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Towards an Absolute Cosmic Distance Gauge by using Redshift Spectra from Light Fatigue.

Described by using

the Maxwell Analogy for Gravitation.

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Abstract

Light is an electromagnetic wave with a dynamic mass, and with a zero rest mass. A fourth parameter is gyrotation, the second field of the Newtonian gravitation, discovered by using the Maxwell Analogy for Gravitation. Here, we apply gyrotation for light. The dynamics analysis of the gyro-gravitation parameters for light turns out in the possible existence of a very tiny light fatigue and a very tiny redshift as a direct consequence. This redshift however is frequency-dependent, unlike the other causes for redshift, as the Doppler effect, the Ashmore effect, the gravitational redshift and the temperature redshift. The discovery of this quadratically frequency-dependent redshift allows us to set up the basis for an universal cosmic distance measurement gauge.

Key words : *gyrotation, gravitation, light fatigue.*
Method : *analytic.*

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1. Pro Memore : The Maxwell Analogy for gravitation: equations and symbols.

For the basics of the theory, I refer to : "A coherent double vector field theory for Gravitation".
The Maxwell Analogy laws for gravitation can be expressed in equations (1.1) up to (1.6) below.

In the 'gyro-gravitation theory' (or 'dual field gravitation theory' or 'Maxwell analogue gravitation theory', etc...), the electric charge is substituted by mass, the magnetic field by *gyrotation*, and the respective constants are also substituted. The gravitation acceleration is written as $\boldsymbol{g}$, the so-called second field or *gyrotation field* as $\boldsymbol{\Omega}$ (dimension [s^{-1}]) and the universal gravitation constant is found as $G^{-1} = 4\pi\zeta$, where G is the universal gravitation constant and ζ the gravitation constant that is equivalent to the electrostatic constant ε . We use the sign $\Leftarrow$ instead of $=$ because the right-hand side of the equations causes the left-hand side. This sign $\Leftarrow$ will be used when we want insist on the induction property in the equation. F is the resulting force, v the relative velocity of the mass m with density ρ in the gravitational field. And $\boldsymbol{j}$ is the mass flow through a fictitious surface.

$$\boldsymbol{F} \Leftarrow m\,(\,\boldsymbol{g} + \boldsymbol{v} \times \boldsymbol{\Omega}) \qquad (1.1)$$

$$\nabla \,.\, \boldsymbol{g} \;\Leftarrow \rho\,/\,\zeta \qquad (1.2)$$

$$c^2\, \nabla \times \boldsymbol{\Omega} \Leftarrow \boldsymbol{j}\,/\,\zeta + \partial\, \boldsymbol{g}\,/\partial t \qquad (1.3)$$

$$div\, \boldsymbol{j} \Leftarrow -\, \partial\rho\,/\,\partial t \qquad (1.4)$$

$$div\;\boldsymbol{\Omega} \equiv \nabla.\; \boldsymbol{\Omega} = 0 \qquad (1.5)$$

$$\nabla \times \boldsymbol{g} \;\Leftarrow\; -\,\partial\, \boldsymbol{\Omega}/\,\partial t \qquad (1.6)$$

It is possible to speak of gyrogravitation waves with a transmission velocity c.

$$c^2 = 1\,/\,(\,\zeta\,\tau\,) \qquad (1.7) \qquad \text{wherein} \qquad \tau = 4\pi\, G/c^2. \qquad (1.8)$$

τ is the equivalent constant to the magnetic constant (permeability) μ .

2. The mechanics and dynamics of light.

2.1 The mechanics of light.

Light owns a dynamic mass, but not a rest mass. In that case, light must make use of a mass which isn't its own, but has to earn it from some medium. It borrows mass. The name we give that medium isn't important here, so let us call it dark energy.
Light can then be seen as a compression of the medium itself, running at a velocity c, which is only dependent from the mass-density and the energy-density of the medium. The same equation for the wave velocity is then found, identical to the one of fluids:

$$\boldsymbol{c} = \sqrt{\frac{\Sigma}{\rho}}$$

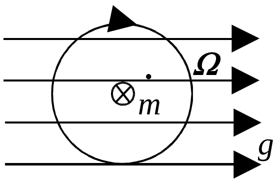
(Σ is the energy-density, similar to an elasticity factor, ρ is the mass-density)

which is the same as saying that $\boldsymbol{E} = \boldsymbol{m}\,\boldsymbol{c}^{2}$. The idea here is that the entity *mass* as well as the entity *dark energy* are of the same kind. This gives a physical meaning to the famous equation, for light.

2.2 The dynamics of light.

Let us consider a light wave, traveling at a velocity c through the *dark energy*. A consequence of the propagating mass wave in the weak gravitation field of the *dark energy* itself is that, when the wave propagates at a velocity c , the compressed *dark energy* will almost instantly jump from a very low mass-density status to a very high mass-density, and back again to the low density. This jump will result in the creation of a gyrotation field $\boldsymbol{\Omega}$, that is circular and perpendicular to the motion of the light, as explained in "A Coherent Dual Vector Field Theory for Gravitation".

In fig 2.1 is shown what happens in the weak gravitational field g , if a mass-flow (which here is directed towards the plane of the paper) travels in that field g .



A moving mass in a gravitation field will generate a second field (analogically to electromagnetism) that is perpendicular to the gravitation field of the moving mass.

Fig. 2.1.

Since the sudden change of mass (pulse) occurs locally, the gyrotation field will be a local pulse as well. At a certain place, on the light's path the pulse first grows to a maximum, and decreases back to (almost) zero.

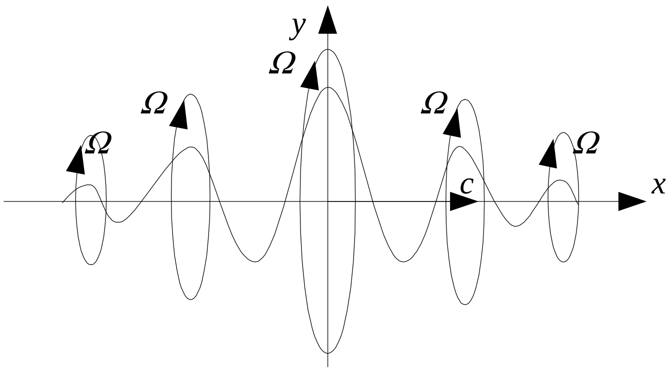


Fig. 2.2

A light wave, traveling in the positive x-axis' direction will generate locally an increasing gyrotation field during the first half period of the wave. During the second half period, it will generate a decreasing gyrotation field.

For a certain location, this results in a increase of the gyrotation field during the first half period of the wave, and a decrease of the gyrotation field during the second half period of the wave.

3. The dynamics of the dark energy in the presence of light.

3.1 The gyro-gravitational description of a light wave.

Since the change of mass occurs locally as a pulse, the gyrotation field will be a local pulse as well. But if we follow the wave, the value of the gyrotation pulse remains a constant, and in occurrence, it equals to the maximum value of the pulse.

While the gyrotation pulse travels with a velocity c , and the medium has a velocity zero (reference), the relative medium velocity is indeed $-c$.
Applying equation (1.1) results in the generation of a cylindrical gyrotation force which acts on the medium, as shown in fig.3.1.

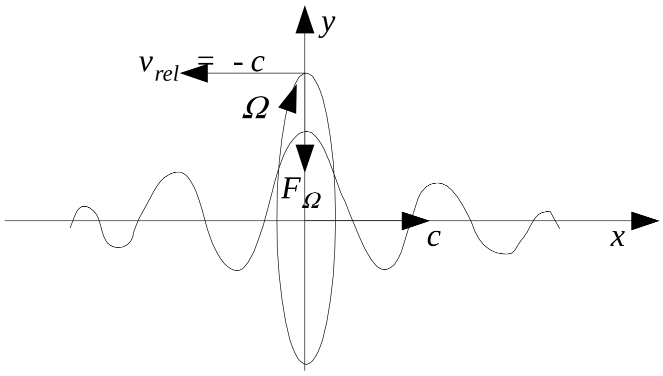


Fig.3.1.a.

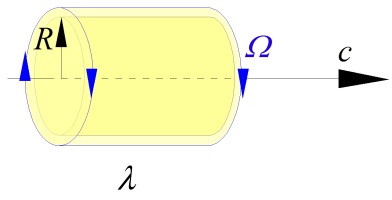


Fig.3.1.b.

A light wave travels with velocity c *and creates an elementary cylindrical gyrotation force* F_Ω *on the medium's mass, towards the wave mass.*

From equation (1.1) follows $\boldsymbol{F} = \boldsymbol{m}\boldsymbol{v}\,\Omega$ with $\boldsymbol{m} = \rho \boldsymbol{V}$. Herein $\boldsymbol{v}$ is the velocity of the wave (in fact, the speed of light: $\boldsymbol{c}$) , $\boldsymbol{m}$ is its dynamical mass within the wave radius $\boldsymbol{R}$, ρ is the density of the dark energy and $\boldsymbol{V}$ is the volume of the uncompressed dark energy that is related to the electromagnetic wave.

3.2 Compression of a light wave.

The infinitesimal work to compress the light carrier, i.e. the dark energy is given by :

$$\mathbf{d}\boldsymbol{W} = \mathbf{d}\boldsymbol{E} = \mathbf{2}\pi \boldsymbol{F}\,\mathbf{d}\boldsymbol{r} \qquad (3.1)$$

For a given cylinder with length λ and radius $\boldsymbol{R}$, on which Ω acts , the total force is given by :

$$\boldsymbol{F} = \pi \lambda \rho \boldsymbol{c}\, \boldsymbol{R}^2\, \Omega_{\boldsymbol{R}} \qquad (3.2)$$

Here, $\boldsymbol{R}$ is the radius of the uncompressed dark energy volume that has to be taken in account for the light wave. The wave matter that flows through the dark energy at velocity $\boldsymbol{c}$ in a cylinder with radius $\boldsymbol{R}$ will be contracted by the gyrotation that is created by this flux.

At the other hand, the infinitesimal radial displacement responds to $\mathbf{d}\boldsymbol{r} = \boldsymbol{a_g}\boldsymbol{t}\,\mathbf{d}\boldsymbol{t}$, wherein $\boldsymbol{a_g}$ is the gravitational acceleration, wherefore we have the equation $\boldsymbol{a_g} = \boldsymbol{c}\,\Omega$. (3.3.a.b.)

This last equation follows from the physical origin of the speed of light in analogy with electromagnetism, where we use the electrical field $\boldsymbol{E}$ and the magnetic field $\boldsymbol{B}$, wherefore $\boldsymbol{E} = \boldsymbol{c}\,\boldsymbol{B}$.

The value of the time $\boldsymbol{t}$ is only half the period of the wave or $\boldsymbol{t} = \dfrac{\mathbf{1}}{\mathbf{2}\upsilon}$. Hence, from (3.2.a) follows that :

$$\boldsymbol{r} = \int_{\mathbf{0}}^{\boldsymbol{r}} \mathbf{d}\boldsymbol{r} = \frac{\boldsymbol{c}\,\Omega}{\mathbf{4}\,\upsilon} \qquad (\boldsymbol{r} \geq \boldsymbol{R}) \qquad (3.4)$$

Since there is no gravitational source we can reduce equation (1.3) to $c^2\,\nabla \times \boldsymbol{\Omega} \Leftarrow \boldsymbol{j}\,/\,\zeta$. The integrated equation, after application of the Stokes' theorem (see "A Coherent Dual Vector Field Theory for Gravitation", equation (2.2)) , is :

$$\oint \Omega\, \mathbf{d}\,\boldsymbol{l} = 4\,\pi\,\boldsymbol{G}\,\dot{\boldsymbol{m}}/\boldsymbol{c}^2 \qquad (3.5)$$

For a circular path about the light packet, this gives : $\Omega = 2\,\boldsymbol{G}\,\dot{\boldsymbol{m}}\big/\left(\boldsymbol{r}\,\boldsymbol{c}^2\right) \quad (\boldsymbol{r} \geq \boldsymbol{R}) \qquad (3.6)$

wherein $\dot{\boldsymbol{m}}$ is the derivative of the mass to the time.

Now, we can say that for light waves, we have $\boldsymbol{E} = \boldsymbol{m}\boldsymbol{c}^2$ and $\boldsymbol{E} = \boldsymbol{h}\upsilon$.

At a certain place, the density of the dark energy changes to the compressed value of the light mass $\boldsymbol{m} = \dfrac{\boldsymbol{h}\,\upsilon}{\boldsymbol{c}^2}$.

Now, we know that the mass packet of a length λ passes at a velocity of $\boldsymbol{c}$. The variation of the mass packet over time is then $\Delta\,\boldsymbol{m}/\Delta\,\boldsymbol{t}$. And the time $\Delta\,\boldsymbol{t}$ correspondents to the period of the light packet which is the inverse of the frequency : $1/\upsilon$.

Hence, it follows that the mass variation equals to : $\dfrac{\Delta\,\boldsymbol{m}}{\Delta\,\boldsymbol{t}} = \dfrac{\boldsymbol{h}\,\upsilon^2}{\boldsymbol{c}^2} \qquad (3.7)$

Hence, we can rewrite (3.6) as :

$$\Omega = \frac{2\,\boldsymbol{G}\,\boldsymbol{h}\,\upsilon^2}{\boldsymbol{r}\,\boldsymbol{c}^4} \qquad (\boldsymbol{r} \geq \boldsymbol{R}) \qquad (3.8)$$

And the elimination of from (3.4) and (3.8) gives :

$$\boldsymbol{r}^2 = \frac{\boldsymbol{G}\,\boldsymbol{h}\,\upsilon}{2\,\boldsymbol{c}^3} \qquad (\boldsymbol{r} \geq \boldsymbol{R}) \qquad (3.9)$$

Since this elimination results in a right hand that is a constant for a given frequency υ , we have to conclude that $\boldsymbol{r} = \boldsymbol{R}$. Remark that the value of the radius $\boldsymbol{R}$ is only dependent from the frequency υ.

Combining (3.8) and (3.9) gives also a frequency-dependent equation : $\Omega^2 = \dfrac{8\,\boldsymbol{G}\,\boldsymbol{h}\,\upsilon^3}{\boldsymbol{c}^5} \qquad (3.10)$

Hence, (3.2) can be rewritten as follows, when filling in (3.9) and (3.10) :

$$\boldsymbol{F} = \pi\,\lambda\,\rho\,\boldsymbol{c}\sqrt{\frac{\boldsymbol{G}^3\,\boldsymbol{h}^3\,\upsilon^5}{\boldsymbol{c}^{11}}} \qquad (3.11)$$

and the integration of (3.1) becomes, for a work $\boldsymbol{W}$ over the wavelength λ , since we know that $\boldsymbol{R}$ is a constant for a given frequency υ :

$$\boldsymbol{W}_\lambda = \sqrt{2}\;\pi^2\,\lambda\,\rho\,\boldsymbol{G}^2\,\boldsymbol{h}^2\,\upsilon^3\,\boldsymbol{c}^{-6} \qquad (3.12)$$

This is the work that is necessary for the compression of the light over a distance λ.

3.3 Depression of the light wave.

The depression of the wave, when the light packet of length λ passed by, should of course be the same value, but with a minus sign, excepted a very tiny part, due to the fact that in the real world, we can expect that the elasticity of the dark energy will show a very tiny energy loss. The value of this loss is unknown, and we represent it by the loss factor $(1-\varepsilon)$, wherein $\varepsilon < 1$.

Hence, the energy gain by the depression is given by :

$$-W_\lambda = -\varepsilon\sqrt{2}\ \pi^2\ \lambda\rho G^2\ h^2\ \upsilon^3\ c^{-6} \qquad (3.13)$$

Unfortunately, we don't know how much will be lost. But anyway, the dark energy density isn't known either.

In order to do not confuse this with the tired light theories, which are cosmology theories, we call this effect "light fatigue". Light fatigue is a very small redshift effect that is only a fraction from the other causes of redshift.

3.4 Frequency-dependent redshift.

The equations (3.12) and (3.13) were found for a cylinder length of λ, but for a distance $\mathbf{d}x$ between the emission of the wave and its observation, we would get the following energy losses (we have put κ in replacement of the constants $\sqrt{2}\left(1-\varepsilon\right)\pi^2\rho G^2\ h^2\ c^{-6}$) :

$$\mathbf{d}W = h\,\mathbf{d}\,\upsilon = \kappa\,\upsilon^3\ \mathbf{d}\,x \qquad (3.14)$$

Hence, $$\int_{\upsilon_e}^{\upsilon_o}\frac{\mathbf{d}\,\upsilon}{\upsilon^3} = \kappa\int_0^L \mathbf{d}\,x \qquad (3.15)$$

which, after integration gives the distance L between the emitter and the observer:

$$\boxed{L = \frac{1}{2\kappa}\left(\frac{1}{\upsilon_o^2}-\frac{1}{\upsilon_e^2}\right)} \qquad (3.16)$$

wherein the suffix *o* stands for observer and *e* for emitter.

Equation (3.16) shows that the redshift of the observed light will be non-linear, unlike the redshift that is caused by the recoil of hydrogen by the Mössbauer effect, unlike the gravitational redshift, unlike the redshift due to the Doppler effect and unlike the one due to temperature redshift.
An interesting consequence is that for a frequency spectrum of given isotopes, wherefore the values υ_e are well known, the distance L can be found by the spread of the observed frequency spectrum for these isotopes.
When the linear redshifts have been subtracted, the remaining frequency-dependent spectrum will correspond to equation (3.15).
It is true that the values of the dark energy's mass-density or its energy-density, as well as its inelastic part are not known yet. An estimate can however been found by using the equation (3.15) for already known distances.

4. Discussion and conclusion.

If light fatigue, due to the slightly inelastic dark energy, can be observed, it has to be quadratically frequency-dependent. The possible presence of a quadratic colour shift for a very distant object could result in the finding of the real distance of that object to us. Other redshifts are frequency-invariant, such as the gravitational analogy for the Compton effect (Zwicky) or Mössbauer redshift (L.Ashmore) , the gravitational redshift (Einstein) , Doppler redshift (Doppler) and the temperature redshift (J.García). After subtraction of the frequency-invariant redshifts, as a whole, the remaining small redshift can appear to be quadratic. If so, no other know effect than the light fatigue will explain it. After a number of such observations, a relative distance scale can then be created in order to find the loss factor $(1-\varepsilon)$.

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