THE ILLUSION OF QUANTUM MECANICAL PROBABILITY WAVES

Light contains the key to open the doors to Heaven.
Unfortunately, the same key fits on the doors to Hell

Author:	Wim Vegt
Country:	The Netherlands
Website:	https://wimvegt.topworld.center
Email:	j.w.vegt@topacademy.center

Images of broken light
Which dance before me like a million eyes
They call me on and on
Across the Universe
Thoughts meander
Like a restless wind inside a letter box
They tumble blindly
As they make their way
Across the Universe

The Beatles 1968

Books from Wim Vegt in the series: "The POWER OF LIGHT":

12) The World Beyond Black Holes. (A Mathematical Framework for the Electromagnetic-Gravitational Force Density Divisions of the Inner Structure Modes within Black Holes). (E-book) ISBN: 9789464058727 (Paperback) ISBN: 9789464053685

11) 150 YEARS PHYSICS based on the WRONG EQUATION. (E-Book) ISBN: 9789402192896. (Paperback) ISBN: 9789402192735.

10) The Nikola Tesla Way of Energy Transport. (E-book) ISBN: 9789402191349. (Paperback) ISBN: 9789402190984.

9) The Rise of ELF Electromagnetic Attack Weapons and the Necessity of the Development of Corresponding ELF Defense Systems. (E-book) ISBN: 9789402189544. (Paperback) ISBN: 9789402189117

8) Unified 4-Dimensional Hyperspace Equilibrium. (E-book) ISBN: 9789402181036. (Paperback) ISBN: 9789402180985

7) Beyond Superstrings. (E-book) ISBN: 9789402179668. (Paperback) ISBN: 9789402179637

6) The Hidden World Behind Superstrings. (E-book) ISBN: 9789402180053

5) Light is the Bridge between God, Relativity and Quantum Physics (E-book) ISBN: 9789402178975

4) The Particle-Wave-Mass Unification. A New Theory in Quantum Physics. (E-book) ISBN: 9789402178647. (Paperback) ISBN: 9789402178586

3) The Tri-Unity in Religion and in Science. (Paperback) ISBN: 9789402178531

2) The Power of the LIGHT rules over the SHADOWS of the DARKNESS (Paperback) ISBN: 9789402178326

1) The Bridge of Light (E-book) ISBN: 9789402177947. (Paperback) ISBN: 9789402177763

PREFACE

This is a book about the world beyond Quantum Mechanical Probability Waves as a solution of the Fundamental Quantum Mechanical Wave Equations like the “Schrődinger Wave Equation” and the Relativistic “Diraq” Equation and has been divided into three parts.

The first part, Level 1, describes the theory about the differences and the similarities between Quantum Mechanical Probability Waves and Electromagnetic Waves at a fundamental level which is understandable for everyone with a few years of basic Physics education. The reader is familiar with fundamental equations like Newton’s second Law of motion ($F = m\ a$) and Einsteins’s famous relationship between mass and energy ($E = m\ c^2$).

The second part, Level 2, describes the theory about the differences and the similarities between Quantum Mechanical Probability Waves and Electromagnetic Waves at a university level which is understandable for everyone with a Physics university education. The reader is familiar with fundamental mathematics like tensor calculus.

The third part, Level 3, describes the complete New Theory and offers new insights in the mathematical approach for Quantum Mechanical Probability Waves and the relationship with Electromagnetic Waves, Electric Charge, Magnetic Spin and Electromagnetic Mass.

Keywords: General Relativity; Quantum Physics; Dirac Equation; Gravitational-Electromagnetic Interaction; Black Holes; Gravitational-Electromagnetic Confinement; Electromagnetism; Quantum Optics

Classical Theory

NEWTON in 3 dimensions

$$\bar{F} = m \bar{a}$$

$$\begin{pmatrix} x_3 \\ x_2 \\ x_1 \end{pmatrix} \rightarrow \begin{pmatrix} F_z \\ F_y \\ F_x \end{pmatrix} = m \begin{pmatrix} a_z \\ a_y \\ a_x \end{pmatrix}$$

Maxwell (James Clerk Maxwell)

$$\nabla . \bar{E} = \frac{\rho}{\varepsilon}$$

$$\nabla \times \bar{E} = - \mu \frac{\partial \bar{H}}{\partial t}$$

$$\nabla . \bar{H} = 0$$

$$\nabla \times \bar{H} = \varepsilon \frac{\partial \bar{E}}{\partial t}$$

Dirac/ Schrödinger (Newton 4th Dimension)

Energy-Time Domain (x-4)

$$\nabla . (\bar{E} \times \bar{H}) = - \frac{1}{2} \frac{\partial \left(\varepsilon_0 \left(\bar{E} . \bar{E} \right) + \mu_0 \left(\bar{H} . \bar{H} \right) \right)}{\partial t}$$

$$\bar{\phi} = \frac{1}{\sqrt{2 \mu}} \left(\bar{B} + i \frac{\bar{E}}{c} \right) \qquad \bar{\phi}^* = \frac{1}{\sqrt{2 \mu}} \left(\bar{B} - i \frac{\bar{E}}{c} \right)$$

$$\bar{\phi} . \bar{\phi}^* = \frac{1}{2 \mu} \left(\bar{B} + i \frac{\bar{E}}{c} \right) . \left(\bar{B} - i \frac{\bar{E}}{c} \right) = \frac{1}{2} \mu H^2 + \frac{1}{2} \varepsilon E^2 = w$$

$$\bar{\phi} \times \bar{\phi}^* = \frac{1}{2 \mu} \left(\bar{B} + i \frac{\bar{E}}{c} \right) \times \left(\bar{B} - i \frac{\bar{E}}{c} \right) = i \sqrt{\varepsilon \mu} \, \bar{E} \times \bar{H} = i \sqrt{\varepsilon \mu} \, \bar{S}$$

$$- \frac{i}{\sqrt{\varepsilon_0 \mu_0}} \nabla . (\bar{\phi} \times \bar{\phi}) = - \frac{\partial \bar{\phi} . \bar{\phi}^*}{\partial t}$$

$$\bar{\alpha} = \begin{bmatrix} 0 & \sigma \\ \sigma & 0 \end{bmatrix} \quad \text{and} \quad \bar{\beta} = \begin{bmatrix} \delta_a & 0 \\ 0 & - \delta_a \end{bmatrix}$$

$$\left(\frac{i m c}{h} \bar{\beta} + \bar{\alpha} . \nabla \right) \psi = - \frac{1}{c} \frac{\partial \psi}{\partial t}$$

Quantum Gravity (Newton 4th Dimension)

Energy-Time Domain (x-4)

$$\nabla . (\bar{E} \times \bar{H}) + \frac{1}{2} \frac{\partial \left(\varepsilon_0 \left(\bar{E} . \bar{E} \right) + \mu_0 \left(\bar{H} . \bar{H} \right) \right)}{\partial t} + \frac{\sqrt{\varepsilon \mu}}{2} \left(\varepsilon \left(\bar{E} . \bar{E} \right) + \mu \left(\bar{H} . \bar{H} \right) \right) \bar{g}$$

$$\bar{\phi} . \bar{\phi}^* = \frac{1}{2 \mu} \left(\bar{B} + i \frac{\bar{E}}{c} \right) . \left(\bar{B} - i \frac{\bar{E}}{c} \right) = \frac{1}{2} \mu H^2 + \frac{1}{2} \varepsilon E^2 = w$$

$$\bar{\phi} \times \bar{\phi}^* = \frac{1}{2 \mu} \left(\bar{B} + i \frac{\bar{E}}{c} \right) \times \left(\bar{B} - i \frac{\bar{E}}{c} \right) = i \sqrt{\varepsilon \mu} \, \bar{E} \times \bar{H} = i \sqrt{\varepsilon \mu} \, \bar{S}$$

$$- \frac{i}{\sqrt{\varepsilon_0 \mu_0}} \nabla . (\bar{\phi} \times \bar{\phi}) = - \frac{\partial \bar{\phi} . \bar{\phi}^*}{\partial t}$$

$$\bar{\alpha} = \begin{bmatrix} 0 & \sigma \\ \sigma & 0 \end{bmatrix} \quad \text{and} \quad \bar{\beta} = \begin{bmatrix} \delta_a & 0 \\ 0 & - \delta_a \end{bmatrix}$$

$$\left(\frac{i m c}{h} \bar{\beta} + \bar{\alpha} . \nabla \right) \psi = - \frac{1}{c} \frac{\partial \psi}{\partial t} - \frac{g}{c^2} \psi$$

New Theory

NEWTON in 4 dimensions

$$\bar{F}^4 = m \bar{a}^4$$

$$\begin{pmatrix} x_4 \\ x_3 \\ x_2 \\ x_1 \end{pmatrix} \rightarrow \begin{pmatrix} F_t \\ F_z \\ F_y \\ F_x \end{pmatrix} = m \begin{pmatrix} a_t \\ a_z \\ a_y \\ a_x \end{pmatrix}$$

Maxwell (Newton in 3 Dimensions)

$$\text{NEWTON:} \rightarrow \bar{F}_{TOTAL} = m \bar{a} \, [N] \rightarrow \bar{f}_{TOTAL} = \rho \bar{a} \, [N/m^3]$$

$$- \rho \bar{a} + \bar{f}_{TOTAL} = \bar{0} \, [N/m^3]$$

$$- \rho \bar{a} + \bar{f}_{ELECTRIC} + \bar{f}_{MAGNETIC} = \bar{0} \, [N/m^3]$$

$$- \rho \bar{a} + \bar{f}_{COULOMB} + \bar{f}_{LORENTZ} + \bar{f}_{COULOMB} + \bar{f}_{LORENTZ} = \bar{0} \, [N/m^3]$$

$$- \frac{1}{c^2} \frac{\partial (\bar{E} \times \bar{H})}{\partial t} + \varepsilon_0 \bar{E} (\nabla . \bar{E}) - \varepsilon_0 \bar{E} \times (\nabla \times \bar{E}) + \mu_0 \bar{H} (\nabla . \bar{H}) - \mu_0 \bar{H} \times (\nabla \times \bar{H}) = 0 \, [N/m^3]$$

Dirac/ Schrödinger (Newton 4th Dimension)

Energy-Time Domain (x-4)

B-6 B-7

$$(x_4) \qquad \nabla . (\bar{E} \times \bar{H}) = - \frac{1}{2} \frac{\partial \left(\varepsilon_0 \left(\bar{E} . \bar{E} \right) + \mu_0 \left(\bar{H} . \bar{H} \right) \right)}{\partial t}$$

3-Dimensional Space Domain

B-1 B-2 B-3

$$\begin{pmatrix} x_3 \\ x_2 \\ x_1 \end{pmatrix} \qquad - \frac{1}{c^2} \frac{\partial (\bar{E} \times \bar{H})}{\partial t} + \varepsilon_0 \bar{E} (\nabla . \bar{E}) - \varepsilon_0 \bar{E} \times (\nabla \times \bar{E}) +$$

B-4 B-5

$$+ \mu_0 \bar{H} (\nabla . \bar{H}) - \mu_0 \bar{H} \times (\nabla \times \bar{H}) = \bar{0}$$

Quantum Gravity (Newton 4th Dimension)

Energy-Time Domain

Inner Energy Potential Energy

B-7 B-8

$$(x_4) \qquad \nabla . \bar{S} + \frac{\partial w}{\partial t} + \rho \bar{g} \frac{\Delta x}{\Delta t} = 0$$

3-Dimensional Space Domain

B-1 B-2 B-3

$$\begin{pmatrix} x_3 \\ x_2 \\ x_1 \end{pmatrix} \qquad - \frac{1}{c^2} \frac{\partial (\bar{E} \times \bar{H})}{\partial t} + \varepsilon_0 \bar{E} (\nabla . \bar{E}) - \varepsilon_0 \bar{E} \times (\nabla \times \bar{E}) +$$

B-4 B-5 B-6

$$+ \mu_0 \bar{H} (\nabla . \bar{H}) - \mu_0 \bar{H} \times (\nabla \times \bar{H}) + \frac{1}{2} \left(\varepsilon^2 \mu \left(\bar{E} . \bar{E} \right) + \varepsilon \mu^2 \left(\bar{H} . \bar{H} \right) \right) \bar{g} = \bar{0}$$

Index

The Illusion of Quantum Mechanical Probability Waves (Level 1)

1.1 Introduction

The physical concept of quantum mechanical probability waves has been created during the famous 1927 5th Solvay Conference. During that period there were several circumstances which came just together and made it possible to create an unique idea of material waves being complex (partly real and partly imaginary) and describing the probability of the appearance of a physical object (elementary particle).

The idea of complex probability waves was completely new in the beginning of the 20th century and it is hard to believe that this strange non- scientific concept of probability waves has been created at a famous scientific Conference like the 1927 5th Solvay Conference. Since then the New Concept has been protected carefully within the Copenhagen Interpretation.

To understand this unique non-scientific approach in physics during the famous Solvay Conference in 1927, we have to go back 300 years in time. Back to the time of Isaac Newton who was a scientist as well as a religious monk. During that time Science was part of the New Religious Catholic Culture and the disappearing of the Magical World which was strongly forbidden within the Catholic Belief. Isaac Newton had to find a safe balance between science and the small boundaries between what was allowed within the Catholic Church and the Magic which was strongly forbidden. Because a small mistake in interpretation was enough to end up as an heretic on the burning stakes in the middle ages.

Isaac Newton was brilliant because he found that safe path. Quantum Physics was impossible during that time because a concept like "Quantum Mechanical Probability Waves" would have turned God into a Dice. The death of the Schrödinger Cat would not have been a decision of God anymore but would have been decided by radioactive decay which is comparable with the outcome of a Dice. Also a concept of a Black Hole would have been unacceptable during that time. Because during that time God has been presented in the presence of immense powerful Light. A Black Hole absorbing and destroying Light

would have been interpreted as a demon or a devil destroying God and was part of evil and forbidden magic.

Isaac Newton found in his time the universal path, the Leitmotiv, the universal concept in Physics which was fundamental in science and not in conflict with the Catholic Church. Newton found the concept of universal equilibrium which he formulated in his famous third equation Action = - Reaction. Which can easily be written as Action + Reaction = 0. The universal sum of all actions plus all reactions always equals zero in the whole universe. A principle we find back in all kinds of religions and spiritual teachings. In eastern countries knows as Karma. And in the Catholic Church known as Sin and Punishment.

With this concept of equilibrium Newton had found a powerful path and when science would have followed his path. physics would have followed a completely different path. The concept of probability waves would never have been created and Einstein would have been right when he claimed during his discussion with Max Born: God does not play Dice.

Already 150 years later, Physics left the path of "Perfect Equilibrium", when James Clerk Maxwell introduced his four equations describing the electromagnetic field. From these four equations, Maxwell derived the famous Electromagnetic wave equation which predicted very accurately the speed of light. Because of that success, Maxwell became famous and nobody doubted anymore about the correctness of these equations and the corresponding theory. From that time on Physics became a floating science not grounded anymore on a rock like Newton's physics.

Because Maxwell did not build his theory. He simply solved a problem. The problem how to unify two different concepts, the electric field and the magnetic field, into one concept: Electromagnetic Waves". And that is not science. Science is building on a rock, building on a basic solid concept. Solving problems is building on quick sand. For a while it keeps standing. But then it falls apart. After Maxwell, science became more "Solving Problems Science" and the foundation of a New Theory on a solid rock like "Universal Equilibrium" became forgotten.

And there was still the influence of the Catholic Church. At the time of Niels Bohr almost every scientist was religious. And every scientist knew the famous Christion Prayer: Our Father in Heaven (Mathew 6:9-13). The sentence “Your will be done on Earth as in Heaven” inspired Niels Bohr when he developed his model of the atom in which electrons circle around the nucleus like the earth around the sun. Niels Bohr’s Christian Belief was one of the most powerful reasons why he did not want to give up his model of the atom which described so perfectly: “God’s will be done in the large universe (Heaven) as well within in the smallest atom (Earth)”. It was like giving up his belief in God.

1.2 The Creation of Probability

When Schrödinger published his famous material wave equation in 1926, he found spherical and elliptical solutions for the presence of the electron within the atom. With that outcome Bohr's model of the atom completely fell apart. Because in Bohr's model of the atom an electron as a particle can only exist at one place at one time. But according to the solutions of the wave equations, for a spherical solution the electron is everywhere at the same time dived equally along a sphere.

And now lines in history come together. The first idea of the material waves in Schrödinger's wave equation was the concept of confined Electromagnetic Waves. But according to Maxwell this was impossible. According to Maxwell's equations Light (Electromagnetic Waves) can only propagate along straight lines and it is impossible that Light (Electromagnetic Waves) could confine with the surface of a sphere or an ellipse.

For that reason these material waves in Schrödinger's wave equation could only be of a different origin than Electromagnetic Waves. And that conclusion opened for Niels Bohr the opportunity to save his model of the atom and to save his belief in God.

Niels Bohr introduced the very strange and unusual concept of "Probability Waves" as the origin of the material waves in Schrödinger's wave equation. And defined the New Concept that the electron was still a particle but the physical presence of the electron in the Atom was equally divided by a spherical probability function. And like Maxwell also Niels Bohr chose for the problem-solving approach, building also his theory on quicksand.

Niels Bohr solved two problems at the same time. He found an answer for the origin of the material waves in Schrödinger's wave equation and he could keep his model of the atom, keeping his belief in God.

At a small price, the introduction of a fundamental uncertainty in Physics, Bohr saved his belief in God and the legitimacy of the holy "Our Father in Heaven" , Your will be done on Earth (within the smallest atom) as in Heaven (in the vast interstellar universe). But sometimes a seemingly small price turns into a huge price and the small

price of the introduction of fundamental uncertainty turns the almighty God into a meaningless Dice. Like a child who loves the beautiful doll so much that she embraces the doll so tightly that it breaks into a million pieces.

An important milestone in quantum physics has been reached by the publication of the Relativistic Quantum Mechanical Dirac Equation in 1928. However, the Dirac equation represents a 1-Dimensional quantum mechanical equation which is unable to describe the 4-Dimensional Physical Reality.

In this article the 4-Dimensional Relativistic Quantum Mechanical Dirac Equation expressed in the vector probability functions $\bar{\phi}$ and the complex conjugated vector probability function $\overline{\phi^*}$ will be published. To realize this, the classical boundaries of physics has to be changed. It is necessary to go back in time 300 years ago. More than 200 years ago before the Dirac Equation had been published.

A Return to the Inception of Physics. The time of Isaac Newton who published in 1687 in the "Philosophiae Naturalis Principia Mathematica" a Universal Fundamental Principle in Physics which was in Harmony with Science and Religion. The Universal Path, the Leitmotiv, the Universal Concept in Physics. Newton found the concept of "Universal Equilibrium" which he formulated in his famous third equation Action = - Reaction. This article presents a New Kind of Physics based on this Universal Fundamental Concept in Physics which results in a New Approach in Quantum Physics and General Relativity.

The physical concept of quantum mechanical probability waves has been created during the famous 1927 5th Solvay Conference. During that period there were several circumstances which came together and made it possible to create an unique idea of material waves being complex (partly real and partly imaginary) and describing the probability of the appearance of a physical object (elementary particle). The idea of complex probability waves was new in the beginning of the 20th century. Since then the New Concept has been protected carefully within the Copenhagen Interpretation.

In the New Theory it will be demonstrated that because of a mistake in the Maxwell Equations, in 1927 Confined Electromagnetic waves could not be considered to be the material waves expressed in Schrödinger's wave equation. The New Theory presents a new equation describing electromagnetic field configurations which are also solutions of the Schrodinger's wave equation and the relativistic quantum mechanical Dirac Equation and carry mass, electric charge and magnetic spin at discrete values.

The physical concept of quantum mechanical probability waves has been created during the famous 1927 5th Solvay Conference. During that period there were several circumstances which came just together and made it possible to create an unique idea of material waves being complex (partly real and partly imaginary) and describing the probability of the appearance of a physical object (elementary particle).

The idea of complex probability waves was completely new in the beginning of the 20th century and it is hard to believe that this strange non- scientific concept of probability waves has been created at a famous scientific Conference like the 1927 5th Solvay Conference. Since then the New Concept has been protected carefully within the Copenhagen Interpretation.

When Schrödinger published his famous material wave equation in 1926, he found spherical and elliptical solutions for the presence of the electron within the atom. With that outcome Bohr's model of the atom completely fell apart. Because in Bohr's model of the atom an electron as a particle can only exist at one place at one time. But according to the solutions of the wave equations, for a spherical solution the electron is everywhere at the same time dived equally along a sphere.

And now lines in history come together. The first idea of the material waves in Schrödinger's wave equation was the concept of confined Electromagnetic Waves. But according to Maxwell this was impossible. According to Maxwell's equations Light (Electromagnetic Waves) can only propagate along straight lines and it is impossible that Light (Electromagnetic Waves) could confine with the surface of a sphere or an ellipse.

For that reason these material waves in Schrödinger's wave equation could only be of a different origin than Electromagnetic Waves. And that conclusion opened for Niels Bohr the opportunity to save the general accepted model of the atom.

Niels Bohr introduced the unusual concept of "Probability Waves" as the origin of the material waves in Schrödinger's wave equation. And defined the New Concept that the electron was still a particle but the physical presence of the electron in the Atom was equally divided by a spherical probability function. And like Maxwell also Niels Bohr chose for the problem-solving approach.

Niels Bohr solved two problems at the same time. He found an answer for the origin of the material waves in Schrödinger's wave equation and he could keep the general accepted model of the atom.

1.3 Back to the roots

To change the nowadays popular concept of "Problem Solving Physics" into "Fundamental Physics" we have to go back in time for over 300 years. Back to the time when the vast areas of Science, Religion and Magic met each other and often collided towards each other in an unknown challenging world.

Back to the time of Isaac Newton who published in 1687 in the "Philosophiae Naturalis Principia Mathematica" a Universal Fundamental Principle in Physics in Harmony with Religion. The Universal Path, the Leitmotiv, the Universal Concept in Physics which was fundamental in science and not in conflict with the Catholic Church. Newton found the concept of "Universal Equilibrium" which he formulated in his famous third equation Action = - Reaction. In nowadays math the concept of "Universal Equilibrium" has been formulated as:

$$\sum_{i=0}^{i=n} \overline{F_i} = 0 \qquad (1)$$

Because the Inertia Force is a Reaction Force, the Inertia Force appears in the equation with a minus sign.

$$\sum_{i=0}^{i=n} \overline{F_i} - m\,\overline{a} = 0 \qquad (2)$$

Equation (2) is a general presentation of Newton's famous second law of motion. In a fundamental way, Newton's second law of motion describes the required electromagnetic equation for the Gravitational-Electromagnetic Interaction in general terms, including Maxwell's theory of Electrodynamics published in 1865 in the article: "A Dynamic Theory of the Electromagnetic Field" and Einstein's theory of General Relativity published in 1911 the article: "On the Influence of Gravitation on the Propagation of Light".

Because Maxwell's 4 equations are not part of one whole uniform understanding of the universe like the fundamental equation of Newton's second law of motion represents, Maxwell's theory is missing a fundamental foundation.

Newton's second law of motion has been based on a profound understanding of the universe which is based on the fundamental principle of Harmony and Equilibrium, expressed in equation (2).

To describe the interaction between light and gravity and to understand electromagnetic waves and their interaction and to understand the concept of "photons" it is important to define the fundamental equation for the electromagnetic field based on the fundamental principle of Harmony and Equilibrium formulated by Newton in 1687 and published in his famous work: "Philosophiae Naturalis Principia Mathematica (Mathematical Principles of Natural Philosophy)".

To realize this, Newton's second law of motion will be the Ground, the Leitmotiv, the Universal Concept in Physics on which the New Theory will be built. The fundamental Electromagnetic force density equation has been based integral on Newton's second law of motion and has been divided into 5 separate terms (B-1 – B-5), each one describing a part of the electromagnetic and inertia force densities.

$$\sum_{i=0}^{i=5} \mathbf{B}_i = 0 \qquad (3)$$

The first term B-1 represents the inertia of the mass density of light (Electromagnetic Radiation). The terms B-2 and B-3 represent the electric force densities within the Electromagnetic Radiation (Beam of Light) and the terms B-4 and B-5 represent the magnetic force densities within the Electromagnetic Radiation (Beam of Light).

Fundamental in the New Theory is the outcome of (3) which always has to be zero according Newton's fundamental principle of "Universal Equilibrium".

To apply the concept of "Universal Equilibrium" within an electromagnetic field, the electric forces $F_{Electric}$, the magnetic forces $F_{Magnetic}$ and the inertia forces will be presented separately in equation (3):

$$\sum_{i=0,j=0}^{i=n,j=m} \left(\overline{F_{\text{Electric-i}}} + \overline{F_{Magnetic-j}} - m\,\bar{a} \right) = 0 \qquad (4)$$

1.4 The Inertia of Light (Term B-1)

Reducing Equation (2) to one single Force $\bar{F}$, equation (2) will be written in the well-known presentation:

$$\bar{F} = m\,\bar{a} \tag{5}$$

The right and the left term of Newton's law of motion in equation (5) has to be divided by the Volume "V" to find an equation for the force density $\bar{f}$ related to the mass density "ρ".

$$\begin{aligned} \bar{F} &= m\,\bar{a} \\ \left(\frac{\bar{F}}{V}\right) &= \left(\frac{m}{V}\right)\bar{a} \\ \bar{f} &= \rho\,\bar{a} \end{aligned} \tag{6}$$

The Inertia Force $\overline{F_{Inertia}}$ for Electromagnetic Radiation will be derived from Newton's second law of motion, using the relationship between the momentum vector $\bar{p}$ for radiation expressed by the Poynting vector $\bar{S}$:

$$\overline{F_{INERTIA}} = -m\,\bar{a} = -m\frac{\Delta\bar{v}}{\Delta t} = -\frac{\Delta\left(m\bar{v}\right)}{\Delta t} = -\frac{\Delta\bar{p}}{\Delta t} = -\left(\frac{V}{c^2}\right)\frac{\Delta\bar{S}}{\Delta t} \tag{7}$$

Dividing the right and the left term in equation (7) by the volume V results in the inertia force density $\overline{f_{Inertia}}$:

$$\begin{aligned} \overline{F_{INERTIA}} &= -m\,\bar{a} = -m\frac{\Delta\bar{v}}{\Delta t} = -\frac{\Delta\left(m\bar{v}\right)}{\Delta t} = -\frac{\Delta\bar{p}}{\Delta t} = -\left(\frac{V}{c^2}\right)\frac{\Delta\bar{S}}{\Delta t} \\ \frac{\overline{F_{INERTIA}}}{V} &= -\frac{m}{V}\bar{a} = -\frac{m}{V}\frac{\Delta\bar{v}}{\Delta t} = -\frac{1}{V}\frac{\Delta\bar{p}}{\Delta t} = -\left(\frac{1}{c^2}\right)\frac{\Delta\bar{S}}{\Delta t} \\ \overline{f_{INERTIA}} &= -\rho\,\bar{a} = -\left(\frac{1}{c^2}\right)\frac{\Delta\bar{S}}{\Delta t}\ \left[N/m^3\right] \end{aligned} \tag{8}$$

The Poynting vector $\bar{S}$ represents the total energy transport of the electromagnetic radiation per unit surface per unit time [J / m^2 s]. Which can be written as the cross product of the Electric Field intensity $\bar{E}$ and the magnetic Field intensity $\bar{H}$.

$$\overline{f_{INERTIA}} = -\rho a = -\left(\frac{1}{c^2}\right)\frac{\Delta S}{\Delta t} = -\left(\frac{1}{c^2}\right)\frac{\Delta\left(\bar{E}\times\bar{H}\right)}{\Delta t}\left[N/m^3\right]$$

$$\overline{f_{INERTIA}} = -\left(\frac{1}{c^2}\right)\frac{\partial\left(\bar{E}\times\bar{H}\right)}{\partial t}\left[N/m^3\right] \qquad (9)$$

1.5 Coulomb's Law (Colomb Force) for Electromagnetic Radiation (Term B-2 and B-4)

An example of the Coulomb Force is the Electric Force $F_{Coulomb}$ acting on an electric charge Q placed in an electric field E. The equation for the Coulomb Force equals:

$$\overline{F_{Coulomb}} = \overline{E}\, Q \quad [N] \tag{10}$$

Dividing the right and the left term in equation (10) by the volume V results in the Electric force density $\overline{f_{Coulomb}}$:

$$\begin{aligned} \overline{F}_{COULOMB} &= \overline{E}\, Q \quad [N] \\ \frac{\overline{F}_{COULOMB}}{V} &= \overline{E}\, \frac{Q}{V} \quad \left[N/m^3\right] \\ \overline{f}_{COULOMB} &= \overline{E}\, \rho_E \quad \left[N/m^3\right] \end{aligned} \tag{11}$$

Substituting Gauss's law in differential form in (11) results in Coulombs Law for Electromagnetic Radiation for the Electric force density $\overline{f_{Coulomb}}$:

$$\begin{aligned} \overline{f}_{COULOMB} &= \overline{E}\, \rho_E \\ \overline{f}_{COULOMB} &= \overline{E}\, \rho_E = \overline{E}\, \left(\nabla \cdot \overline{D}\right) \\ \overline{f}_{COULOMB} &= \overline{E}\, \left(\nabla \cdot D\right) = \varepsilon\, \overline{E}\, \left(\nabla \cdot \overline{E}\right) \left[N/m^3\right] \end{aligned} \tag{12}$$

In Electromagnetic Field Configurations, there is in general no preference for the electric force densities or the magnetic force densities. In general the equations for the electric field densities are universally exchangeable with the magnetic field densities.

For the magnetic field densities, equation (12) can be written as:

$$\bar{f}_{\text{Coulomb - Electric}} = \bar{E}\left(\nabla . \bar{D}\right) = \varepsilon\ \bar{E}\ \left(\nabla . \bar{E}\right)\ \left[\text{N/ m}^3\right] \text{ (Term B-2)}$$

$$\bar{f}_{\text{Coulomb - Magnetic}} = \bar{H}\left(\nabla . \bar{B}\right) = \mu\ \bar{H}\ \left(\nabla . \bar{H}\right)\ \left[\text{N/ m}^3\right] \text{ (Term B-4)} \qquad (13)$$

1.6 Lorentz's Law (Lorentz Force) for Electromagnetic Radiation (Term B-3 and B-5)

An example of the Lorentz Force is the Magnetic Force $F_{Lorentz}$ acting on an electric charge Q moving with a velocity v within a magnetic field with magnetic field intensity B (magnetic induction).

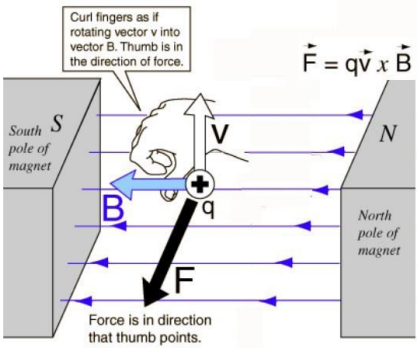

Fig. 1. The Lorentz Force equals the cross product of the Magnetic Induction B and the velocity v of the charge q moving within the magnetic field times the value of the electric charge

The equation for the Lorentz Force equals:

$$\bar{F}_{LORENTZ} = Q\,\bar{v} \times \bar{B} \quad [N] \tag{14}$$

Dividing the right and the left term in equation (14) by the volume V results in the Lorentz force density $\overline{f_{Lorentz}}$

$$\begin{aligned} \bar{F}_{LORENTZ} &= Q\,\bar{v} \times \bar{B} \quad [N] \\ \frac{\bar{F}_{LORENTZ}}{V} &= -\,\bar{B} \times \frac{Q\,\bar{v}}{V} \quad \left[N/m^3\right] \\ \bar{f}_{LORENTZ} &= -\,\bar{B} \times \frac{Q\,\bar{v}}{V} = -\,\bar{B} \times \bar{j} = -\,\mu\,\bar{H} \times \bar{j} \quad \left[N/m^3\right] \end{aligned} \tag{15}$$

In which q is the electric charge, v the velocity of the electric charge, B the magnetic induction and j the electric current density. Substituting

Ampère's law in differential form in (15) results in Lorentz's Law for Electromagnetic Radiation for the Electric force density $\overline{f_{Lorentz}}$:

$$\bar{f}_{LORENTZ} = -\mu \bar{H} \times \left(\bar{j}\right)$$
$$\bar{f}_{LORENTZ} = -\mu \bar{H} \times \left(\bar{j}\right) = -\mu \bar{H} \times \left(\nabla \times \bar{H}\right) \left[N/m^3\right] \quad (16)$$

In Electromagnetic Field Configurations, there is in general no preference for the electric force densities or the magnetic force densities. In general the equations for the electric field densities are universally exchangeable with the magnetic field densities. For the electric field densities, equation (16) can be written as:

$$\bar{f}_{Coulomb\text{ - }Electric} = -\varepsilon \bar{E} \times \left(\nabla \times \bar{E}\right) \left[N/m^3\right] \text{ (Term B-3)}$$
$$\bar{f}_{Coulomb\text{ - }Magnetic} = -\mu \bar{H} \times \left(\nabla \times \bar{H}\right) \left[N/m^3\right] \text{(Term B-5)} \quad (17)$$

1.7 The Fundamental Universal Equation for the Electromagnetic field (Term B-1 + Term B-2 + Term B-3 + Term B-4 + Term B-5)

Newton's second law of motion applied within any arbitrary electromagnetic field configuration results in the fundamental equation (23) for any arbitrary electromagnetic field configuration (a beam of light):

$$\text{NEWTON: } F_{TOTAAL} = m\,a \text{ represents: } f_{TOTAAL} = \rho\, a$$

$$-\rho\, a + f_{TOTAAL} = 0$$

$$-\rho\, a + f_{ELEKTRISCH} + f_{MAGNETISCH} = 0$$

$$-\rho\, a + F_{COULOMB} + F_{LORENTZ} + F_{COULOMB} + F_{LORENTZ} = 0$$

$$-\frac{1}{c^2}\frac{\partial(\bar{E}\times\bar{H})}{\partial t} + \varepsilon_0\,\bar{E}(\nabla.\bar{E}) - \varepsilon_0\,\bar{E}\times(\nabla\times\bar{E}) + \mu_0\,\bar{H}(\nabla.\bar{H}) - \mu_0\,\bar{H}\times(\nabla\times\bar{H}) = 0 \qquad (23)$$

B-1 B-2 B-3 B-4 B-5

Term B-4 is the magnetic equivalent of the (electric) Coulomb's law B-2 and Term B-3 is the electric equivalent of the (magnetic) Lorentz's law B-5.

The universal equation for the electromagnetic field (free electromagnetic waves and confined electromagnetic fields) has been presented in (24) and expresses the perfect equilibrium between the inertia forces (B-1), the electric forces (B-2 and B-3) and the magnetic forces (B-4 and B-5) in any arbitrary electromagnetic field configuration.

$$-\frac{1}{c^2}\frac{\partial(\bar{E}\times\bar{H})}{\partial t} + \varepsilon_0\,\bar{E}(\nabla.\bar{E}) - \varepsilon_0\,\bar{E}\times(\nabla\times\bar{E}) + \mu_0\,\bar{H}(\nabla.\bar{H}) - \mu_0\,\bar{H}\times(\nabla\times\bar{H}) = 0 \qquad (24)$$

B-1 B-2 B-3 B-4 B-5

1.8 The Universal Integration of Maxwell's Theory of Electrodynamics:

The universal equation (24) for any arbitrary electromagnetic field configuration can be written in the form:

$$-\frac{1}{c^2}\frac{\partial(\bar{E}\times\bar{H})}{\partial t}+\varepsilon_0\bar{E}(\nabla.\bar{E})-\varepsilon_0\bar{E}\times(\nabla\times\bar{E})+\mu_0\bar{H}(\nabla.\bar{H})-\mu_0\bar{H}\times(\nabla\times\bar{H})=0$$

$$-\varepsilon_0\mu_0\left(\bar{E}\times\frac{\partial(\bar{H})}{\partial t}+\bar{H}\times\frac{\partial(\bar{E})}{\partial t}\right)+\varepsilon_0\bar{E}(\nabla.\bar{E})-\varepsilon_0\bar{E}\times(\nabla\times\bar{E})+\mu_0\bar{H}(\nabla.\bar{H})-\mu_0\bar{H}\times(\nabla\times\bar{H})=0 \quad (25)$$

$$-\left(\varepsilon_0\bar{E}\times\frac{\partial(\bar{B})}{\partial t}+\mu_0\bar{H}\times\frac{\partial(\bar{D})}{\partial t}\right)+\bar{E}(\nabla.\bar{D})-\varepsilon_0\bar{E}\times(\nabla\times\bar{E})+\bar{H}(\nabla.\bar{B})-\mu_0\bar{H}\times(\nabla\times\bar{H})=0$$

M-3 M-4 M-1 M-3 M-2 M-4

The Maxwell Equations are presented in (26):

$$\nabla.\bar{D}=\rho \quad (\text{M-1}) \qquad \nabla\times\bar{E}=-\frac{\partial B}{\partial t} \quad (\text{M-3}) \qquad (26)$$

$$\nabla.\bar{B}=0 \quad (\text{M-2}) \qquad \nabla\times\bar{H}=\frac{\partial D}{\partial t} \quad (\text{M-4})$$

In vacuum in the absence of any charge density, it follows from (26) that all the solutions for the Maxwell's Equations are also solutions for the separate parts of the Universal Equation (25) for the Electromagnetic field.

Universal Equation for the Electromagnetic Field.

$$-\left(\varepsilon_0\bar{E}\times\frac{\partial(\bar{B})}{\partial t}+\mu_0\bar{H}\times\frac{\partial(\bar{D})}{\partial t}\right)+\bar{E}(\nabla.\bar{D})-\varepsilon_0\bar{E}\times(\nabla\times\bar{E})+\bar{H}(\nabla.\bar{B})-\mu_0\bar{H}\times(\nabla\times\bar{H})=0$$

M-3 M-4 M-1 M-3 M-2 M-4

4 Maxwell's Equations

$$\nabla.\bar{D}=\rho \quad (\text{M-1}) \qquad \nabla\times\bar{E}=-\frac{\partial B}{\partial t} \quad (\text{M-3}) \qquad (27)$$

$$\nabla.\bar{B}=0 \quad (\text{M-2}) \qquad \nabla\times\bar{H}=\frac{\partial D}{\partial t} \quad (\text{M-4})$$

Comparing the 4 Maxwell Equations (26) with the Universal Equation (24) we conclude that the 4 Maxwell equations show only the 4 parts of the Universal Dynamic Equilibrium in 4 separate terms and the 4 Maxwell equations are missing the fundamental term for inertia. For that reason it is impossible to calculate the interaction between light and gravity with the 4 Maxwell equations. To find the interaction terms between light and gravity the inertia term (B-1 in 24) is necessary.

1.9 Interaction between Gravity and Light (Electromagnetic Radiation).

To define the Fundamental Equation for the Interaction between Gravity and Light, an extra term (B-6) has been introduced in equation (24). The term B-6 represents the force density of the gravitational field acting on the electromagnetic mass density.

$$F_{GRAVITY} = m\,\bar{g} \quad [N]$$

Dividing both terms by the Volume V:

$$\frac{F_{GRAVITY}}{V} = \frac{m}{V}\,\bar{g} \quad [N/m^3] \qquad (28)$$

Results in the force density:

$$f_{GRAVITY} = \rho\,\bar{g} \quad [N/m^3]$$

The specific mass "ρ" of a beam of light follows from Einstein's equation:

$$W = m\,c^2$$

Divinding both terms by the Volume V results in:

$$\frac{W}{V} = \frac{m}{V}\,c^2 \qquad (29)$$

which represents the energy density "w" and the specific mass "ρ" of the electromagnetic radiation:

$$w = \rho\,c^2$$

which results for an expression of the specific mass ρ:

$$\rho = \frac{1}{c^2}\,w = \varepsilon\,\mu\,w$$