Gravity
caused by TEM waves operating on dipoles in atoms

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Key words: gravity, gravitation, Poynting vector, elementary particle, dipole, TEM waves,

Abstract

The study displays the existence of a gravitational singularity in the universe generating synchronized, extremely low frequency plane TEM (transverse electromagnetic) waves. It is proposed that atomic intrinsic electromagnetic fields create resonance with these plane TEM waves, causing particles and atoms to receive and to re-emit synchronized plane TEM waves. The energy flow of synchronized plane TEM waves, travelling in opposite directions between e.g. two atoms, creates mutual force of attraction, i.e. gravity. Consequently, gravity is not an intrinsic atomic feature; however, the result of fully passive atoms exposed to electromagnetic energy. The study describes how plane TEM waves emitted by the gravitational singularity was measured, how gravity was measured and how gravity was simulated using an electronic device. The present electromagnetic law of gravity is compared with Newtonian geometric law of gravity.

1. Introduction

Newton made the geometric description of gravity. Despite elapsed time the theoretical description of gravity remains unsolved.

It's known that the atom contains charge, static electric- and magnetic dipole moment. These fields decrease with the square of the distance and can consequently not create gravity. It seems unlikely that the atom generates alternating electromagnetic fields by itself, and hence electromagnetic energy is often ruled out as the origin of gravity. The prevailing track is to explain gravity by string theory.

The present study builds on the observation that gravity comprises plane TEM (transverse electromagnetic) waves or energy. The theory of plane TEM waves is well known and hence, it is possible to describe gravity entirely by the laws of electromagnetism. All theory is found in university grade textbooks, e.g. (Bleaney, 1965) or (Melrose and McPhedran, 1991).

The study builds on the observation that the universe contains one generator emitting plane TEM waves. All emitted plane TEM waves are quasi synchronized, facilitated by its extremely low frequency and origin. This generator or gravitational singularity can consist of circulating intrinsic charge or dipoles in a black hole and is called the GravitySource in the present study.

Electric, **E**, and magnetic, **B**, field vectors are linked in plane TEM waves and in this case they are almost static. An elementary particle that contains a static electric field, $\mathbf{E_i}$, merged with a static magnetic field, $\mathbf{B_i}$, creates resonance with this type of plane TEM waves; it receives plane TEM waves and re-emits them without changing content. It is called EQ (energy quantum) in the present study.

In order to illustrate the simplicity of gravity a grossly simplified universe is described. This simplified universe contains a GravitySource and only two EQs, EQ_1 and EQ_2. The GravitySource emits plane TEM waves, TEM_1, to EQ_1. EQ_1 creates resonance, receives and re-emits TEM_1 to EQ_2. EQ_2 creates resonance, receives and re-emits TEM_1 to the GravitySource. Simultaneously the GravitySource emits plane TEM waves, TEM_2, to EQ_2, EQ_2 re-emits it to EQ_1 and EQ_1 re-emits it to the GravitySource. Consequently this simplified universe contains circulating, synchronized plane TEM waves travelling in opposite directions between the GravitySource, EQ_1 and EQ_2. According to the laws of electromagnetism, synchronized plane TEM waves travelling in opposite directions create mutual force of attraction, i.e. gravity. This model can be scaled up to any number of EQs, e.g. to today's universe.

In the present study the hypothesis is that gravity is electromagnetic energy generated centrally in the universe, distributed within the universe, received and re-emitted by fully passive elementary particles or energy quantum in atoms.

This theory was verified in Section 2. Synchronized, plane TEM waves travelling in opposite direction were mapped on the laws of electromagnetism. It resulted in an equation describing the relation between the number of involved EQs, their distance and the mutual force of attraction, i.e. the electromagnetic law of gravity and which was compared with the Newtonian geometric law of gravity.

Section 3 describes an electronic device that simulated the EQ. This device was used in section 4 in order to

empirically verify the theory in Section 2. Section 3 also describes an electronic device that contained a static magnetic field merged to an alternating electric field and where the frequency of this field was adjusted to the frequency of plane TEM waves emitted by the GravitySource. It facilitated measurement of the GravitySource frequency.

Conclusions are made in Section 5. This novel description of gravity was also mapped on a number of well-known phenomena in order to validate the theory.

Aim of the study. The aim of the study is to present and to verify a theoretical model of gravity.

2. Theoretical model of gravity

Maxwell's equations $\text{curl}\,\mathbf{H} = \mathbf{i} + \frac{\partial \mathbf{D}}{\partial t}$ and $\text{curl}\,\mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$ result in plane TEM (transverse electromagnetic) waves (Bleaney, 1965). This is the most common electromagnetic energy in the universe resulting in e.g. radio waves, light and X-rays depending on frequency.

The behaviour and characteristics of plane TEM waves is independent of its frequency. The field vectors **E** and **B** or **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 as 1/r. The Poynting vector **S** describes the TEM energy flow density (Bleaney, 1965);

$$\mathbf{S} = \mathbf{E}\text{x}\mathbf{H} \quad (1)$$

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 **E** and **H** is reversed.

Assume that one source, Source 1, radiates plane TEM_1 waves, described by its Poynting vector $\mathbf{S}_1(r)$ at the distance r. Source 2 is positioned at the distance r. Source 2 is switched on whereby it radiates plane TEM_2 waves uniformly. In the direction towards Source 1 plane TEM_1 and TEM_2 waves interact because of the force between their synchronized field vectors. This also implies that there is energy transfer from TEM_1 to TEM_2 when TEM_2 propagates towards Source 1. In equilibrium there is energy transfer in both directions, i.e. from TEM_1 to TEM_2 vice versa. Note that **E** and **H** are always perpendicular and hence **S** = **E**x**H** can be replaced by S = E·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) proportional to $S_1(r)$ on Source 1 and $S_2(r)$ on Source 2, i.e. radiation reaction (Melrose and McPhedran, 1991), and where γ is a constant;

$$F(r) = \gamma \cdot S_1(r) \cdot S_2(r) \quad (2)$$

This creates mutual force of attraction F(r).

It is now assumed that each source is an EQ (energy quantum, defined below) and where its Poynting vector is $\delta\mathbf{S}(r)$ and where r denotes the distance from the source. **E** and **H** decrease linearly with the distance r implying that $\delta\mathbf{S}(r)$ decreases with the square of the distance; $\delta\mathbf{S}(r) = \delta\mathbf{S}(0)/r^2$. The mutual force of attraction $\delta F(r)$ between two EQs at distance r is;

$$\delta F(r) = \gamma \cdot \delta S \cdot \delta S / r^2 \quad (3)$$

It is now assumed that one EQ acts on p collocated EQs, belonging to the set **P** of all EQs at Source 2, and where each force can be described by $\delta F(r)$. These EQs are synchronised resulting in the force;

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

It is now assumed that n collocated EQs, belonging to the set **N** of all EQs at Source 1, act on p collocated EQs, belonging to the set **P** of all EQs at Source 2, resulting in the total force F(r):

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

$\delta S \cdot \delta S$ is a constant described by the intrinsic characteristics of the EQ, and hence Eq. (5) is simplified into;

$$F(r) = \text{constant} \cdot \frac{n \cdot p}{r^2} \quad (6)$$

In the present study Eq. (6) is called the law of gravity between two clusters, at distance r containing n respectively p EQs. Note that the cluster can be a particle, an atom, a mass or a planet.

The implication of Eq. (3) is that a particle or atomic EQ (energy quantum) generates gravity quantum and consequently, the present theory applies to quantum gravity.

It is proposed that elementary particles or more precisely energy quanta EQs, in the atomic nucleus, contain intrinsic, combined electric and magnetic fields or electromagnetic dipoles. Every EQ creates resonance and receives GravitySource plane TEM waves or electromagnetic energy. This results in emitted TEM waves. Two EQs and their emitted TEM waves create mutual force of attraction $\delta F(r)$. This is illustrated with gravity between the earth and the sun. The earth contains *n* energy quanta (EQs) creating a force $n \cdot \delta F(r)$ on every energy quanta (EQ) in the sun. The sun contains p energy quanta (EQs), thus the total force of attraction is $n \cdot p \cdot \delta F(r)$ and that is equal to Eq. (6). The earth's mass, m_1, is proportional to the number of EQs on earth, i.e. $m_1 \propto n$, and the sun's mass, $m_2 \propto p$. Eq. (6) is then approximately equal to the Newtonian geometric law of gravity;

$$F_G = constant \cdot \frac{n \cdot p}{r^2} \cong F_{\text{Newton}} = G\frac{m_1 \cdot m_2}{r^2} \quad (7)$$

Note that F_G, G and the *constant* decreases with the distance to the GravitySurce.

3. Materials and methods

All experiments were performed using one or many identical devices called EQ. The EQ created resonance with

plane TEM waves; it received and emitted plane TEM waves. Each EQ consisted of two neodymium magnets, with diameter 22 mm, spaced by a thin (0.05 mm) plastic foil and where the south pole of one magnet attracted the north pole of the other. This created an internal magnetic field $\mathbf{B}_i$. One magnet was connected to the positive pole of a voltage source, *U*, the other magnet to the negative pole, see Fig. 1. This created an internal electric field $\mathbf{E}_i$, e.g. 10^6 V/m at U = 50 V. $\mathbf{B}_i$ and $\mathbf{E}_i$ were merged within the thin space between the magnets and could be described as electromagnetic dipoles. Measurements were performed with the neodymium magnets connected to a 9 V battery, forming a portable EQ, detached from external influence (e.g. AC, ground). This EQ was used in experiments 5-10.

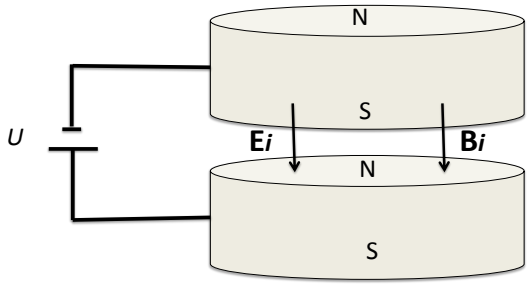

Fig. 1. Generating TEM energy.
Two neodymium magnets, with a diameter 22 mm, were spaced by a thin (0.05 mm) plastic foil with the south pole of one magnet attached to the north pole of the other. This created an internal magnetic field $\mathbf{B}_i$. One magnet was connected to the positive pole of a voltage source *U*, and the other magnet to the negative pole. This created an internal electric field $\mathbf{E}_i$, combined with $\mathbf{B}_i$. This device, called EQ (energy quantum) received and re-emitted plane TEM waves.

Experiments 1-4 and 11 were performed with the magnets connected to a low frequency signal generator with output voltage 0.5 mV RMS. Hence, the static electric field was replaced by an alternating electric field. The EQ created resonance at the signal generator frequency; it received and re-emitted plane TEM waves having this frequency. This device, also called EQ, was used in order to measure the frequencies of plane TEM waves originating from the GravitySource.

Measurements of plane TEM wave field vector amplitudes were made as described by Giertz (2010). That report describes in detail how the position and amplitude of electric and magnetic field vectors were measured using a charge meter. The charge meter is described in detail. Measurements in the present study were made almost identically to those described in (Giertz, 2010). In summary the charge meter contained a probe with charge density ρ. This probe was moved, with constant speed, through the TEM wave electric field vectors **E**. This resulted in an electric body force $\rho\mathbf{E}$ on the charge ρ. This current pulse was amplified and displayed. In this case **E** were field vectors, implying that div**E** was large and resulted in a distinct current pulse. This probe was also moved, with constant speed, through the TEM magnetic field vectors **B**, which resulted in a magnetic body force **J**x**B** on current **J** in the probe. In this case **B** were field vectors, implying that div**B** was large and resulted in a distinct current pulse. The measurement method had one important feature. The field vector's physical length was proportional to its amplitude, and in the present study between 0.1 – 10 m. It was easy to measure and determine the physical length of the field vectors since div**E** and div**B** were large. Hence, this was an accurate measure of the relative amplitude. Consequently, all results are presented as relative amplitude.

Measurements were performed 50 km south of Stockholm, Sweden.

Analysis. The experiments were blind, random and repeated 3 times. One person performed the measurements and the second person selected the parameters and recorded the data.

4. Results

Experiments 1 - 4 were made with the EQ connected to the signal generator. The purpose with these experiments was to verify plane TEM wave frequency and its origin. Initially the signal generator frequency was increased from 1 to 100 Hz in increments of 0.1 Hz. TEM wave amplitude close to the EQ was measured as a function of frequency. It was observed that the EQ received and emitted plane TEM waves from the object being measured at two distinct frequencies; 69.9 Hz and 91.9 Hz. The signal generator was adjusted to these two frequencies in experiments 1-4. It was also observed that the EQ always received and emitted plane TEM waves from the earth (i.e. ground). Hence, the EQ did not generate TEM waves; its only function was to create resonance at the plane TEM wave frequency.

Experiment 1. One EQ, connected to a signal generator, was positioned on a table and this was called Source 1. The signal generator frequency was 69.9 Hz and then changed to 91.9 Hz. The generator frequency was carefully adjusted to maximum TEM wave field vector amplitude. 1 % deviation in frequency resulted in approximately 50 % change in TEM wave field vector amplitude, which illustrated the demand for accuracy. The EQ was activated at the frequency 69.9 Hz for 48 hours in order for the experiment to stabilize. It was observed that the field vector amplitude increased approximately 10 times during 48 hours. It also continued to increase after 48 hours by approximately 10 % daily. It produced plane TEM_1 waves propagating from Source 1 towards north (earth's rotational axis). It followed a counter-clockwise circle with approximately 20 degrees cone angular radius. Its peak altitude was approximately 75 degrees and occurred at noon (in Sweden) and the direction was towards the geographical north +/- 5 degrees. Plane TEM_2 waves propagated from a source in the universe towards Source 1, aligned along and merged with TEM_1. Experiment 10 describes how this was measured. Measurements displayed "positive" electric field vectors $\mathbf{E}^+$ and magnetic field vectors $\mathbf{B}^+$ perpendicular to the direction from Source 1 to Source 2 and "negative" electric field vectors $\mathbf{E}^-$ and magnetic field vectors $\mathbf{B}^-$ perpendicular to the direction from Source 1 to Source 2. The field vector polarity alternated and "positive" denotes positive polarity and "negative" denotes negative polarity. The field vectors $\mathbf{E}^+$ and $\mathbf{B}^+$ respectively $\mathbf{E}^-$ and $\mathbf{B}^-$ were perpendicular, i.e. separated 90 degrees as in any plane TEM wave, e.g. radio

wave (Bleaney, 1965). The amplitudes were identical, i.e. $E^+=E^-$ and $B^+=B^-$. Positioning an electric or magnetic field close to the field vectors changed their positions, confirming their nature and polarity. The method is described by (Giertz, 2010). The experiment was repeated, using generator frequency 91.9 Hz, displaying similar results. It is proposed that Source 2 was the GravitySource generating plane TEM waves with the frequency 69.9 Hz and 91.9 Hz.

Experiment 2. The above experiment was repeated; however, in this case TEM_1 and TEM_2 waves to and from the sun were measured at 69.9 Hz and then at 91.9 Hz. Measurements displayed results similar to experiment 1. It was possible to determine the sun's position in the daytime but also during the night, i.e. plane TEM_1 and TEM_2 waves passed through the earth. The amplitude of plane TEM waves to/from the sun were approximately 5 % of the plane TEM waves to/from the GravitySource, indicating the huge influence of the GravitySource.

Experiment 3. The above experiment was repeated; however, in this case plane TEM_1 and TEM_2 waves to and from the moon were measured at 69.9 Hz and then at 91.9 Hz. Measurements displayed results similar to experiment 2. It was possible to determine the moon's position at night and also when plane TEM_1 and TEM_2 waves passed through the earth.

Experiment 4. The above experiment was repeated; however, in this case plane TEM_1 and TEM_2 waves to and from a nearby object (e.g. 10 kg iron) were measured at 69.9 Hz and then at 91.9 Hz. Measurements displayed results similar to experiment 2 and 3. The amplitude of $E^+=E^-$ and $B^+=B^-$ were proportional to the object's mass and inverse proportional to the objects distance r to the EQ.

Experiments 5 - 7 aimed at verifying the theoretical model, presented in Section 2. One EQ or many collocated EQs were positioned at Source 1. Source 2 was located at the distance r = 10 m and one or many EQs were positioned at Source 2. All EQs were connected to a 9 V battery each. It produced plane TEM_1 waves propagating from Source 1 to Source 2 and plane TEM_2 waves propagating from Source 2 to Source 1. Measurements displayed "positive" electric field vectors $\mathbf{E}^+$ and magnetic field vectors $\mathbf{B}^+$ perpendicular to the direction between Source 1 and Source 2 and "negative" electric field vectors $\mathbf{E}^-$ and magnetic field vectors $\mathbf{B}^-$ perpendicular to the direction between Source 1 and Source 2. The field vectors $\mathbf{E}^+$ and $\mathbf{B}^+$ respectively $\mathbf{E}^-$ and $\mathbf{B}^-$ were perpendicular, i.e. separated 90 degrees, as in any plane TEM wave. The amplitudes were identical, i.e. $E^+=E^-$ and $B^+=B^-$. It was also observed that Source 1 and Source 2 received and emitted plane TEM waves from the GravitySource and from the earth (i.e. ground). Hence, the energy in TEM_1 and TEM_2 originated from these sources. Consequently, the EQs did not generate TEM waves; their only function was to create resonance with low frequency plane TEM waves.

Experiment 5. One EQ was positioned at Source 1 and one EQ at Source 2. The amplitude of the field vectors E^+, E^-, B^+ and B^- were measured. Then the number, *n*, of EQs at Source 1 was increased to 4 in steps of 1. Subsequently the number, *p*, of EQs at Source 2 was increased to 4 in steps of 1. Measurements displayed that the amplitude of the electric and magnetic field vectors E^+, E^-, B^+ and B^- were proportional to n·p. Subsequently the EQ at Source 1 was connected to a variable voltage source and the voltage *U* on Source 1 was varied from 0 to 40 V in steps of 5 V. Measurements displayed that the amplitude of the electric and magnetic field vectors E^+, E^-, B^+ and B^- were proportional to *U*, see Fig. 2.

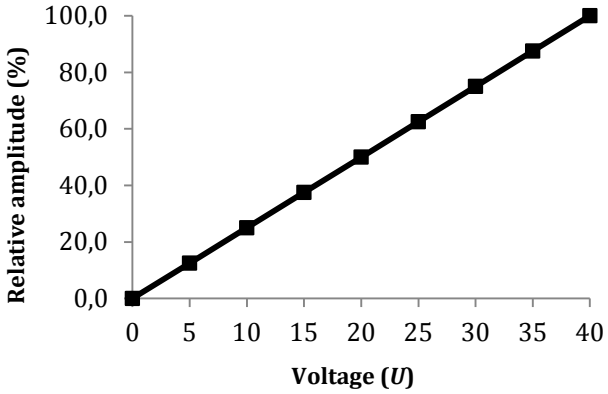

Fig. 2. Field vector amplitude as function of voltage on one EQ. Two EQs, as described in Fig. 1, Source 1 and Source 2, were positioned at 10 m distance. Source 2 was connected to a 9 V battery. The voltage *U* on Source 1 was varied from 0 – 40 V in steps of 5 V. The amplitude of the combined plane TEM_1 and TEM_2 waves electric and magnetic field vectors (E^+, B^+, E^- and B^-) was measured as a function of the voltage *U*. The amplitudes of all four field vectors were proportional to *U* and $E^+=E^-$ and $B^+=B^-$. E^+ amplitude as function of *U* is displayed in Fig. 2.

Experiment 6. One EQ was positioned at Source 1 and one EQ at Source 2. The distance r between Source 1 and Source 2 was varied, starting with r = 1 m, then increased to 10 m in steps of 1 m. The amplitude of the field vectors E^+, E^-, B^+ and B^- were measured as a function of the distance r. Measurements displayed that the amplitudes of the electric and magnetic field vectors E^+, E^-, B^+ and B^- were inverse proportional to the distance r, see Fig. 3.

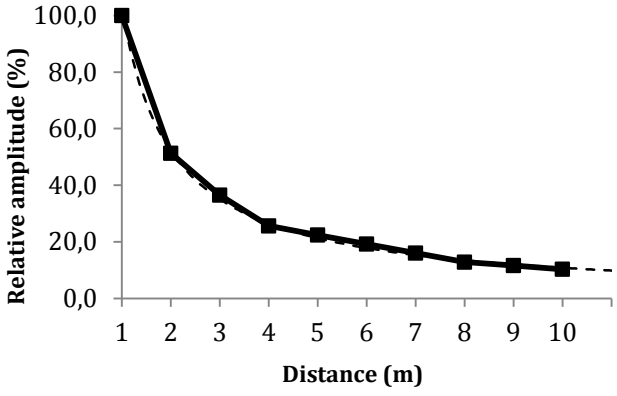

Fig. 3. Field vector amplitude as a function of distance. Two EQs, described in Fig. 1, were positioned at the distance r, which was initially 1 m and then increased to 10 m in steps of 1 m. The amplitude of the combined TEM_1 and TEM_2 waves electric and magnetic field vectors (E^+, B^+, E^- and B^-) was measured as a function of the distance r. The amplitudes of all four field vectors were proportional to $\frac{1}{r}$ and $E^+=E^-$ and $B^+=B^-$. E^+ amplitude as function of r is displayed in Fig. 3. The dotted line represents the theoretical decline $\frac{1}{r}$.

Experiment 7. One EQ was positioned at Source 1 and one EQ at Source 2 and the distance between them was 10 m. The amplitude of field vectors E^+, E^-, B^+ and B^- were measured at different distances from Source 1 along the straight direction from Source 1 to Source 2. Measurements displayed that the amplitude of the electric and magnetic field vectors E^+, E^-, B^+ and B^- were constant at every position between Source 1 and Source 2 and always $E^+=E^-$ and $B^+=B^-$. $\mathbf{E}^+$, $\mathbf{B}^+$, $\mathbf{E}^-$ and $\mathbf{B}^-$ were always spaced 90 degrees as in any plane TEM wave.

In the following experiments 8 and 9 one EQ connected to a 9 V battery was positioned at Source 1. Source 2 was a mass in experiment 8 and the sun in experiment 9.

Experiment 8. A mass (source 2) consisting of iron was positioned 5 m from the EQ at Source 1. The mass was increased from 0 to 10 kg in increments of 1 kg. Measurements displayed plane TEM_1 waves propagating from Source 1 to the mass and plane TEM_2 waves propagating from the mass to Source 1. The amplitude of field vectors E^+, E^-, B^+ and B^- were measured as a function of the mass. Measurements displayed that the amplitude of the electric and magnetic field vectors E^+, E^-, B^+ and B^- were proportional to the mass, see Fig. 4. It was also observed that the mass received and emitted plane TEM waves to and from the GravitySource and the earth (i.e. ground).

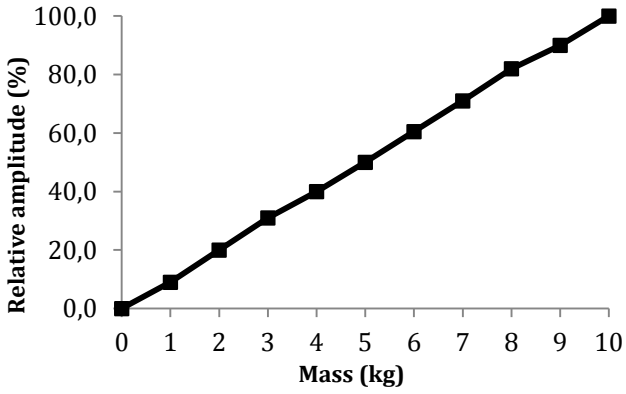

Fig. 4. Field vector amplitude as a function of mass.
One EQ (Source 1) was positioned 5 m from a mass consisting of iron (Source 2). The mass was changed from 0-10 kg in steps of 1 kg. The amplitude of the combined plane TEM_1 and TEM_2 waves electric and magnetic field vectors (E^+, B^+, E^- and B^-) was measured as a function of mass, m. The amplitudes of all four field vectors were proportional to m and $E^+=E^-$ and $B^+=B^-$. E^+ amplitude as function of the mass m is displayed in Fig. 4.

Experiment 9. Source 1 (the EQ connected to a 9 V battery) was positioned on a table. Measurements were performed outside Stockholm, Sweden during the daytime. Measurements were performed 2 m in front of Source 1 and roughly in the direction of the sun. Measurements displayed plane TEM_1 waves propagating from Source 1 in direction towards the sun (Source 2) and plane TEM_2 waves propagating in the opposite direction. The amplitude of field vectors E^+, E^-, B^+ and B^- were measured as a function of time. Measurements displayed that the amplitude of the electric and magnetic field vectors E^+, E^-, B^+ and B^- increased to approximately six times the initial amplitude within 16 minutes. Then they remained stable displaying no change in amplitude, see Fig. 5. After 16 minutes the length of the field vectors were approximately 0.4 m at U = 9 V, indicating that the electric and magnetic field strength was significant and thus the field divergence, div**E**, was significant and easy to measure. Measurement was also performed on plane TEM waves to and from the GravitySource (after 48 hours). TEM wave amplitude of the GravitySource was approximately 20 times larger than the sun's TEM wave amplitude, indicating its large influence. Note that TEM wave amplitude from the GravitySource continued to increase after 48 hours by approximately 10 % daily.

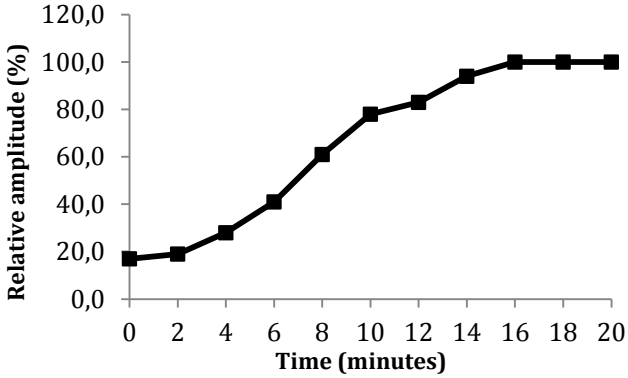

Fig. 5. Field vector amplitude towards the sun as a function of time.
One EQ, Source 1, was positioned on a table. The sun constituted Source 2. Measurements displayed plane TEM_1 waves propagating from Source 1 in direction towards the sun and plane TEM_2 waves propagating in direction from the sun to the EQ, Source 1. The amplitude of the combined plane TEM_1 and TEM_2 waves electric and magnetic field vectors (E^+, B^+, E^- and B^-) was measured as a function of time. The amplitudes of field vectors were $E^+=E^-$ and $B^+=B^-$ at all times. The field vector amplitude E^+ was measured as a function of time. After 16 minutes the amplitude was constant during an 8 hour measured period. The direction of plane TEM_1 waves and plane TEM_2 waves followed the position of the sun at all times.

Experiment 10. All above experiments were enhanced in the following way; a static magnetic field (i.e. a 1 μT magnet) was inserted at the centre of the plane TEM_1 and TEM_2 waves, 0.5 m from Source 1. The magnetic field induced a force on the magnetic field vectors and the back reaction force made E^+ and B^+ divert the distance d_1 to one side and E^- and B^- diverted the distance d_2 to the opposite side. d_1 and d_2 were proportional to B^+ respectively B^-. It was observed that in Experiment 1, TEM_1 was diverted much further than TEM_2, which provided a way to measure the plane TEM waves to and from the GravitySource separately and to make a relative comparison between TEM_1 and TEM_2 amplitudes. It was also observed that in Experiment 9, TEM_1 was diverted much further than TEM_2, during the initial 16 minutes. It facilitated a way to measure the plane TEM waves to and from the sun separately and to make a relative comparison between TEM_1 and TEM_2 amplitudes.

Experiment 11. One EQ, connected to a signal generator, was positioned on a table and this was called Source 1. The signal generator frequency was changed from 0.1 Hz to 1 Hz in steps of 0.01 Hz. The generator voltage was 0.5 mV RMS. It was observed that the EQ created resonance at 0.74 Hz and received plane TEM_2 waves from the direction of the GravitySource. It was also observed that the EQ radiated

0.74 Hz plane TEM_1 waves to every type of matter, Source 2, in its vicinity. The amplitude of TEM_1 was proportional to the mass of Source 2. Furthermore, the amplitude of TEM_1, at Source 1, decreased linearly with the distance to Source 2. It was also observed that the amplitude of TEM_1 along the straight line between Source 1 and Source 2 decreased linearly with the distance from Source 1. It was not possible to observe any TEM_2 waves propagating from matter, Source 2, to the EQ, Source 1. It was concluded that the GravitySource radiated plane TEM waves at 0.74 Hz.

It was observed in experiments 1-11 that vertically propagating plane TEM waves resulted in magnetic field vectors oriented north to south caused by influence from the geomagnetic field. Otherwise the magnetic field vectors were oriented vertically, also the result of influence from the geomagnetic field. Consequently the plane TEM waves were polarized which explains the efficiency of the measurement method used in experiments 1-11.

5. Conclusions and discussion

The study proposes that gravity is created by plane TEM (transverse electromagnetic) waves, which is the solution to Maxwell's equations $\text{curl}\,\mathbf{H} = \mathbf{i} + \frac{\partial \mathbf{D}}{\partial t}$ and $\text{curl}\,\mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$. The gravitational force or mutual force of attraction between two synchronized plane TEM waves travelling in opposite direction is proportional to the scalar product of their Poynting vectors according to Eq. (2).

It is proposed that a gravitational singularity called the GravitySource emitted plane TEM waves to elementary particles, or, more precisely, to energy quanta, EQ, within the atom's nucleus. It is proposed that the EQ contained intrinsic, merged electric and magnetic fields or electromagnetic dipoles or one electric dipole. These almost static merged fields created resonance with the plane TEM wave's almost static field vectors. The received plane TEM waves were re-emitted as plane TEM waves and distributed to, in principle, every EQ in the universe and where the amplitude decreased linearly with the distance to the EQ. The content of these plane TEM waves remained unchanged. Simultaneously every EQ in the universe received plane TEM waves from, in principle, every other EQ in the universe. The plane TEM wave amplitude was inverse proportional to the distance. This created a state of equilibrium where energy emitted by the GravitySource equalled energy re-emitted to the GravitySource. Hence, every EQ was also exposed to gravity from the GravitySource.

The mutual force of attraction between two EQs is described by Eq. (3). The mutual force of attraction between two masses (i.e. the sum of contributions from many EQs) is described by Eq. (6), which is approximately equal to the Newtonian geometric law of gravity according to Eq. (7).

The plane TEM wave frequency was measured in experiments 1-4 using a device, EQ, which created resonance at a predetermined frequency; it received and re-emitted plane TEM waves at one particular frequency. It consisted of an internal alternating electric field $\mathbf{E}_i$ with frequency 69.9 Hz alternatively 91.9 Hz, merged with an internal static magnetic field $\mathbf{B}_i$.

Experiment 1. This experiment confirmed the existence of the GravitySource generating plane TEM waves with the frequency 69.9 Hz and 91.9 Hz. The direction towards the GravitySource was to the north and followed a counter-clockwise circle with approximately 20 degrees cone angle radius. It was assumed that the direction was the result of the precession of the equinoxes. It is suggested that the gravity between the earth and the GravitySource has aligned the earth's precession centre towards the GravitySource, as described below. It indicates the large influence from the GravitySource. Experiment 2 displayed that plane TEM waves amplitude to/from the GravitySource was at least twenty times the plane TEM waves amplitude to/from the sun, confirming its large influence.

Experiments 2-4. These experiments confirmed that the sun, the moon, the earth and an object (e.g. iron) positioned in close proximity to the EQ, generated and received synchronized and mutually coupled plane TEM waves with frequency 69.9 Hz and 91.9 Hz. It indicated that these objects generated 69.9 Hz and 91.9 Hz plane TEM waves and that these plane TEM waves were synchronized to the GravitySource's plane TEM waves.

Experiments 5-9. The observed and measured field vector amplitudes E^+, B^+, E^- and B^- were the combined plane TEM_1 and TEM_2 wave field vector amplitudes, as described in Section 2. All experiments comprised EQs connected to DC voltage. Experiments 5-7 aimed at verifying the theoretical model.

Experiment 5. In this experiment *n* respectively *p* EQs were positioned at a distance r. Results displayed that E^+, B^+, E^- and B^- amplitudes were proportional to $n \cdot p$ confirming Eqs. (3, 4, 5, 6). This was simulated by varying the voltage *U* on Source 1, resulting in proportional change in field vector amplitude.

Experiment 6. In this experiment the distance r between EQs was varied, displaying that E^+, B^+, E^- and B^- amplitudes were proportional to $\frac{1}{r}$ confirming Eqs. (3, 4, 5, 6) (Note that field vectors decreased with $\frac{1}{r}$ while energy decreased with $\frac{1}{r^2}$).

Experiment 7. Plane TEM waves propagating between two EQs displayed that field vector amplitudes were constant all the way from one EQ to the other EQ. This indicated that the measured field vector amplitude was the combined plane TEM waves generated from Source 1, TEM_1, and from Source 2, TEM_2. It indicated the mutual coupling between synchronized plane TEM_1 and TEM_2 waves and that there was a transfer of energy between the two plane TEM waves. This transfer of energy and the back reaction force that the plane TEM waves created on its source created mutual force of attraction or gravity according to Eq. (2). Consequently, experiment 7 confirmed the theoretical model.

Experiment 8. This experiment proved that a mass generated gravity proportional to its mass, confirming Eqs. (6 and 7). This experiment showed that a mass generated plane TEM waves identical to an electronic device, i.e. the EQ, the

GravitySource, the sun and the moon. This revealed the intrinsic nature of the elementary particle or energy quantum. It is proposed that the energy quantum consisted of an intrinsic electric field or dipole merged or in parallel with a magnetic field or dipole.

Experiment 9. It took 16 minutes to stabilize the plane TEM waves exchanged between the EQ and the sun, i.e. the field vector amplitudes reached their maximum amplitude after 16 minutes. The round trip to the sun was 16 minutes at the speed of light. It can be explained as follows. The EQ at Source 1 was switched on at time t=0 minutes. After 8 minutes (t=8) plane TEM_1 waves reached the sun creating the force $F(r) = \gamma \cdot S_1(r) \cdot S_2(r)$ at the sun. Then it took another 8 minutes (t=16) before the influenced plane TEM_2 waves reached Source 1. The two synchronized plane TEM_1 and TEM_2 waves created mutual force of attraction and back reaction force from TEM_1 on Source 1 and full gravity (at t=16). The experiment confirmed the mutual exchange of energy between the two sources according to Eq. (2) and also that plane TEM waves (off course) propagated with the speed of light.

Experiment 10 displayed that it was possible to separate plane TEM_1 waves from plane TEM_2 waves and that it was possible to measure the two directions separately.

Experiment 11 displayed that investigated matter contained some type of mechanism that absorbed plane TEM waves at 0.74 Hz, originating from the Gravity Source. However, these plane TEM waves were not re-emitted and did not contribute to gravity.

The conclusion is that the universe contained a gravitational singularity, called the GravitySource, that generated plane TEM waves with the frequency 69.9 Hz and 91.9 Hz. Energy quanta, EQ, consisting of intrinsic, merged static electric and magnetic fields or dipoles created resonance with these plane TEM waves. They were then re-emitted to other EQs as plane TEM waves with the frequency 69.9 Hz and 91.9 Hz. EQs in the universe were synchronized to the GravitySource which resulted in that received and emitted plane TEM waves were synchronized, causing exchange of energy and mutual force of attraction, which is called gravity. The atom consisted of many EQs. This resulted in an equation called the electromagnetic law of gravity, Eq. (6). It was compared with the Newtonian geometric law of gravity, Eq. (7). In addition the GravitySource radiated plane TEM waves at 0.74 Hz Hz, which was absorbed by matter and the absorbed plane TEM wave amplitude was linear to the mass, indicating an intrinsic atomic mechanism.

The following offers a possible explanation to the origin of the GravitySource. According to Maxwell's equations EQs (combined electric and magnetic dipoles), orbiting other EQs with the period T, generated plane TEM waves with the period T. During the Big Bang all EQs were initially at close distance. Then it developed into a kernel of EQ's rotating at three speeds (i.e. T=1/0.74 s, T=1/69.9 s and T=1/91.9 s), constituting a gigantic electromagnetic generator that emitted plane TEM waves at 0.74 Hz, 69.9 Hz and 91.9 Hz. This electromagnetic energy was emitted to surrounding EQs and created gravity and controlled expansion of the universe. The gravitational force of the GravitySource was so large that no other energy than plane TEM waves was radiated (see below for explanation). It was a black hole and could only be observed by its radiated plane TEM waves at 0.74 Hz, 69.9 Hz and 91.9 Hz, and by its gravitational influence (e.g. rotational direction of the earth).

Experiments 1-11 can also be summarized as follows. Gravity consisted of extremely low frequency plane TEM waves. Using state of the art measurement technique would require unrealistically long antennas. The trick was to create plane TEM wave spatial divergence, which was created with the electronic device called EQ and polarization created by the geomagnetic field. The plane TEM wave spatial divergence created div**E** and div**B** that was measured with a charge meter. This innovative measurement technique enabled unbundling of gravity.

Discussion. Experiments 2 and 9 displayed that gravity between the EQ and the GravitySource was much larger than gravity between the EQ and the sun. From Section 4 and 5 follows that gravity between the EQ and the GravitySource is significant. Consequently, the EQ is exposed to two different gravity components, gravity between the EQ and all other EQs in the universe and gravity between the EQ and the GravitySource. It is proposed that the former is called gravitational gravity and the latter is called inertial gravity. The inertial gravity results in that the universe rotates around the GravitySource. Exposing the EQ to force accelerates the EQ relative to all other EQs and the GravitySource. It can be illustrated with an EQ travelling through space, far away from planets and stars. It is primarily influenced by TEM waves from and to the GravitySource. Its reference frame is the GravitySource or more precisely TEM energy at EQ proximity. Its energy state relative to its reference frame (i.e. TEM energy generated by the GravitySource) is changed when the EQ is accelerated and hence, $\delta F = \gamma EQa$. a is the acceleration created by the quantified force δF on the inertial mass quantum γEQ. A mass on earth experiences two reference frames; the first is the earth and its gravity and the second is the GravitySource and its gravity. Hence, this mass, m, can be described as inertial mass, $m_i = \gamma \sum EQ$ and gravitational mass, $m_g = ß \sum EQ$ according to Eq. (6) and Eq. (7). *n* and *p* denote the number of EQs in the two gravitational masses, γ and ß are constants. This explains why, according to classical mechanics, the gravitational mass is proportional to the inertial mass. Perhaps mass does not exist; perhaps it is only the observation of electromagnetic energy (i.e. the GravitySource) operating on static electric and magnetic fields (i.e. the EQs)? In that case Einstein's mass-energy equivalence may relate to the EQ, $E = mc^2 = \Omega \sum EQ$, where Ω is a constant.

In the following a number of phenomena on atomic and universal level are discussed in light of the present electromagnetic description of gravity.

Discussion, atomic level. The atom is in traditional physics described by its particles, quarks, gluon graviton, baryon, proton electron etc. and by its forces, the strong interaction, the weak interaction, electromagnetism and gravity. The present paper describes the EQ (energy quantum) as a particle creating gravity and inertia. It consists of a static electric field in parallel with a magnetic field.

In its simplest form the EQ may consist of only two charges, a positive and a negative charge forming an electric dipole. This dipole is exposed to plane TEM waves from the GravitySource with the frequencies 0.74 Hz and this induces a magnetic field with the frequency 0.74 Hz. Hence, this dipole consists of a static electric field and an almost static magnetic field. Consequently, the dipole can be regarded as an electromagnetic dipole which also creates resonance with plane TEM waves (gravity waves) at 69.9 Hz and 91.9 Hz. The dipole has electric and magnetic fields, electric and magnetic dipole moments, it generates gravity and it creates inertia (inertial mass). Positioning two dipoles side-by-side; however, in opposite direction results in a very strong electromagnetic force and also gravity which fuses the two dipoles. More dipoles can be added forming a matrix. Such configuration can result in a quark and various configurations result in various types of quarks.

Amalgamated quarks result in baryons, e.g. neutron. A proton is created when a positive charge is added to one EQ in a neutron. An electron is created when a negative charge is added to one EQ in a small configuration of EQs (e.g. a dipole with one positive charge and two negative charges). The sum of these particles is the atom.

The force (the sum of gravitational and electromagnetic forces) between EQs in a quark is strong and may be equal to the strong interaction. The force between quarks in a baryon is also strong and may be equal to the strong interaction. The force between baryons may also be the strong interaction. The force between clusters of EQs decreases at increased cluster size and at increased number of clusters, i.e. the force decreases in large EQ configurations. Hence, the strong interaction is larger between two EQs and within a quark, compared to the strong interaction between quarks and which in its turn is larger than the strong interaction between baryons. This may explain why quarks are more stable than baryons and baryons are more stable than atoms. The electromagnetic (Coulomb) force dominates between the atom's nucleus and orbiting electrons.

The field generated by a quark consist of the vector sum of the EQs electromagnetic fields and the vector sum of the EQs gravitational fields (TEM waves). This field is complex resulting in that the force between two adjacent quarks depends on their exact position relative to each other. This may result in, depending on relative position, in mutual attraction, alternatively with distance slowly decreasing attraction, alternatively with distance rapidly decreasing attraction, alternatively neutral force or repulsion. This may explain some phenomena observed in particle research.

EQs, quarks and baryons positioned at mutual distance have potential energy relative to each other. Amalgamating them results in that the difference in potential energy is emitted as electromagnetic energy, i.e. a wave package (which does not have gravity and inertia). This process can also result in that one or many configurations of EQs are emitted, i.e. particles. The emitted particles are characterized by gravity and inertia. As an example an amalgamated proton and electron cannot exist, resulting in that particles are emitted and the difference in energy (proton + electron respectively emitted particles) is emitted as electromagnetic energy (wave package).

Consequently, the atom may consist of only electric dipoles (EQs), where the dipoles (EQs) are configured into electrons, quarks, baryons etc. In that case mass does not exist, mass is only the perception of gravity or the perception of electromagnetic energy operating on configurations of dipoles (EQs). It is proposed that a particle having mass must consist of EQs having gravity and inertia. It is proposed that the wave-particle duality, i.e. the photon, describes a different type of particle. The photon does not contain EQs and does consequently not have gravity and inertia. The photon may consist of solitary positive and negative charge, which have no mass, and thus propagates with the speed of light. This will be elaborated on in a separate paper. Gluons consist of electromagnetic fields creating the strong interaction, described above. The graviton is a photon that can be described as the gravity quantum generated by one EQ and by the photon-wave duality, i.e. by its TEM wave.

Discussion, universe level. It is proposed that the universe, by its first approximation, can be described as a central gravitational singularity called the GravitySource, clusters of EQs (planets and stars), photons and low frequency plane TEM waves generated by the GravitySource as well as high frequency photons and plane TEM waves (radio waves, light, X-rays etc.) generated within the universe.

It is proposed that photons and TEM energy generated by the GravitySource is equal to the energy called the cosmological constant and dark energy.

The GravitySource creates gravitation between every EQ in the universe and the GravitySource. It is proposed that this results in that the universe orbits the GravitySource and that the gravitational force decreases with the square of the distance to the GravitySource. The inertial mass decreases linearly with the distance to the GravitySource, resulting in increased acceleration of matter in the outskirts of the universe. This may result in that the universe expands and which explains the expanding space paradigm.

Eq. (7) describes the static relationship between two masses. One mass can rotate around its axis (e.g. the earth's diurnal rotation), i.e. plane TEM waves rotate relative to other plane TEM waves. Their Poynting vectors are rotated hence; they produce a force component perpendicular to the radial direction **r**. This can introduce a back reaction force component perpendicular to **r** as well as labour, which may explain geodetic precession, the moon's facing towards the earth and the earth rotational axis facing roughly towards the GravitySource. One mass can orbit around the other (e.g. the earth orbiting the sun). This can introduce a back reaction force component on the mass perpendicular to **r** and may explain geodetic precession, precession of apsides and frame dragging effects.

Binary pulsar systems, consisting of co-orbiting (i.e. with period T) masses, create strong rotating plane TEM waves (rotating with period T), i.e. rotating electric and magnetic fields relative to plane TEM waves generated by the GravitySource. This can generate plane TEM waves (i.e.

radio waves) with period T, according to Maxwell's equations. These plane TEM waves originate from rotating gravity waves; however, it is not appropriate to call them gravity waves or gravitational radiation. The emitted energy results in binary pulsar energy loss and decreased rotational speed, i.e. the period T decreases and which may explain orbital decay.

Plane TEM waves (gravity) between the GravitySource and clusters of EQs and between clusters of EQs can influence and can be influenced by other TEM waves (e.g. from other clusters) according to the super positioning principle. This may result in that plane TEM waves contain low frequency content and which may explain the phenomena called ripple in the metric of spacetime.

Plane TEM waves interact with electric fields, magnetic fields, electrons (i.e. charge density and current) and other types of EM waves, which can create force, back reaction force, labour and transfer of energy from one state to another. These interactions are caused by influence from plane TEM waves (gravity waves) and in popular terms some of these interactions can be called "gravity friction". Many EM processes can lose energy in the presence of plane TEM waves. "Gravity friction" may result in that time runs slower (change of proper time). Light wave field vectors passing high amplitude plane TEM waves (strong gravity) exert an oscillating force on their electric and magnetic field vectors. The back reaction force makes light lose energy, i.e. light is exposed to "gravity friction". This may account for gravitational red shift. Light (the field vectors) passing e.g. the sun's high amplitude plane TEM waves is exposed to back reaction force, which causes light energy loss, changes its trajectory and may account for light deflection, and gravitational lensing. A black hole is characterized by extremely high amplitude plane TEM waves (strong gravity). EM energy, including light, passing or generated within the black hole is exposed to extremely strong back reaction forces, i.e. "gravity friction". This exerts force on e.g. light field vectors and creates energy loss, resulting in light being conserved in the black hole. The only energy that escapes black holes is low frequency plane TEM waves (i.e. gravity). This may also be explained using the wave-particle duality. Light consists of photons with high frequency. The gravitational wave consists of photons with low frequency, however in the above cases with very high concentration. Light photons passing very high concentration of gravitational wave photons will lose energy.

Conclusions from discussion. It may be possible to explain a substantial part of the atomic structure and its particle structures as configurations of charges (dipoles) exposed to plane TEM waves generated from a gravitational singularity. The universe and its phenomena can to large extent be described detached from mass, and where phenomena can be described as electromagnetic processes based on the laws of electrodynamics.

It is proposed that the present study unifies gravity, described by Eq. (6), with electromagnetic theory. Hence this electromagnetic theory of gravity supplements Newtonian geometric theory of gravity, relativistic metric theory of gravity, Newton's second law of motion and Einstein's mass-energy equivalence.

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