnetic interactions.	"Field" is defined as ether's density gradient. This definition is valid for electric and gravitational fields.
8.	The ultimate origin of gravity and inertia is unknown; this applies also to "Higgs" mechanism.	Gravitational and inertial forces on particles are explained by the interaction between particle's wave structure and waves from other particles in the universe.
9.	Relies on wave-particle dualism for fundamental particles and waves (photons). Quantum Entanglement is predicted in quantum theory and verified experimentally.	Fundamental particles (electrons, protons, neutrons) naturally incorporate wave aspects in their structures. This enables a mechanism to support Quantum Entanglement, too.
10.	"Curvature" of space is postulated in General Relativity theory; this feature is used to explain gravity. Accelerated expansion of universe is assumed to be related to the existence of "dark energy".	"Curvature" of space is a consequence of ether's density gradient close to massive bodies and leads to perception of gravitational forces on particles. Accelerated expansion of universe is considered as joint effect of "dark energy" and "dark matter".
11.	The "flow of time" depends on the motion and gravitational state of the object relative to an observer.	"Time" (and length) itself can be defined as absolute. However, frequency of an atomic clock depends on its gravitational state and motion (see Einstein's "clock paradox").

Quantum Wave Structure of Matter (WSM)

The Wave Structure of Matter (WSM) model is an emerging fringe theory in the category of theoretical physics. The concept of WSM was proposed first time about 1870 by William Clifford and later (about 1930) by Erwin Schrödinger. Those early pioneers pointed out that what we observe as large scale particle-like matter, is only the "appearance" of wave structures in space. Since 1985, Milo Wolff and others have created a mathematical basis of Wave Structures. The theory of WSM is based upon an idea of wave medium in all space of the "observable" universe. [3], [4], [5], [6].

The particle, or building brick, of the WSM is a spherical standing wave with an amplitude decreasing with distance from the wave center. This wave has the character of a quantum wave. The particle is regarded as the entire wave structure but its location is the quantum wave center when observed. This fundamental structure is an electron or positron, depending on whether the amplitude in the wave center represents a value of negative or positive "charge". The spherical standing wave structure is illustrated in figures below.
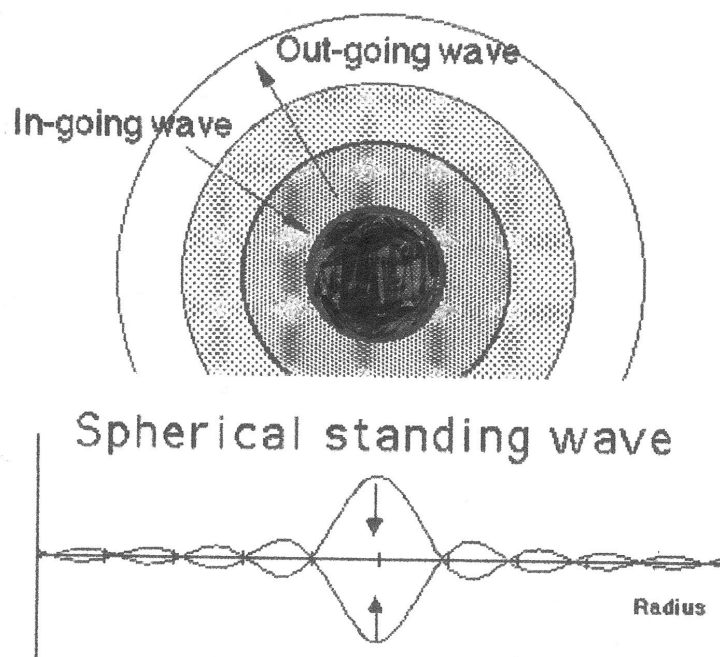
Fig.1: Electron Structure [4]. The upper diagram shows a cross section of the spherical wave structure, something like the layers of onion. It is comprised of an inward moving wave and an

outward moving wave. The two waves combine to form a single dynamic standing wave structure with its center as the nominal location of the electron. The amplitude of a quantum wave is a scalar number, not an electromagnetic vector. Thus these waves are part of quantum theory, not electric theory. At the center the quantum wave amplitude (and the electric potential) is finite, not infinite, in agreement with the observed electron. The lower diagram shows the same quantum wave amplitude plotted along a radius outwards from the electron center. The lover diagram is a slice from the upper diagram.
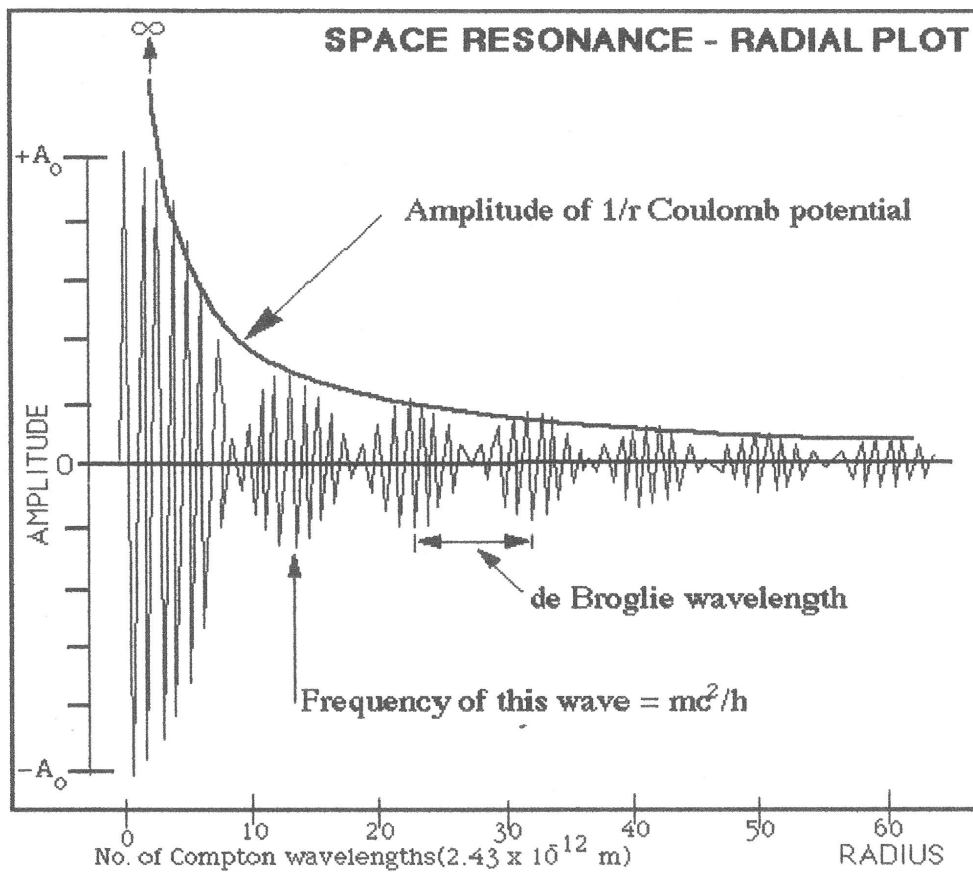

Figure 2. Radial Plot of the Electron Structure.

Fig. 2: Radial Plot of the Electron Structure [4] [5] [6]. When In and Out waves combine they form

a standing wave. This detailed plot, the same as the approximate lower plot of Fig.1 above, corresponds exactly to the equation below. The envelope of the wave amplitude matches the Coulomb potential everywhere except at the center, where it is not infinite in agreement with the observations of Lamb and Rutherword. If the electron were moving and observed by another detector atom with relative velocity v, the deBroglie wavelength (h/(mv)) appears as a Doppler effect on both waves. The frequency mc^2/h of the waves was first proposed by Schroedinger and deBroglie, proportional to the mass of the electron.

The following three principles are used to describe the Quantum Wave Structure of Matter (WSM):

– **Principle I: The Wave Equation**:

$$\blacktriangledown^2 A - 1/c^2\, \partial^2 A/\partial t^2 = 0$$

- The governing equation of matter waves traveling in space at velocity c.

– where A is the amplitude of the wave. This wave equation has two solutions: In Wave (propagating towards wave center) and Out Wave. Those two waves have opposite phases and they form a standing wave, so called "space resonance", around the wave center of the particle. When In Wave reaches the wave center of the particle it rotates the wave center clock wise (CW for electron) or counter clock wise (CCW for positron) and encounters a phase shift of 180 degrees to become Out Wave; this rotation is to create a quantised spin for the particle.

– **Principle II: The Wave Density Principle**

The propagation property of the space "ether" can be described as proportional to a density of space. The density of space at a given point is proportional to the sum of the densities of all the waves from all the particles in the universe which have arrived at that point, in accordance with Mach's Principle. The wave amplitude of any particle at that point shall be included. The frequency (or mass m x c^2 = hf) of the waves of an electron is proportional to the space density:

Space density is proportional to: constant x SUM $[(amp_n / r_n)^2] = mc^2 = hf$

where r_n and amp_n are the distance and amplitude of each particle wave center.

In most of the space, the total density from all n particle waves is almost constant, because of the huge number of particles in the universe. Hence, the propagation speed c, the electron mass m and its frequency f are nearly constant everywhere, as observed. However, the space density is significantly larger only at the center of each electron due to the electron's own wave density.

– **Equation of the Cosmos:**

The correctness of Principle II above can be tested using astrophysical measurements because the radius of the visible /observable universe and the number of particles (mostly Hydrogen) there are approximately known. If an electron's own waves are to have any significant effect on space density at its center, then that density shall be roughly equal to the total density due to all the waves from the other particles in the universe. This requirement results in the following Equation of the Cosmos:

$$r_e^2 = R^2 /3N$$

where r_e = radius of electron, R=radius of visible universe, N=number of particles in the universe

- **Principle III: Minimum Amplitude Principle (MAP)**:

- "The total amplitude of particle waves in space at every point always seeks a minumum. As a result, wave centers move or undergo frequency exchanges (energy exchanges) to approach a minimum value. Eg. particles of opposite charge move together because total wave amplitude is decreased":

$$\text{SUM } \{[\ A1 + A2 + A3 + ...+ An\ ]\} = \textbf{minimum}$$

where A1 – An are the wave amplitudes at a given point due to the particles 1 – n, respectively.

There are many applications of the Minimum Amplitude Principle (MAP) in particle physics. One example is the formerly mysterious Pauli Exclusion Principle which states that "no two identical particles may occupy the same state".

- **The Energy Exchange Mechanism**:

Principle II above shows that the density of the propagation medium at the center of each particle is large, thus exhibiting an effect of "non-linearity" (ie. reduced propagation speed) at wave centers. This non-linearity causes two particles to interact by mixing their wave frequencies, thus providing an energy exchange mechanism.
The exchange mechanism of wave centers provides properties a particle must have: communication means by In /Out Waves, it mimics "charge" and "mass". As a consequence, the old concepts of particulate "mass substance" and "charge substance" are no longer needed or useful.
Atoms and molecules are compositions and interactions of the standing waves, thus matter only exist at discrete frequencies and energy states.

- **Conservation of Energy law**

Energy is exchanged in nature by two resonances (oscillators) interacting with each other. For oscillator pairs known in nature, significant coupling occurs only if both may have the same resonant frequency. If one oscillator changes its frequency upwards, the other have to change downwards. Thus, the frequency and energy changes of interacting space resonances are equal and opposite in its direction. This results in the Conservation of Energy law.

It shall be noted that matter waves discussed herein are not the same as electromagnetic waves. On the other hand, the electromagnetic vector fields are large scale appearances of many discrete energy exchanges of the scalar quantum waves. Reference [7] gives a more detailed insight into how electromagnetic waves (as we have imagined those classic concepts of quantum electrodynamics) are created by atoms, as well as by resonators and antennas in a larger macroscopic scale, based on concepts of wave functions and "wave based electromagnetism" as a whole.

APPENDIX 2.:   EXPLORING WAVE AND ETHER BASED ELECTROMAGNETISM

A. Electromagnetic Induction and wave Propagation Scenarios

In the classic theory of electromagnetism we have assumed that sources of electromagnetic phenomena are point-like particles with unknown charge (and mass) substance. Maxwell's equations and other empirical formulas are used to "model" the phenomena observed. Hence, the ultimate mechanisms behind the observations have been unknown. The scenarios to be proposed here are in fact the same ones we have used for classic point particle concept of electron. However, the wave based electron concept, as described in Appendix 1, provides inward and outward waves as a means to interact with other electrons in the surrounding medium. There is no charge or mass substance in this concept.

Scenario of Fig.1. below represents a case of classic Faraday induction. When the standing wave structure of an electron moves, eg. accelerated by a current I(t) in a source (primary) circuit, an interaction may take place with other (secondary) electrons (in their wave centers) close to the primary source of the current. This interaction is perceived as an occurrence of *electrokinetic field*:

[8]

$$\mathbf{E_k} = - 1/4\pi\varepsilon_0 c^2 \int 1/r \, [\delta\mathbf{J}/\delta t] \, dv' \qquad (1)$$

ie. a phenomenon we have considered as "electromagnetic induction" since the 19th century when Faraday and Maxwell et al created their famous theories.

Referring to "inertia and gravity", electrokinetic induction has basically the same origin while maintaining a balance between frequencies of Inward and Outward waves. The role of electrokinetic field is to accelerate free electrons in order to achieve the balance. In this interaction instance the "spin" of the secondary electron may rotate a bit faster or slower depending on the orientation and magnitude of vector E_k.

It is noticeable also that wave based interpretation above is in good agreement with the causality aspects of electromagnetic induction, as concluded by Jefimenko [8]. The finite propagation speed (c) of the inward and outward waves of an electron, on the other hand, explains the "retarded" (delay) effects that may be of interest when the source current I(t) is changing very abruptly and/or the distance separating the primary and secondary circuits is large; that is the case in the radio transmission scenario in Fig.1. below: To propagate an interaction between transmitter and receiver circuits, energy transfers, ie. excitations and emissions, are needed between electrons bound by atoms (or molecules) located along the transmission path linking the transmitter and receiver. When the source current I(t) is modulated by a signal of radio (or optical) frequency f_1, electromagnetic and electrodynamic interactions in the transmission medium concerned take place at frequency f, and the receiver will finally observe (demodulate) a signal at this same frequency f.

Concerning the scenario above, Carver Mead has considered the energy transfer mechanisms involved herein in more details in his book "Collective Electrodynamics – Quantum Foundations of Electromagnetism" [7]. Instead of considering a movement and energy transfer mechanism associated with just a single electron or atom, we have to keep in mind a collective behaviour of those major items while discussing electrodynamics and electromagnetic phenomena as a whole. It shall be noted that this mechanism of producing transversal electromagnetic (ie. electric) waves from originally longitudinal scalar waves by transversally moving charges has been predicted also in Ref.[13].

While taking a look into electromagnetism on the basis of Jefimenko's book [8], we may have got a feeling that magnetic quantities H and B are not of great importance concerning the actual effects we really observe as electromagnetic induction or wave propagation. Using the wave based electrodynamics we may interprete a magnetic interaction as "accumulation of phase of electron's wave function" in a unit time [7]. Furthermore, Ref. [13] does not suppose any (observable) magnetic component to be invoved in electromagnetic waves generated and propagated in the ether proposed. Hence, in this context we could conclude that magnetic fields (H,B) are more of

"metaphysical" origin.

B. Electric and gravitational field concepts in ether - scenarios

Fig.1. illustrates a case where a radiating source antenna (eg. a radio transmitter) produces an electromagnetic wave, ie. spatially and temporally alternating density (W) in the propagation medium of "ether". In accordance with a classic definition of the electric field E (at a certain instant) we may write:

$$E = (1/e) \, dW/dx \qquad\qquad (2)$$

where ether's density gradient dW/dx is in fact the force (F) applied to an electron with charge e.

radiating source antenna

sinusoidal em wave radiated

E(t) electric

t

H(t) magnetic

**In
"matter
waves"**

Out

**electron's wave structure;
Compton wavelength λ_c
electric field E=(1/e)dW/dx**

observer antenna

free electron encountering Faraday induction

F=dW/dx

x

ether's density W

**slope due to local grav.
potential gradient**

source current   **$I(t) = I_0 \sin (2\pi ft)$**

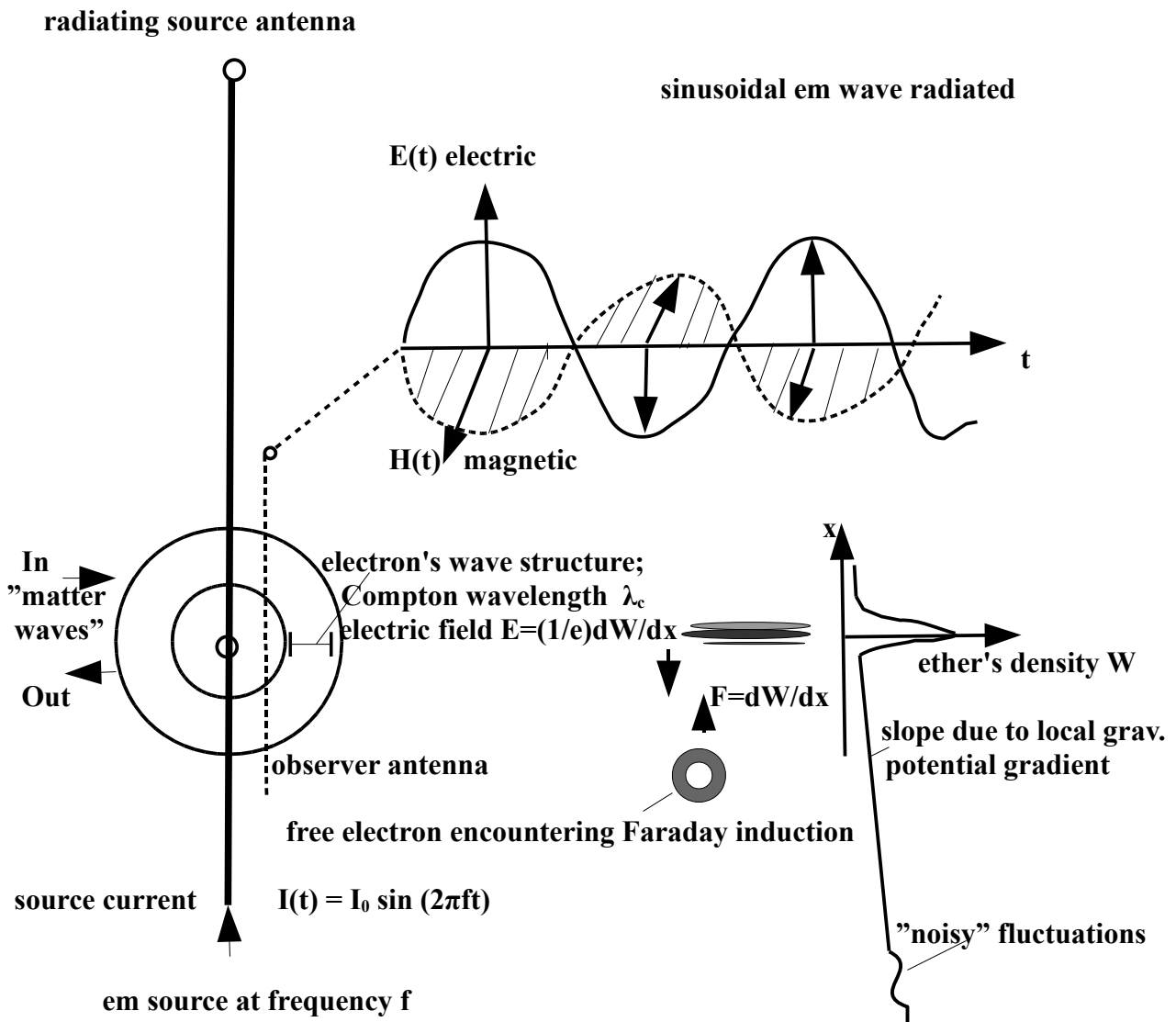**"noisy" fluctuations**

em source at frequency f

Fig.1: Electric field concept in ether with local gravitational potential gradient

We have considered the generation of electric field from a macroscopic point of view, ie. any fine structure produced by the quantum waves propagating in the ether is not shown in the dW/dx diagram of Fig.1. On the other hand, electric field is a small scale dynamic phenomenon compared to that of gravitational one which is to cause the "static" slope in ether's density curve W(x), as shown in Fig.1.. Anyway, the fundamental requirement for electric and gravitational field is the existence of ether's density gradient (dW/dx). The dynamic property of the electric field is determined by the electromagnetic source (a radio transmitter, eg.) responsible for transversally modulated ("polarized") quantum waves, while gravitational field typically stays in its steady state value as determined by a massive nearby body (earth, eg.) emitting a huge amount of "scalar" quantum waves through the ether with a gradually changing density. Hence the mechanisms behind electromagnetic fields and gravity are strongly related to each other (!).

Referring to discussions of scientists, it seems that, in addition to waves at discrete frequencies, the space around us is occupied by noise-like phenomena, such as "quantum fluctuations", "vacuum energy", "zero point energy", "dark energy" - and not forgetting "cosmic microwave background radiation (CMBR)" that is assumed to be a consequence of "Big Bang". Hence, by using proper electronic instruments we can detect a multitude of "electric noise" in the space medium (ether) filling the universe (see Fig.1).

APPENDIX 3.

Electron's spin and Electric /Gravity force ratio (Fe/Fg)

Electric /Gravity force ratio (Fe/Fg) is a quantity having its role in the history of physics during the last century. Typically this quantity has been defined for two charged particles , eg. electron and proton. In this case Fe is electric (Coulomb) force and Fg is gravity force between the particles; textbooks of physics state that Fe/Fg = 0.23 x10^{40} [12]. Anyway, this figure demonstrates an enormous magnitude of the electric interaction between charged particles compared to that of the "tiny" gravitational interaction.

This document is to explore the origin of Fe/Fg ratio in the view of "wave based electromagnetism" that is in the focus of the present study. To proceed, lets take a look into Fig.1. a) below:
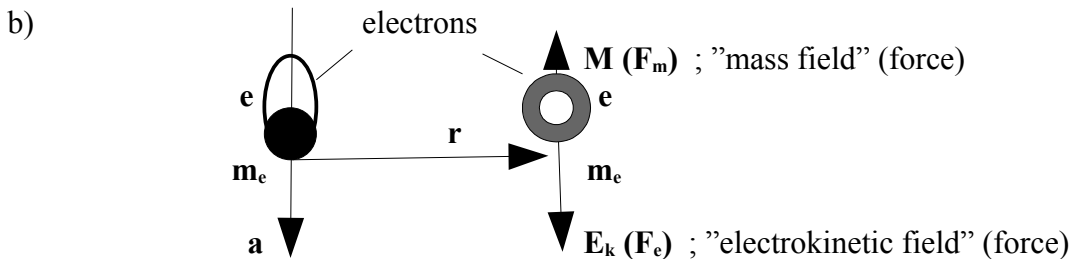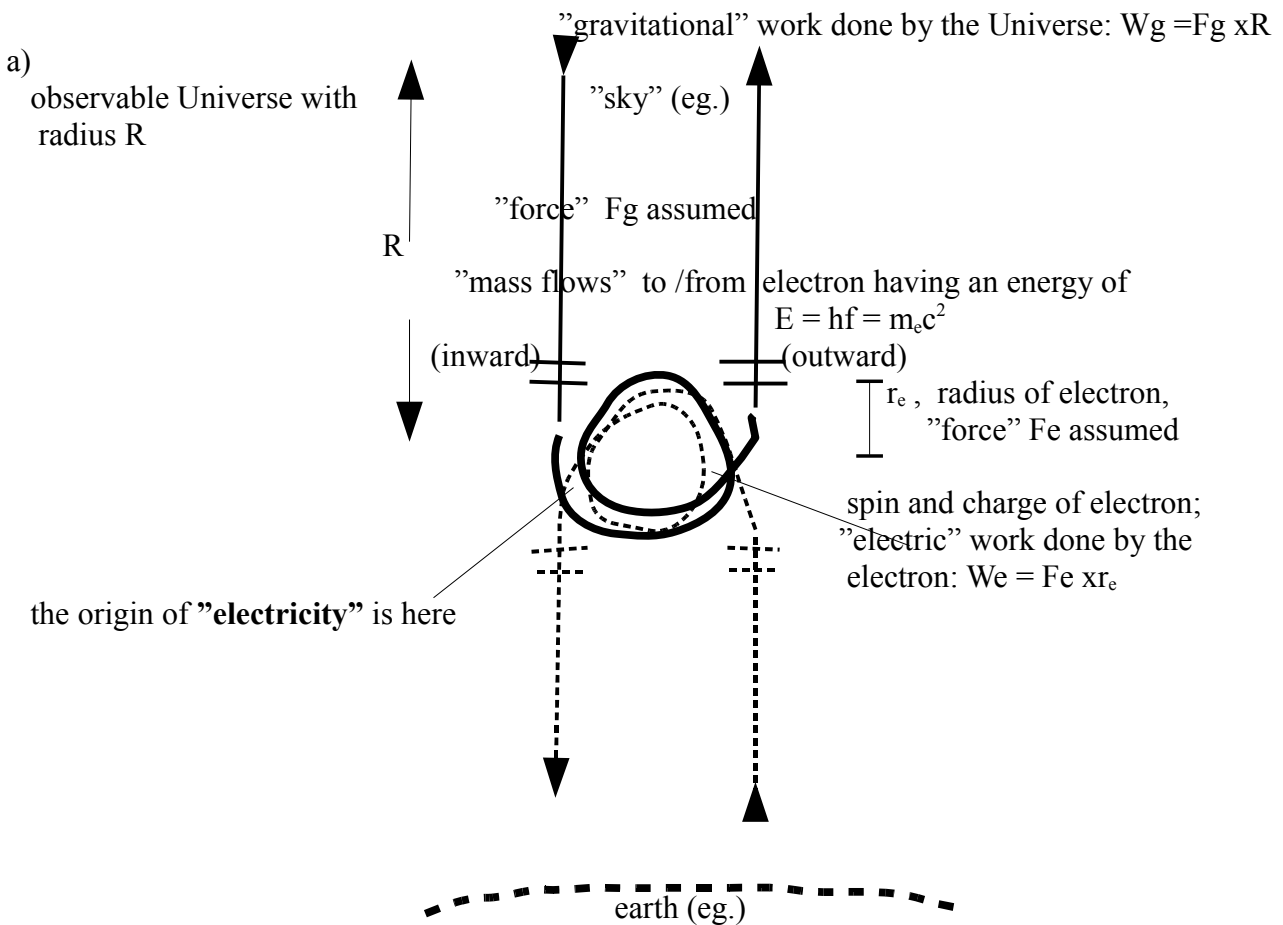

Fig.1: How the Universe (inc. earth and "sky") provides spin, charge and "mass" (energy /frequency) for an electron; origin of Fe/Fg ratio and its applications.

The process described in Fig.1. a) is as follows:

It is assumed here that the Universe (with radius R) creates a "gravity force" Fg. This force drives a "mass" (or energy) flow carried by quantum /matter inward waves propagating in ether. When the inward wave hits an electron it generates there "spin" and "charge" properties of electron by rotating the wave (two rounds) until it becomes the outward wave. The spin activates an "electric force" Fe within the electron having radius of r_e . The electric force pushes a "mass" flow of outward waves towards the rest of the Universe. Hence, it seems that the electron transforms a gravity force Fg to an electric force Fe and once again to a gravity force Fg that is able to lift the "mass" flow of ether (carried by outward wave) back to the Universe. I refer here to the welknown "water fall" analogy.
From energetic point of view, we can conclude that the electric work (We) done by the electron (spin) is equal to the gravitational work (Wg) done by the Universe. This means that

$$Fe \; x r_e = Fg \; xR \qquad\qquad\qquad (1)$$

As a consequence , we can write

$$Fe \, /Fg = R \, /r_e \qquad\qquad\qquad (2)$$

Hence the Electric /Gravity force ratio (Fe /Fg) seems to be the ratio of the radius of the observable Universe and electron, respectively (!). According to reference [4] we can calculate:
Fe/Fg = $1.7 \; x10^{40}$.
Just to mention that an estimate of Fe/Fg = $1.2 \; x10^{40}$ was obtained based on experimental and theoretical studies as presented in my paper "Propagation of Electromagnetic Waves in Turbulent Troposphere" (to be published in Galilean Electrodynamics in a due course).

My conclusion is that Fe /Fg ratio is not just a figure, it connects the origin of gravity to the origin of electromagnetism. The quantum /matter waves propagating trough the ether of the Universe serve here as intermediate mechanism that is able to create both gravitational and electromagnetic phenomena we can observe in our everyday life.
Furthermore, concerning gravity forces observed between bodies (eg. an electron and the earth) , I refer to Fig.1: If there is an imbalance between the "mass" (or energy) flows from different directions (say from earth and "sky", respectively) the body concerned (eg. electron) tends to move towards the origin of accelerated mass flow; this is to compensate for the imbalance. As a consequence, small bodies (like electrons and humans) close to the "massive" body of the earth will fall down , instead of flying to the sky (**Note1**.). On the other hand, if we try to move (accelerate) a body in rest we will experience so called "inertial force" that tends to keep the body in its original position.

Fig.1. b) demonstrates a case where I have compared electric and inertial forces between two electrons. The left electron is in accelerated motion (a) and the right electron is subject to (induced) electric (F_e) and inertial (F_m) force accordingly. Based on references [6] and [8], the following equations can be derived for the induced forces:

(electric force) $\qquad F_e = e^2 \, a \, / \, (4\pi\varepsilon_0 \, c^2 \, r)$ $\qquad\qquad\qquad (3)$
(inertial force) $\qquad F_m = m_e^2 \, a \, G \, / \, (c^2 \, r)$ $\qquad\qquad\qquad (4)$
where G is gravitation constant

Hence, the ratio of forces $\quad F_e \, /F_m = \; e^2 \, / \, (m_e^2 \, 4\pi\varepsilon_0 \, G)$ $\qquad\qquad\qquad (5)$

After calcullculation we obtain $F_e / F_m = 0.42 \times 10^{43}$

It shall be noted that for electron -proton interaction case $F_e / F_m = 0.23 \times 10^{40}$ would be obtained. This is in fact the same figure as stated for "static" Fe/Fg -ratio in textbooks [12]. The lower F_e / F_m -ratio (or Fe/Fg -ratio) for electron -proton pair is due to the higher mass of proton, ie. $m_p = 1840 \times m_e$.

Apparently, it seems that "static" gravitational forces (masses) behave in the same manner as "dynamic" inertial forces (masses) in comparison to electric forces, whether they are static or dynamic ones. Furthermore, we can interpret Faraday induction as a result of Coulomb law and relative motion between the charges involved; this should not be a big surprise, I think.

Note1 on gravity effect and its cause in the vicinity of earth (eg.):
Outward waves from earth propagate towards an ether with lower density and, hence, these waves are accelerating with $g = 9.81$ m/s^2 . A body (eg. an electron) in the vicinity of earth will see those accelerated waves as its inward waves and the body concerned reacts to this condition by moving with acceleration a = g towards earth. In fact, the gravity (and inertia) effect is very similar to that of Faraday induction; now the quantum waves concerned are longitudinal (scalar) ones instead of transversally modulated ones that is the case in electromagnetism.

"Fe/Fg -ratio for Deuterium atom"

Finally, I consider the appearance of Fe/Fg -ratio in case of atoms comprising electrons, protons and neutrons. Fig.2. presents a Deuterium atom having one electron and one proton + one neutron in its nucleus with a mass of $m = m_p + m_n$ (electrons mass m_e is very small here).
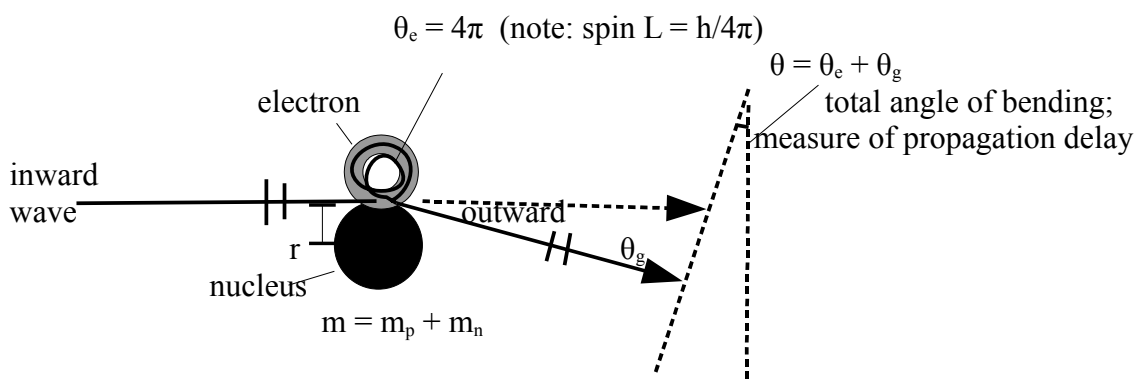

Fig.2: Determination of Fe/Fg -ratio for Deuterium atom

I imagine that a quantum /matter wave enters the electron causing the "spin" effect with the bending angle of $\theta_e = 4\pi$ (ie. two full rotations of the wave within the electron) [6]. In addition, the wave will experience the gravity of the nucleus and a bending angle of

$$\theta_g = 4Gm / (rc^2) \qquad\qquad (6)$$

as stated by Albert Einstein et al since 1915.

It is reasonable to assume that a bending angle (θ) is proportional to the radial force (F) causing it. Hence

$$Fe/Fg = \theta_e / \theta_g \qquad\qquad (7)$$

By assuming r = 10^{-14} m , we obtain Fe/Fg = 1.27 x10^{40}

As expected, the total angle of bending , and the excessive propagation delay as compared to "vacuum", is mostly caused by the "spin" effect of the electron where an inward wave rotates 4π rad (= θ_e) to become an outward wave. Hence, if someone says that electron's spin is responsible for the refractive index (n = c/v) of dielectric materials, its easy to agree with him/her.

This calculated Fe/Fg figure is very close to my experimentally (7GHz microwave propagation in troposphere) obtained estimate of Fe/Fg = 1.2 x10^{40} [1] [2] [19]. It shall be noted that in a real atmosphere Nitrogen (N) and Oxygen (O) atoms are the main contributors concerning the propagation delay, and they could be considered as multiples of a Deuterium atom in this case.

APPENDIX 4.

EXPLORING THE EXISTENCE OF ETHER ITSELF

For the present, the existence of "ether" as a concept throughout this study has been a hypothesis without referring to a specific experimental evidence. Hence, its time to present known relativity related experiments made in the vicinity of earth using atomic clocks and gyroscopes in a spacecraft.

A. Gravity Probe A (GP-A) experiment; gravitational blueshift of atomic clocks

Albert Einstein predicted in his special relativity theory that fractional frequency shift of an oscillator is

$$\Delta f/f = (\Phi_2 - \Phi_1)/c^2 \qquad\qquad (1)$$

where Φ_1 and Φ_2 are gravitational potential ($\Phi = -GM/r$) in location 1 and 2 respectively, M is mass of earth, G is gravitational constant and r is distance from the center of earth.

Referring to Postulate 4 in the main text, it is suggested that the frequency of an oscillator is connected to the local speed of light: Atomic oscillators are composed of electronic / optical circuits whose resonance frequency depends on the local propagation speed of electromagnetic and quantum waves (inc. light) that, on the other hand, shall be determined by the local "density of space medium" concerned.

One objective of Probe A experiment (NASA, 1976) was to confirm Einstein's prediction for oscillator's "blueshift", as given in formula (1). The principle of the experimental system is shown in Fig.1. [11], [14]. A Hydrogen maser oscillator (atomic clock) was sent in a spacecraft by a rocket to an altitude of h = 10 000km along a nearly vertical trajectory. The frequency of the oscillator onboard was sent via a radio signal to the Earth station where a similar Hydrogen maser was used as a reference for frequency comparison. To compensate for the Doppler effect in the radio signal above, an additional two-way radio signal path was used between the Earth station and the spacecraft. The flight of the Probe A lasted about two hours. The experiment confirmed Einstein's prediction in formula (1) with an uncertainty of 0.01%. The maximum fractional frequency (blue)shift obtained in that experiment was about 5×10^{-10} . It shall be mentioned herein that Hydrogen maser was one of the most accurate (fractional frequency error is about 10^{-14} , or less) and stable frequency standards (clocks) at that time (1976).

On the basis of the experiment above, I conclude that there exists in space a "medium" that can alter the propagation speed of electromagnetic waves (inc. light) depending on the location and, hence, on the local "density" of that medium. If we try to measure the local speed of light we need a clock whose frequency, on the other hand, depends also on the density of the medium concerned. Thats why we may come to a conclusion: "The speed of light is a constant as a measured quantity !"
By this end, I propose to use the magnitude of gravitational potential (Φ) as a measure for the local density of space medium that I call "ether".
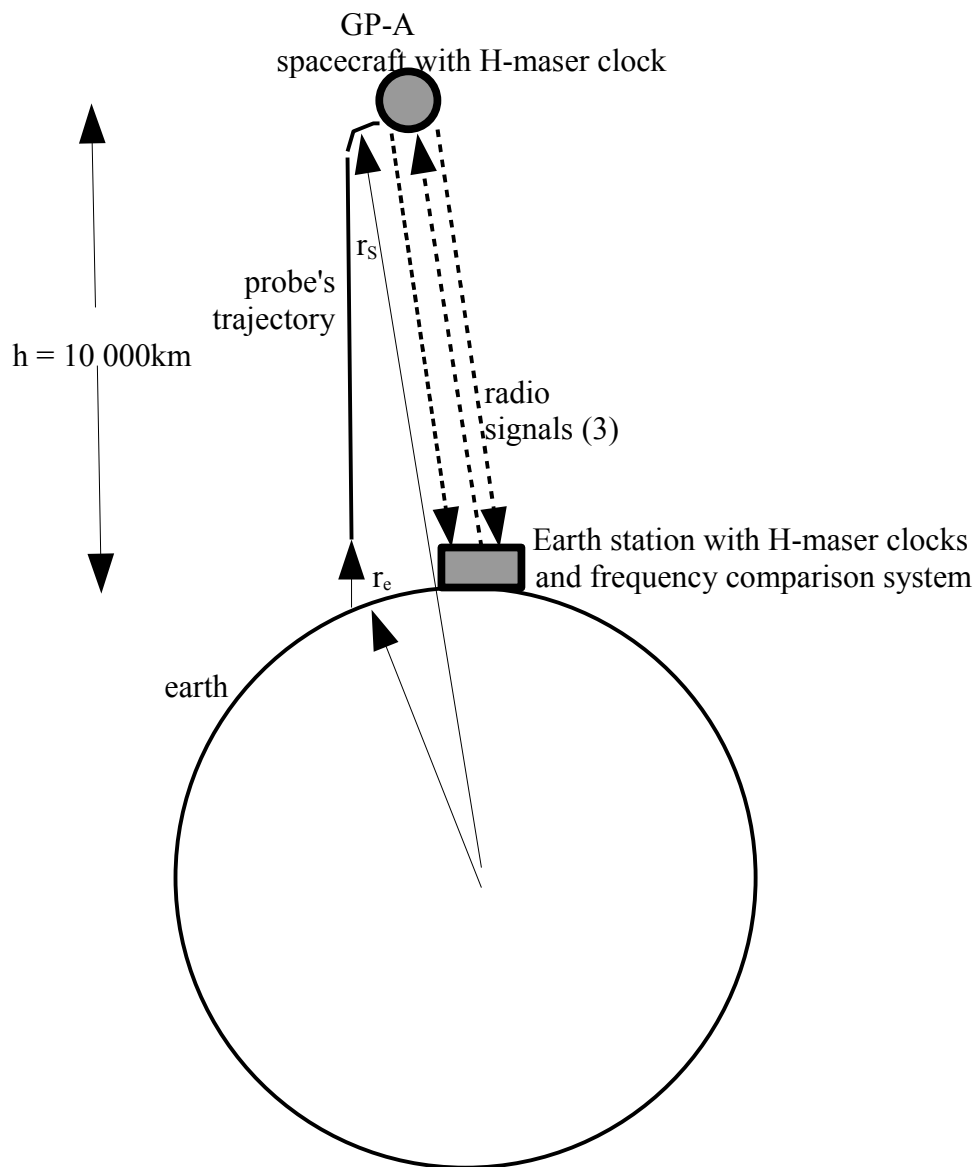
Fig.1: Experimental system (GP-A) for measuring gravitational blueshift of H-maser clock

B. Gravity Probe B (GP-B) experiment; geodetic and frame dragging effects around earth

GP-B experiment's mission (2004 – 2011) was to investigate two gravitational effects predicted by Albert Einstein (1916) in his general relativity theory:

a) The geodetic effect; the amount by which the earth warps the local spacetime in which it resides.
b) The frame dragging effect; the amount by which the rotating earth drags ("twists") its local spacetime around with it.

The objective of GP-B experiment carried out by NASA and Stanford University was to test those two effects by measuring the deflection angles (precession) of the spin axes of the four gyroscopes ("gyros") housed in a satellite orbiting 642km above the earth (Fig.2). A telescope placed in the

satellite enabled to align the satellite towards the "Guide Star" of Im Pegasi. The experimental results over a period of one year were compared to predictions given by Schiff's formula that was derived from Einstein's theory [15]:

total precession of gyro $\Omega = 3GM (\mathbf{R \times v}) / (2c^2 R^3) + GI/ (c^2 R^3) [3\mathbf{R} (\boldsymbol{\omega} \cdot \mathbf{R}) /R^2 - \boldsymbol{\omega}]$ (2)

                            (geodetic precession)   (frame dragging precession)

where G= gravitational constant, M = mass of earth, I = earth's moment of inertia ($I= (2/5) Mr^2$), ω = earth's angular velocity, R = instanteneous distance of the gyroscope (from earth's center) and v = velocity of the gyroscope while orbiting the earth.

Before going into numerical results of the GP-B experiment, it is interesting to interpret the formula (2) in terms of the "ether" concept as adopted previously in the context of GP-A experiment above.

Geodetic precession:

–   The first term of formula (2) indicates that geodetic precession is proportional to $1/R^2$ (and to g = GM/R^2 accordingly), ie. to "density gradient" of the space medium called "ether" herein. This result is obvious as the satellite moves at the velocity v through the "ether" that tends to tilt (slighly) the axis of the gyroscope due to the (small) vertical density gradient of the "ether".

Frame dragging precession:

–   The second term of formula (4) exhibits two simultaneous activities: the one associated with distance (radius) vector R, and the other associated with earth's rotation velocity $\boldsymbol{\omega}$ that is a vector too. The resulting "force" that tends to tilt the axis of the gyroscope is a combination of those two factors. Anyway, its seems that frame dragging precession is proportional to 1/R and $1/R^2$ at the same time. This implicates that the local density (1/R) of ether will push the gyroscope in the direction of earth's rotation, and the density gradient ($1/R^2$) tries to tilt the axis of the gyroscope. This kind of behavior seems to be obvious if we think that the gyroscope is moving in the ether having vertical density gradient and rotating with earth at the same time. Anyway, the magnitude of frame dragging precession is predicted to be very small compared to geodetic one (that is quite small too).

For the polar-orbiting GP-B satellite the following experimental results were obtained in the course of one year and 5000 orbits around the earth:

For geodetic precession: 0.0018 degrees with an uncertainty of 0.5%.
For frame dragging precession: 0.000 011 degrees with an uncertainty of 19%. (**Note1.**)

The results above were consistent with Einstein's theory by taking into account the experimental uncertainties given. It shall be noted that in case of frame dragging effect the reported uncertainty of 19% is quite large (Note1.). On the other hand, this is the first time scientists could measure the frame dragging effect in a direct way that is to confirm the theory at a predictable level of confidence. The gravitational effects confirmed above leads to a conclusion that mechanical oscillators (eg. clock works that are not driven by gravity force) experience a blueshift similar to that of electric/optical oscillators, as oscillation rate is a bit higher in low density ether (!).
As the ether – or the"spacetime" - existing in the near space of earth rotates with the earth, it is obvious that there is no noticeable "ether wind" on earth's surface. This feature of earth's near space is to explain (on its part) why Michelson and Morley failed with their interferometer experiments

(since 1887) while attempting to measure such a "wind". On the other hand, a "null result" was expectable anyway, as both the "measuring arm" and the "reference arm" of the interferometer were immersed in the same local "ether" and, hence, with the similar wave propagation properties.
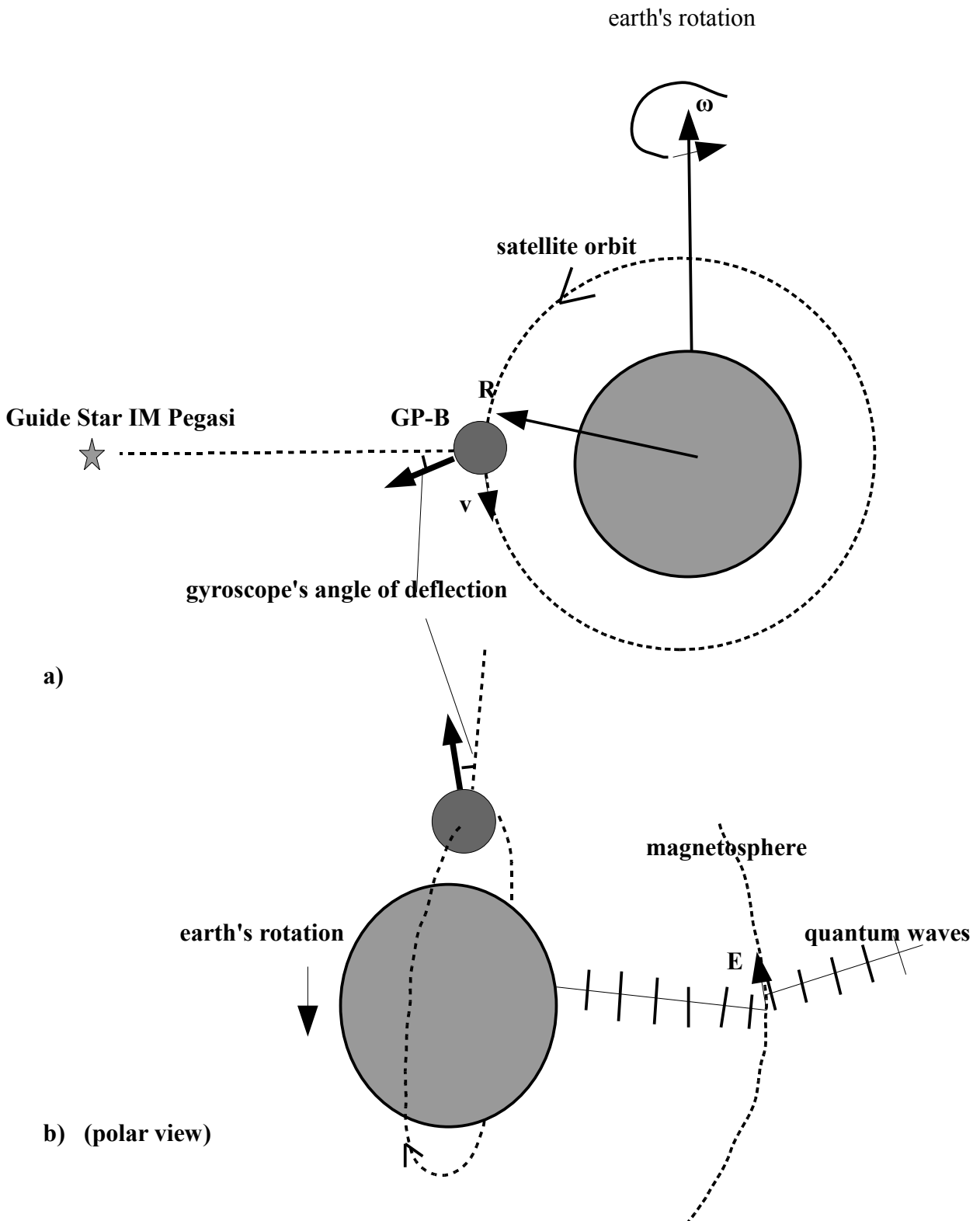

Fig.2: GP-B experiment; observing a) geodetic and b) frame dragging effect around earth

Frame dragging is sometimes renamed as "gravitoelectromagnetic" effect, as it behaves like electromagnetic (Faraday) induction. The "wave based" concept adopted in the present study gives grounds to think that the physical mechanism illustrated in Fig.2. b) may be capable to produce also "real" electromagnetic effects:

Quantum waves emitted by the earth travel first trough the "frame dragged ether" surrounding the earth and penetrade then the "non-dragged ether" of outer space. At the boundary between those two zones of space ether quantum waves will experience some "slips", ie. they are transversally modulated and, hence, tends to induce a (horizontal) electric field E there. Furthermore, a properly calibrated electronic instrument (eg. magnetometer) could indicate here some vertical "magnetic field H" too. Given the scenario above, we could imagine a new potential mechanism for generating a magnetic field within earth's "magnetosphere" – in addition to the traditional "Dynamo" model we have used during the last century (?).

- **Note 1**: Before GP-B experiment (2004) the frame dragging effect was measured in long lasting (about 10 years) experiments by using passive satellites of LAGEOS and laser range measurements in earth based stations. The reported uncertainty of the measurements was about 10%, ie. better than that of GP-B (!). Although the experiments conducted during the last twenty years seem to indicate the existence of frame dragging effect itself, the degraded accuracy of measurements sets a clear challenge for future efforts. To improve considerably the accuracy (targeted even below 1%) of frame dragging results italian scientists launched a new satellite of LARES in February 2012.

C. Concluding remarks on the existence of ether

The experiments above have proven that at least in the near space of the earth there exist a medium with a slighly variable density that can support wave propagation and alter the speed of electromagnetic waves (inc. light) accordingly. Secondly, around the earth there exist a medium that is capable to cause some small gravity related forces to the bodies moving in the near space of the earth. In fact, those effects implicate that motion of electrons and other particles is affected by the density of the space medium, as the particles are composed of waves in that medium (!). It shall be noted, that in this framework the conventional "Newtonian" gravity force between two bodies is due to (g-) accelerated quantum waves that, of course, propagate also in that medium, as already postulated in this study. For simplicity and to be reasonable, I assume that those electromagnetic and gravitational effects are due to the same space medium, called "ether" herein. Furthermore, I suggest that the same ether-like medium exists also in other parts of the universe, and it's local "density" is determined by the local gravitational potential. In this context it is good to recall also Arthur Eddington's experiment 1919 in order to verify the bending of light passing close to the sun, as predicted by Albert Einstein 1915. In those "gravito-lensing" cases we are dealing with the density gradient of "ether", and that seems to be the best way to reveal the existence of an ether-like medium. Otherwise we may be facing with a "null result", as did Michelson and Morley 100 years ago. One fundamental property of the "ether" is that all bodies in our universe seem to be "immersed" in it, and the density of the "ether" is highest close to the massive bodies, such as earth and sun. As a consequence, we can state (a bit "paradoxially") that "although the speed of light is not absolutely constant in space, it is a constant as a measured quantity".

Although the existence of an ether-like medium is obvious in space, we don't know all the properties and the detailed structure of that medium. Hence, the "ether" as a whole is still in some degree a hypothetical concept, and is therefore for further studies, as we can see in Ref. [13], eg..

In the meantime, we can consider the "ether" as an extension of "vacuum" concept where vacuum's traditional properties, such as electric permittivity (ε), magnetic permeability (μ) and speed of light (c) may alter slightly depending on the location in space.

A remaining question of the author: How scientists have survived in the course of the last 100 years with an "empty" space, ie. without assuming any ether-like fundamental substance in the universe ? There is one aspect that could perhaps tell a part of the truth: We may have a feeling that mathematical formulas, such as Maxwell's equations, can describe our observations of nature in a satisfactory way, although they can not reveal the ultimate mechanisms of the phenomena concerned , that is often the case, electromagnetism is just an example; an "abstract" concept of "field" is used without an idea of how and by whom the "field" was created. It is clear that "someone acting in empty space" can not provide an answer to our question. And finally, what was the substance that made the material particles and bodies we see in our everyday life ? "Emptiness" does not sound as a good explanation from logical point of view.

It seems that science community has adopted nowadays some kind of "empty – nonempty -dualism" while discussing the universe: "Officially" speaking the space is "empty", and "in case of emergency" it is allowed to use ad-hoc concepts such as "dark matter" (why not call it "ether" ?) or "dark energy" (I suggest that it may mean same as energy carrying "quantum waves" in my framework (?)). On the other hand, the role of "Higg's field" in giving a mass to particles, as postulated in current models of particle physics, is an interesting scenario in the view of my ether hypothesis; it tells that there exists in space a medium interacting with particles, as indicated also the Table (item 5) of the main text. I prefer to say that that "mass" is particle's capability to trap free energy from space, and "energy" describes "ether's" capability to create wave motion and fundamental particles. As already mentioned in Appendix 2, "field" is considered as ether's density gradient in my framework.

By this end, I take an opportunity to use the following metaphor:
To make a painting an artist needs a fabric (or paper, eg.) to paint it. When the painting is complete we can describe the content (shape, colors...) of the painting without mentioning the fabric behind the painting, anyway, the fabric is there, as nobody can make a painting on "emptiness" !

D. Relativistic effects on particle mass and atomic clock frequency

Now I assume that a particle (eg. an electron of Appendix 1 and Postulate 3) is moving at a velocity of v relative to a reference system that may be another single particle in a simplest case. Doppler effect between two resonances is an interesting property of inward /outward quantum wave solutions, as well as ultimately the wave medium (ether) of space. Note that mathematical solutions of quantum waves for particles at rest were presented in Postulate 3 of the main text. Referring to derivations presented in reference [6], when a particle (electron as an example) moves at a velocity v relative to another particle, the particles will see the following Doppler shifted amplitude of combined inward /outward waves:

$$A_{received} = (1/r) \{ 2A_{max} \exp[ikg(ct+br) \sin[kg(bct+r) \} \qquad (3)$$

(exponential factor) (sine factor)

where $g = (1 – v^2/c^2)^{-1/2}$, ie. Lorentz factor due to Doppler effect, v is relative velocity of particle
wavenumber $k = 2\pi mc/h = 2\pi f_c/c$
m is rest mass of the particle, h is Planck constant, c is speed of light
f_c is Compton frequency of the particle (electron eg.)
$b = v/c$, t is time variable, r is radius (distance) from particle's wave center
A_{max} is max amplitude of quantum wave

As a consequence of exponential factor in eq.(3), the following formula is obtained for the relativistic mass m' of the particle:

$$m' = gm = m (1-v^2/c^2)^{-1/2} \qquad (4)$$

where m is the rest mass of the particle.

Furthermore, as space density seen by a moving electron is proportional to its mass m' and to total energy $E' = m'c^2 = hf_c'$, [6] , the consequence is that energy and frequency difference between successive "quantized" states of an electron bound by a moving atom is decreased inversely proportional to Lorentz factor $g = (1-v^2/c^2)^{-1/2}$. Hence for the frequency f'_{clock} of an atomic clock in motion (v) we may write

$$f'_{clock} = f_{clock} (1-v^2/c^2)^{1/2} \qquad (5)$$

where f_{clock} is the clock frequency at rest (**Note2**).

It shall be noted here that the the results of eqs (4) and (5) do not depend on the sign (+ or -) of the relative velocity v, and both inward and outward waves of particle's wave structure are needed herein. We find that Doppler leads to the origins of special relativity and de Broglie wavelength (h/(mv)), as seen in the sine factor of eq.(3) that is associated with the origins of quantum mechanics, respectively.

In fact, the formula (5) above explains the welknown Einstein's "clock paradox" without any mystery and it is also consistent with many clock experiments conducted in the course of the last 35 years: Motion (v) of particles in "ether" means higher effective medium density, more "curvature" (mass) within particle/ atom structure and lower clock rate that seems to be "gone with the ether wind".

Note2: This result becomes understandable if we think about the space resonance between electron and atom's nucleus: Quantum waves have to travel both in outward and inward directions (ie. two way propagation in a medium of effectively increased density) to produce the standing wave resonance that explains the resulting reduction in absorption /emission frequencies of moving atoms. Fig.1 and 2. of Appendix 1 may be illustrative in this context...

E. Quantum Entanglement and Teleportation

Quantum Entanglement is a phenomenon where quantum states of two (or more) spatially separated particles are correlated, eg. one electron has "spin up" and the other "spin down". Particles concerned may be photons, electrons, atoms and even molecules. Quantum Teleportation is an experiment where a quantum state of a particle is transferred to another particle over a long distance, and this transfer happens (nearly) instantly, ie. faster than the speed of light (c). On the other hand, a classical low speed (< c) communication link is needed to manage the experimental arrangements. The entanglement of quantum states of two (or more) particles was predicted by Quantum Theory several decades ago. Later on many passed experiments to verify this "spooky" phenomenon were conducted, one of the latest one was testing teleportation with photons over a distance of 143 km on Canary Islands last year (2012) [17].

Quantum Entanglement as a physical phenomenon sounds so amazing that we have to ask: How is that possible ? To imagine the mechanism behind the quantum entanglement and teleportation we take a look into Fig.1 and 2 of Appendix 1. (and Eq.(3) of Appendix 4) .
Fig. 3 is a schematical presentation of "thought experiment" where two electrons, A and B, are assumed to be quantum entangled over a distance. Now electron A is excited to have a certain quantum state (say "spin up") by using suitable technical means (electromagnetic pulse, eg.). Furthermore, it is assumed herein that the excitation procedure will induce some tiny motion (speed v) of electron A, the motion may be linear, cyclic or a combined one. As a consequence, de Broglie phase wave is propagated (two ways) between A and B at a speed of $w = c^2/v$, and wavelenght h/ (mv) , this is the result of Doppler shifted amplitude of combined inward /outward waves [18].
If relative speed v is sufficiently low, the quantum state of particle A is transferred to particle B (nearly) instantly. This means that the "quantum mechanical system" A-B behaves like a "rigid" invisible link. Both inward and outward quantum waves (they may be the "hidden variables", as discussed by scientists ?) are needed to enable that quantum mechanical rigidity [6] and, hence, the instant transfer of quantum state between the entangled particles by superluminal de Broglie phase wave. It shall be noted (as Einstein said) that such a fast (w > c) wave can not (likely ?) be used to carry any "useful" information, eg. for telecommunication purposes - anyway, those faster than light communication scenarios remain for further studies...(?).

To conclude, inward and outward quantum waves of a particle and the consequtive de Broglie phase wave are supposed to provide the mechanism that is able to transfer quantum states between particles and, hence, to solve a mystery of quantum mechanics: Quantum Entanglement and Teleportation. Furthermore, now we have some tools to investigate why photons emitted and detected by (entangled) electrons may be entangled as predicted in Quantum Theory and verified also experimentally [17]. By this end, the propagation property of the ether /wave concept seems to be bifilar: First, scalar quantum waves and transversal electromagnetic waves propagate at the speed of light (c) in so called free space of the ether. Secondly, superluminal de Broglie phase wave propagates within quantum entangled particle systems formed by the ether and inward /outward wave pairs.
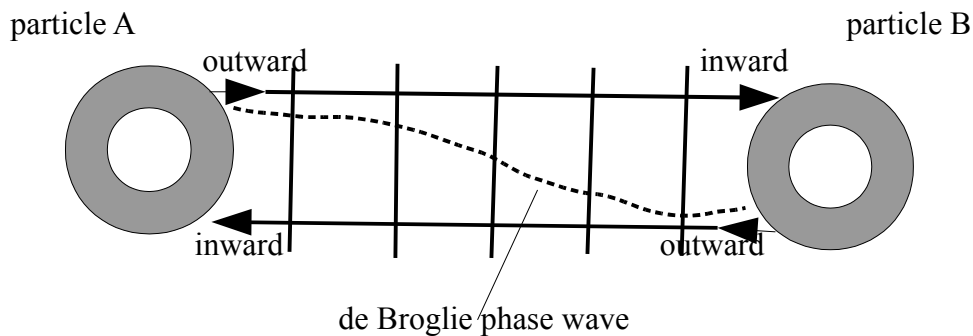
Fig.3: Quantum mechanical system of two entangled particles (electrons).

F. Energy distribution in the universe   - a scenario of ether and expanding universe

It is an interesting question how the total energy of the ether is distributed among different "parties" in our universe. Until now scientists have presented the following approximation of percentage share of the energy involved:

–   so called "visible matter" : 5%
–   "dark matter" :   25%
–   "dark energy" :   70%

In the scenario of Fig.4 I tried to figure out what those percentage numbers could mean in the framework of my "ether /wave" based universe. In the origin of Fig.4 I have imagined a particle (electron, positron, neutron...) and its standing wave structure composed of inward /outward quantum waves. As energy transfers always occur in the wave center of the particle, we can deduce that the wave center represents here "visible matter". Furthermore, as we can not (directly) see the quantum waves surrounding the wave center, it is natural to say that energy involved herein is "dark energy". In addition to the visible matter and the dark energy above, there shall be some "residual" ether (energy) that is not directly involved in forming the particles and and their wave structure; we could call this residual party "dark matter" - as it is always there to cause "curvature" of space, ie. gravity effects and some bending of light.
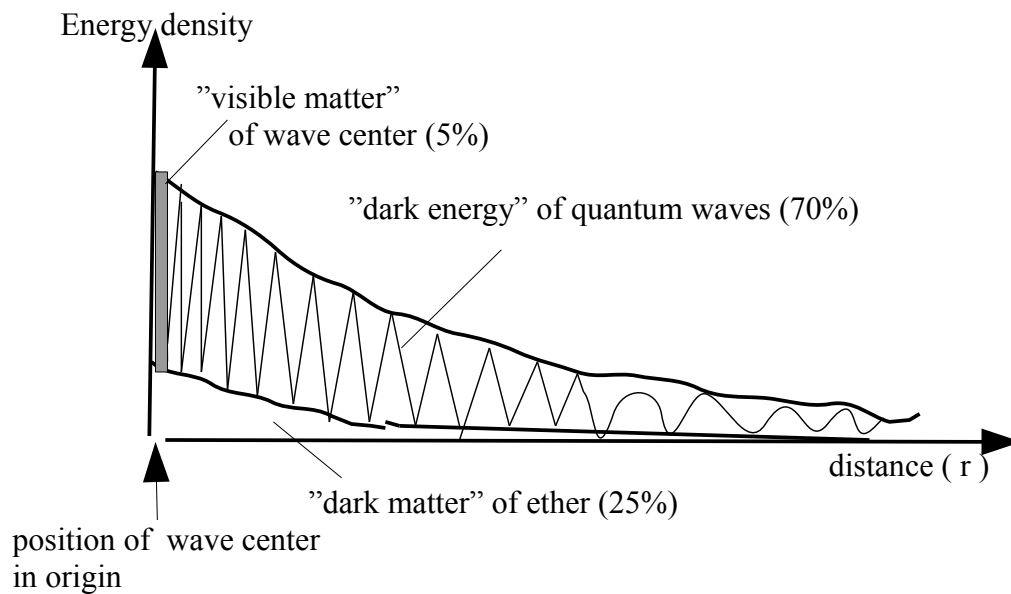
Fig.4: Percentage energy distributions in the universe are proportional to the areas shown in the graphical presentation.

To summarise, "visible matter" represents ether energy trapped by particles, and we perceive that energy as "mass" of particles. "Dark energy" is kinetic ether energy carried by quantum waves. Finally, "dark matter" represents potential nature of ether energy that is perceivable as gravitational potential, eg..

Referring to Fig.4 I come back to speculations of expansion mechanisms for the universe:
Lets imagine that "visible matter" is a massive celestial body (say, a galaxy). In such a case inward waves coming from the surrounding space will speed down slightly due to the high density of "dark matter" in the vicinity of the body. This condition in turn leads to a (small) repulsive force experienced by the body. This force i similar to the gravitational force demonstrated in Appendix 3. However, now the force behaves like a negative gravity and it is to cause a repulsion effect between all massive bodies in the universe. Hence, in this scenario (accelerated) expansion of the universe can be considered as a joint effect of "dark energy" (quantum waves) and "dark matter" (ether).

APPENDIX 5.

Concluding remarks on "Wave based electromagnetism" - advances and "gaps" for future studies

The emphasis of this study has been in explaining generation and propagation of radio waves in atmosphere while assuming the spherical wave structure for the electrons acting as sources (transmitters) and receivers of electromagnetic radiation. Faraday induction, accompanied by some propagation delay, is considered to be the major mechanism of interaction between the electrons concerned. The key factor to the success of the "Wave based electromagnetism" concept is the employment of the quantum waves and its standing wave patterns to establish the existence of the electrons in the ether of space and to provide also a means to interact with other matter (electrons) in the universe [6]. Transversally modulated quantum waves act as a carrier of radio waves that can be detected as an electric current in an appropriate antenna circuit due to a "delayed" Faraday induction. The propagation delay in a dielectric medium (atmosphere, eg.) is caused by the following mechanisms:
a) the process where the inward quantum wave rotates (spins) the wave center of an interacting electron to become the outward wave, respectively
b) refractive effects within an inhomogeneous (turbulent, eg.) medium causing a longer geometrical path for the propagating waves. This includes also polarization effects in dielectric materials, such as atmospheric gases, eg.

The adoption of the "Wave based electromagnetism" concept have some consequences regarding magnetism related phenomena: As quantum waves provide a mechanism of interaction between the electrons, we don't need the concept of "magnetic field" to explain the reason for "inductance" in an electrical circuit, as an example. Although the magnetic field (H, B) shows some illusion-like features compared to the electric field (E) and current (J), we can still use it as parameter in mathematical formalism to describe "phase accumulation of electron's wave function in a unit time" while the electron is moving [7]. On the other hand, predicted deformation ("symmetry breaking") of electron's wave structure, as caused by a nearby electric current, can be regarded as a "magnetic" phenomenon that is effective in electric transformers and electromechanical systems, such as electric motors and generators we use in our everyday life.

Concerning optical waves and the concept of photon, the emission and absorption mechanisms of electrons bound by atoms are (partly) explained and concluded on the basis of the studies presented in the references [6], [10], [11], [13], as well as by the scenarios and demos given in the present study.

The concept of the "Wave based electromagnetism" rely on the existence of the "ether" that is an object we can not see directly, although many experiments have verified the existence of an ether-like medium in space. In this stage, ie. without any further knowledge, the only way to solve the problem of that invisible ether is to postulate the features that are crucial for our research work. However, it should be noted here that filling the "empty space of vacuum" seems to be a common mission and a long term project for the society of physics and cosmology today - not just for the needs of electromagnetism, but mainly to explain the mysteries of the "dark" energy /matter in the universe [13]. "Higgs field" and "Higgs boson" are an attempt of particle physics to fill the space and give mass to particles that are also tasks of the "ether" concept described in this booklet. A remaining question for further studies is to what extent "ether" and "Higgs field" are consistent entities, particularly concerning propagation property of waves, and gravity effects ?
On the other hand, although there is still a "gap" of the knowledge in the "subquantum" level (ie. below the micro level) of the universe, a good feature of the "Wave based electromagnetism" concept presented in the present study is to provide a missing "bridge" between electron and the

surrounding universe in the micro and macro levels where we are able to make observations . This is something where the particle-like electron model has not been successful during the last century due to the lack of an explicit mechanism that could connect a single electron to the surrounding "empty" space, as shown in the comparison table below. It is interesting to note that quantum waves do not provide interaction mechanism only for electromagnetism, but also for gravity, inertia and quantum entanglement.

Author's view is that we can not solve the problem of the empty space by using experimental methods and mathematical tools solely, as it is also an issue that concerns our picture of the reality and and how it will develop in the future.

A comparison of Classic Electromagnetism and Wave Based Electromagnetism concept theories

item	Classic Electromagnetism	Wave Based Electromagnetism
1.	Medium of space is postulated to be an "empty" space of vacuum	Medium of space is assumed to be (hypothetical) "ether" of the space, ie. space is not "empty". [WSM, SQK, QRT]
2.	Predicts an infinite Coulomb potential at the center of discrete point- like particle electron	Predicts a finite Coulomb potential at the center of wave based electron, in agreement with observations. [WSM, SQK, (QRT)]
3.	Relies on wave-particle dualism for fundamental particles and waves	Fundamental particles naturally incorporate wave aspects in their structure. [WSM, SQK, QRT, DU]
4.	Does not explain the origin of charge, mass and spin of fundamental particles and how they generate electromagnetic and gravitational fields and waves.	Explains the mechanisms of generating charge, mass and spin for fundamental particles and how electromagnetic and gravitational fields and waves are generated. [WSM, SQK, QRT]
5.	Empirical equations (Maxwell and others) are employed for describing behavior of electromagnetic fields and for calculating /predicting their numerical values under certain boundary conditions.	Empirical equations (Maxwell and others) can be used to simulate the effects of electromagnetic fields for technical purposes, eg. [WSM, SQK, QRT, DU]
6.	Maxwellian equations are not able to explain the generation of Tesla waves, ie. longitudinal energy waves.	Wave based electromagnetism is able to explain the generation of both transversally polarized Hertzian waves and Tesla waves. [WSM, SQK, QRT]
7.	Classic Electromagnetism concept theories do not provide explicit links to the other physical theories, particularly to those ones related to gravity and nuclear models.	Wave based theories (WSM, SQK, QRT, DU) provide some means to evolve towards a "Unified Theory". However, to achieve this challenging goal, a sophisticated combination of the theories is required to cover the whole range of physics, as related to electromagnetism, atomic and nuclear models, gravity and cosmology (at least).

Wave based theories referred herein:
– Quantum Wave Structure of Matter (WSM ; Milo Wolff et al, 1990-)
– Subquantum Kinetics (SQK; Paul La Violette, 1994-)
– Quantum Ring Theory (QRT; Wladimir Guglinski, 2006-)
– Dynamic Universe (DU; Tuomo Suntola, 2008-)

In the table above I have listed in brackets the Wave based theories that are relevant for each of the items 1-7 as discussed in the table. It shall be noted here that although the Wave based theories referred herein are quite compatible in many aspects of physics, there are differences in interpreting some details, eg. regarding variability of speed of light (c), expansion of the universe, existence of black holes, etc.

APPENDIX 6

Discussing the relation of the "Higgs field" and the "ether /wave" concept

"Higgs field, Higgs boson and Higgs mechanism" as a whole are hypothetical concepts that were developed by Peter Higgs and other particle physicists since the 60s to explain how fundamental particles acquire their "mass" [16]. After hunting the "Higgs boson" for several decades, researchers working at CERN (and other laboratories) claimed on 4 July 2012 that the existence of the "Higgs boson" is (likely) confirmed experimentally. This finding is to complete the collection of the fundamental particles needed in the Standard Model of particle physics.

A question arises now, what is the relation between the "Higgs field" and the "ether /wave" concept presented in this study ?
First, they are both hypothetical media that are assumed to fill the universe, which means that space is not "empty".
Secondly, they should provide the fundamental particles their rest mass (m), and energy (E) respectively:

$$E = mc^2 = hf \qquad\qquad\qquad (1)$$

where c is the velocity of light, h is the Planck constant and f is so called Compton frequency of the particle concerned using the "wave nature of matter" concept, as adopted throughout this study [6]. A high Compton frequency implicates a strong interaction between the particle and the surrounding space (ie. medium and other particles therein) and, hence, a high "mass". Eq.1 was in fact predicted in Postulate 3 of the maintext. Relativistic effect on particle mass is described analytically in Appendix 4, section D.

What are the differences between the "Higgs field" and the "ether /wave" concept of this study ?

"Higgs field" is not postulated to provide any transport medium for waves (inc. light). As particles are considered as "standing wave" structures in the present study, the space medium concerned has to support the propagation of waves, ie. both scalar quantum waves and (polarized) electromagnetic waves (inc. light). On the other hand, the wave structures of the particles together with the propagation property of the "ether" provides the particles a means to interact with other particles in the universe (as described in Postulate 3 of the maintext) that is to explain electromagnetic, gravitational and inertial phenomena, as well as spin and charge polarity of particles. As already known, the "Higgs mechanism" (as it is now) can not explain gravity at all.

To summarise, as the "Higgs mechanism" incorporates its crucial "mass creation" feature for particles and the "ether /wave" concept provides interaction mechanism between particles (inc. gravity, eg.), it could be fruitful to combine the best features of those two concepts – at least we can think about it (?). And we should not forget that they are both still evolving theories.

By the way, in terms of the "ether /wave" concept, I propose (and guess) that the "Higgs boson" is a burst of scalar waves in the "space medium" - that we can call as we like. Furthermore, I expect that the magnitude of "Higgs field" is proportional to the gradient of ether's density; this is the way I could interpret the relation between the "Higgs field" and the "ether" under study at the moment. A remaining question is: how are looking "dark matter particles" that could form the "ether" and the "Higgs field", respectively ?

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