

# Metric Expansion of Space Described by Gravity Based on Electromagnetic Processes

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## Abstract

The present study describes the metric expansion of space based on a novel understanding of gravity and its electromagnetic processes. A singularity in the universe emits electromagnetic energy, which is absorbed by atoms and re-emitted to other atoms. This results in mutual force of attraction, *i.e.* gravity. We assume that the distance  $R$  towards the singularity is constant and  $r$  is the distance between two bodies. Then the gravitational force decreases with the decrease of the re-emitted energy, *i.e.* as  $1/r^2$ , and in line with Newtonian gravity and General Relativity. However, the universe orbits the singularity and hence  $R$  varies.  $R$  increases when a certain part of space travels from the singularity, and whereby the energy re-emitted by atoms decreases as  $1/r^2R^2$ . Consequently, the gravitational force between bodies decreases as  $1/r^2R^2$ , resulting in increasing distance between bodies, *i.e.* metric expansion of space. A theoretical model is presented. The theoretical model describes the mechanisms which results in gravity and expanding space. The study also displays how the electromagnetic characteristics of the singularity and gravity waves and the mechanism creating gravity are measured.

## Keywords

Metric Expansion of Space, Gravity, Atom, *Vis Viva*, Gravitational Ellipse

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## 1. Introduction

It has been reported that the universe contains a gigantic singularity which generates very low frequency and synchronized TEM (transverse electromagnetic) waves, having extremely high amplitude and energy [1] [2]. Atoms contain oscillators with different natural frequencies. These oscillators absorb TEM waves at specific frequencies. The absorbed electromagnetic energy accounts for atomic internal and external forces as well as atomic stored energy and emitted energy [1] [2]. These TEM waves are impossible to measure using the state of art

methods. However, a novel method enables exact characterization of TEM waves emitted by the singularity, absorbed by atoms and re-emitted by atoms [1]-[3].

It has also been reported that atoms absorb these TEM waves in the frequency range of 0.005 - 0.03 Hz [1]. The absorbed energy is very large and may account for atomic forces and atomic stored energy.

Furthermore, it has been reported that atoms also absorb TEM waves with frequency of 69.9 Hz [2]. These TEM waves are called gravity waves in the present paper, and their energy flow density is described by the Poynting vector  $\mathbf{S}$ . These gravity waves are then re-emitted uniformly into space, and whereby some are absorbed by other atoms. This creates a mutual flow of synchronized TEM waves between atoms, resulting in a mutual force of attraction, *i.e.* gravity where the gravitational force between two bodies decreases with the square of the distance  $r$ , *i.e.* as  $1/r^2$ , in line with Newtonian gravity and General Relativity [4].

In the present study it is assumed that the universe orbits the singularity. Two bodies orbiting the singularity receive TEM waves from the singularity where the energy flow density, described by the Poynting vector  $\mathbf{S}_0(R)$ , decreases with the square of the distance  $R$ , *i.e.* as  $1/R^2$ , where  $R$  is the distance to the singularity. This results in that the Poynting vectors  $\mathbf{S}_1(r)$  and  $\mathbf{S}_2(r)$  of re-emitted TEM waves from the two bodies with distance  $r$  decrease as  $1/r^2$ ; however, also as  $1/R^2$  and in total as  $1/r^2 R^2$ . Hence, the gravitational force between the two bodies decreases faster than depicted by the *vis viva* equation (describing elliptical orbital) [5]-[7], when they travel from the singularity, *i.e.* when  $R$  increases. It is now assumed that one body orbits the other. At increasing  $R$  the orbiting body loses velocity less rapidly at increasing  $r$ , *i.e.* when it travels from the larger body (towards the apogee), resulting in that the semi-major axis increases, *i.e.* it travels in a larger ellipse. Consequently that planet system expands, its galaxy expands and the distances between galaxies increase. This may explain the metric expansion of space [8]-[10].

The objective with the present paper is to build on results already presented in a report [2]. This information is compiled into a theoretical model in Section 2, which describes the mechanisms behind the metric expansion of space. The theoretical model is based on state of the art electromagnetic theory [11]-[14], wave theory [15] [16] and the *vis viva* equation which describes elliptic orbital [5]-[7]. Comparison with the Standard Model is made [17]. The relation between energy flow density  $\mathbf{S}_0(R)$  and dark energy is discussed [18]. The present definition of gravity enables description of a number of unsolved issues within physics and astrophysics such as the photon [19], gravitational and inertial mass [20] as well as gravitational lensing [21]. Discussion and conclusions are found in Section 3.

The aim of the study is to present a theoretical model of the metric expansion of space.

## 2. Theoretical Model

### 2.1. Gravity

The theoretical model builds on the observation that atomic oscillators<sub>69,9</sub>, with natural frequency 69.9 Hz, absorb TEM waves with frequency 69.9 Hz [2]. The TEM waves originate from a singularity in the universe and have been thoroughly described [1] [2]. The absorbed TEM waves are then re-emitted uniformly into space.

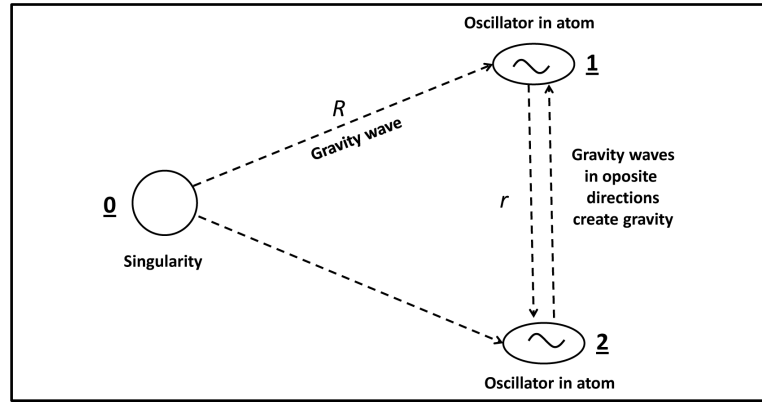
The behavior and characteristics of plane TEM waves is independent of their frequency. The field vectors  $\mathbf{E}$  and  $\mathbf{B}$  or  $\mathbf{H}$  ( $\mathbf{B} = \mu_0 \mathbf{H}$ ) are linked and perpendicular. The field vector amplitudes relate as  $E = cB$ , where  $c$  is the speed of light. The electric and magnetic field vector amplitudes  $E$  and  $B$  decrease with the distance from the source as  $1/r$ . The Poynting vector  $\mathbf{S}$  describes the TEM energy flow density [11] [12]

$$\mathbf{S} = \mathbf{E} \times \mathbf{H}. \quad (1)$$

The energy stored in the magnetic field is just equal to that in the magnetic field. The direction of energy flow is reversed for a wave travelling in the opposite direction because the phase of  $\mathbf{E}$  and  $\mathbf{H}$  is reversed.

The theoretical model comprises a huge singularity in space,  $\mathbf{0}$  in **Figure 1**. It emits vast amount of plane TEM waves with frequency 69.9 Hz. Its energy flow density at distance  $R$  is described by its Poynting vector  $\mathbf{S}_0(R)$ .

One source, Source 1, as  $\mathbf{1}$  in **Figure 1**, where  $R$  is the distance to the singularity, absorbs TEM waves from the singularity described by  $\mathbf{S}_0(R)$ . Source 1 re-emits TEM<sub>1</sub> waves described by its Poynting vector  $\mathbf{S}_1(r)$  at the distance  $r$  from Source 1. Source 2, as  $\mathbf{2}$  in **Figure 1**, where  $R$  is the distance to the singularity and  $r$  is the distance to Source 1, absorbs TEM waves from the singularity described by  $\mathbf{S}_0(R)$ . Source 2 re-emits plane TEM<sub>2</sub> waves described by  $\mathbf{S}_2(r)$  uniformly into space. In the direction towards Source 1 plane TEM<sub>1</sub> and TEM<sub>2</sub> waves



**Figure 1.** A singularity  $\underline{0}$  generates gravity waves (low frequency plane TEM waves). Oscillators<sub>69,9</sub>  $\underline{1}$  and  $\underline{2}$  in atoms create resonance with gravity waves and re-emit them unaltered. This causes flow of gravity waves between atoms and their oscillators<sub>69,9</sub>  $\underline{1}$  and  $\underline{2}$ . The flow of gravity waves in opposite directions between oscillators<sub>69,9</sub> results in mutual force of attraction, *i.e.* gravity.

interact because of the force between their synchronized field vectors. This also implies that there is energy transfer from TEM<sub>1</sub> to TEM<sub>2</sub> when TEM<sub>2</sub> propagates towards Source 1. In equilibrium there is energy transfer in both directions, *i.e.* from TEM<sub>1</sub> to TEM<sub>2</sub> vice versa. Note that  $\mathbf{E}$  and  $\mathbf{H}$  are always perpendicular and hence  $\mathbf{S} = \mathbf{E} \times \mathbf{H}$  can be replaced by  $S = E \cdot H$ . Equilibrium is defined by the amount of energy that Source 1 is able to deliver at Source 2, *e.g.* at the distance  $r$ ,  $S_1(r)$ , and the amount of energy that Source 2 is able to deliver at Source 1, *i.e.*  $S_2(r)$ . This results in back reaction force  $F(r)$ , *i.e.* radiation reaction [11]. This creates mutual force of attraction  $F(r)$ :

$$F(r) = \gamma \cdot S_1(r) \cdot S_2(r). \tag{2}$$

It is here assumed that the distance  $R$  to the singularity is constant. Hence,  $\mathbf{S}_0(R)$  is constant and thus  $\gamma$  is a constant.

The entity which absorbs and re-emits TEM waves with frequency 69.9 Hz is an (forced damped) oscillator<sub>69,9</sub> with natural frequency 69.9 Hz. It is now assumed that each source consists of many oscillators<sub>69,9</sub> where each atomic oscillator<sub>69,9</sub> re-emits TEM waves described by its Poynting vector  $\delta S(r)$  and where  $r$  denotes the distance from the source and its oscillator<sub>69,9</sub>.  $\mathbf{E}$  and  $\mathbf{H}$  decrease linearly with the distance  $r$  implying that  $\delta S(r)$  decreases with the square of the distance;  $\delta S(r) = \delta S(0)/r^2$ . The mutual force of attraction  $\delta F(r)$  between two atomic oscillators<sub>69,9</sub> with distance  $r$  is

$$\delta F(r) = \gamma \cdot \delta S(0) \cdot \delta S(0) / r^2. \tag{3}$$

In order to simplify  $\delta S(0)$  is from now on denoted  $\delta S$ .

It is now assumed that one oscillator<sub>69,9</sub> acts on  $p$  collocated oscillators<sub>69,9</sub>, belonging to the set  $\mathbf{P}$  of all oscillators<sub>69,9</sub> at Source 2, and where each force can be described by  $\delta F(r)$ . These oscillators<sub>69,9</sub> are synchronized resulting in the force

$$\sum_{p \in \mathbf{P}} \delta F(r) = \gamma \cdot \delta S \cdot \sum_{p \in \mathbf{P}} \delta S / r^2 = \gamma \cdot (\delta S \cdot \delta S) \cdot p / r^2. \tag{4}$$

It is now assumed that  $n$  collocated oscillators<sub>69,9</sub>, belonging to the set  $\mathbf{N}$  of all oscillators<sub>69,9</sub> at Source 1, act on  $p$  collocated oscillators<sub>69,9</sub>, belonging to the set  $\mathbf{P}$  of all oscillators<sub>69,9</sub> at Source 2, resulting in the total force  $F(r)$ :

$$F(r) = \gamma \cdot \sum_{n \in \mathbf{N}} \delta S \cdot \sum_{p \in \mathbf{P}} \delta S / r^2 = \gamma \cdot (\delta S \cdot \delta S) \cdot n \cdot p / r^2. \tag{5}$$

$\delta S \cdot \delta S$  is a constant described by the intrinsic characteristics of the oscillator<sub>69,9</sub> and  $S_0(R)$ , therefore Equation (5) is simplified into

$$F(r) = \xi \cdot n \cdot p / r^2, \tag{6}$$

where  $\zeta$  is a constant.

In a previous study Equation (6) was called the law of gravity between two clusters, at distance  $r$  containing  $n$  respectively  $p$  oscillators<sub>69,9</sub> [2]. Note that the cluster can be few oscillators<sub>69,9</sub>, an electron, an atom, a mass, a planet or a black hole.

Equation (6) can be illustrated with gravity between the earth and the sun. The earth contains  $n$  atomic oscillators<sub>69,9</sub> creating a force  $n \cdot \delta F(r)$  on every atomic oscillator<sub>69,9</sub> in the sun. The sun contains  $p$  oscillators<sub>69,9</sub>, thus the total force of attraction is  $n \cdot p \cdot \delta F(r)$  and that is equal to Equation (6). The earth's mass  $M_1$  is proportional to the number of atomic oscillators<sub>69,9</sub> on earth, *i.e.*  $M_1 \sim n$ , and the sun's mass  $M_2 \sim p$ . Equation (6) is then approximately equal to the Newtonian geometric law of gravity, where  $F_G$  is the gravitational force:

$$F_G = \gamma \cdot S_1(0) \cdot S_2(0) / r^2 = \xi \cdot n \cdot p / r^2 \approx F_{\text{Newton}} = GM_1 M_2 / r^2. \quad (7)$$

$S_1(0)$  is the Poynting vector of Source 1 or body 1 and  $S_2(0)$  is the Poynting vector of Source 2 or body 2.  $\zeta$ ,  $G$ ,  $S_1(0)$  and  $S_2(0)$  in Equation (7) depend on the distance  $R$  between the singularity and body 1 respectively body 2, as described in Section 2.3.

## 2.2. Classical Astrodynamics

In astrodynamics, the *vis viva* equation, also referred to as orbital energy conservation equation, is one of the fundamental and useful equations that govern the motion of orbiting bodies. It is the direct result of the law of conservation of energy, which requires that the sum of kinetic and potential energy is constant at all points along the orbit. *Vis viva* represents the principle that the difference between the aggregate work of the accelerating forces of a system and that of the retarding forces is equal to one half the *vis viva* accumulated or lost in the system while the work is being done. For any Kepler orbit (elliptic, parabolic, hyperbolic or radial), the *vis viva* equation [5] is as follows (Figure 2):

$$v^2 = GM (2/r - 1/a), \quad (8)$$

where:

- $v$  is the relative speed of the two bodies.
- $r$  is the distance between the two bodies.
- $a$  is the semi-major axis ( $a > 0$  for ellipses,  $a = \infty$  or  $a = 0$  for parabolas, and  $a < 0$  for hyperbolas).
- $G$  is the gravitational constant.
- $M$  is the mass of the central body.

## 2.3. Metric Expansion of Space

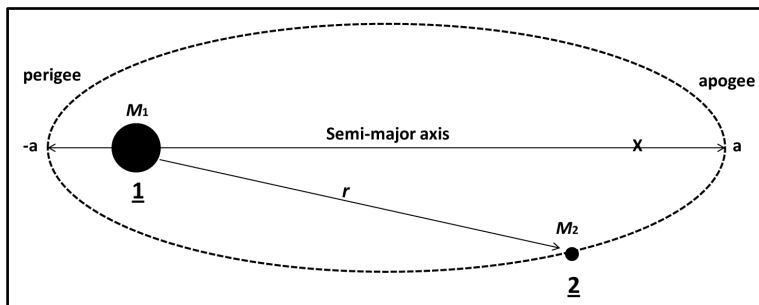
In the present theoretical model bodies in space orbit the singularity **0** with mass  $M_0$ , as shown in Figure 3. In this case  $R$  is not constant and hence the absorbed energy at Source 1 decreases as  $S_0(R) = \alpha/R^2$ , where  $\alpha$  is a constant. Hence, the re-emitted energy flow density  $S_1(0)$  from **1** and  $S_2(0)$  from **2** are not constant but decreases as  $1/R^2$ .

Bodies which orbit each other are illustrated in Figure 3, comprising the larger mass **1** and the smaller mass **2**, described in Section 2.2. The smaller mass **2** orbits the larger mass **1**. At constant distance  $R$  to the singularity, this orbit follows Equation (7) and Equation (8). However, **1** and **2** orbit the singularity **0** and  $R$  is not constant. Equation (7) must be enhanced to include that  $S_0(R)$  varies:

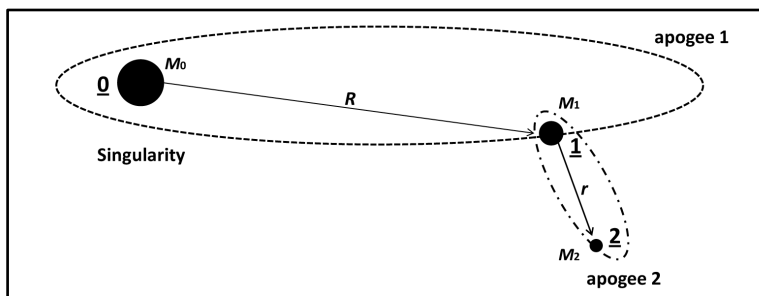
$$F_G = \beta \cdot S_0(R) \cdot S_1(0) \cdot S_2(0) / r^2, \quad (10)$$

where  $\beta$  is a constant and  $r$  is small compared to  $R$ .  $S_0(R)$  decreases as  $1/R^2$ , hence  $F_G$  decreases as  $1/R^2$  when **1** and **2** travels towards the apogee 1. This implies that when **2** orbits **1** its velocity decreases slower when **2** travel towards apogee 2, compared to the situation at smaller distance  $R$  to the singularity. This results in a larger ellipse, *i.e.* larger semi-major axis and semi-minor axis. Consequently, this planet system expands when **1** and **2** travels from the singularity **0**. This is generally valid for orbital in space and thus galaxies expand and distance between galaxies increases.

According to the theoretical model the part of space that travels towards apogee 1 experiences faster expansion as it approaches apogee 1 (because  $R$  increases). An observer in this part of space will notice escalating expansion of space.



**Figure 2.** According to classical astrodynamics a small body with mass  $M_2$  orbits a large body, with mass  $M_1$  in an ellipse, described by the *vis viva* equation, Equation (8).



**Figure 3.** Two bodies **1** and **2** orbiting the singularity **0** experience smaller mutual gravitational force  $F_G(r)$  when the distance  $R$  to the singularity increases. This results in that the planet system **1** and **2** is exposed to metric expansion. The semi major axis and semi minor axis increase when **1** and **2** travels from the singularity. This explains the metric expansion of space.

### 3. Discussion and Conclusions

We do not know the starting position, velocity or direction of our part of space relative to the singularity. However, observations display that space that we can observe expands at an increasing speed [8]-[10]. The present theoretical model may explain this metric expansion of space. The model indicates that our part of space is in a position where it travels from the singularity, resulting in escalating expansion of space.

It has not been possible to detect any change in the gravitational constant  $G$  over time. This indicates that the relative change in  $R$  over measurable time is extremely small, and consequently the distance between the Milky Way galaxy and the singularity ought to be very large.

The strength of the present theory is a novel method facilitating measurement of relevant parameters [1]-[3]. TEM waves originating from the singularity have been measured to a degree which allows exact description of their characteristics such as direction of origin, amplitude, phase, frequencies and field vector behavior [1] [2]. Furthermore, TEM waves, absorbed and re-emitted by atoms, have been measured to a degree which reveals the atomic intrinsic mechanism; forced damped oscillators with natural frequencies 0.005 - 0.03 Hz [1] and 69.9 Hz [2]. The force of attraction between TEM waves has been measured [2]. The direction towards the singularity is towards north and roughly in line with the earth's rotational axis, where these measurements are described in [2]. Hence, crucial parts of the present theory have been measured in laboratory and some parts have been simulated and reproduced in laboratory.

It is proposed that the energy flow density  $S(R)$  described in this paper and in [1] [2] is what is called dark energy [18]. In that case dark energy decreases as  $1/R^2$  with the distance  $R$  to the singularity. In that case it is possible to measure dark energy as described previously [1] [2].

The platform of modern physics is elementary particle physics, described in the Standard Model [17]. The Standard Model lacks definition of gravity; hence, it falls short in describing the metric expansion of space.

The General Relativity provides a metric description of gravity. However, it does not define the mechanism creating gravity. Hence, General Relativity lacks the tools needed to explain expansion of space.

Here a new theory is launched which describes the mechanisms creating gravity and metric expansion of space. The theory also explains why the metric expansion of space escalates when that part of space travels from the singularity. The theory is based on electromagnetic theory and wave theory.

The present definition of gravity and the singularity's energy flow density  $S(R)$  enables a fundamental enhancement of astrophysics. Hereto unsolved phenomena, such as the photon [19], gravitational and inertial mass [20] as well as gravitational lensing [21], can be described in a novel way based on one and the same mechanism in atoms, *i.e.* passive oscillators which absorb and re-emit energy originating from the singularity. One and the same mechanism operates on micro level (atomic level) as well as on macro level (universal level).

The geocentric model was replaced by heliocentric model in the middle ages. Today's science is dominated by the atomcentric model where all forces and energy are believed to originate from the atom itself [17]. The atomcentric model will be replaced by the unicentric model where all atoms are controlled by energy originating from a singularity in the centre of the universe. The universe may be very logical, once we understand its simplicity.

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