About the Origin of the Dark Energy and the Zero Mass/Energy Universe

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Abstract.
Based on the Gravito-Electro-Magnetic (GEM) equations as another form (for low fields) of Einstein's Equations of General Relativity Theory (GRT) an equation is derived for the total energy density in the universe, including the gravitational fields, the contribution thereof is always negative and so it represents the Dark Energy. When calculating the total energy of the universe from this equation, the result is near to zero because of negative contributions from gravitational fields, depending a little on the available parameters of the universe as e.g. it's baryonic mass. Thus the assumption is given a high amount of probability, that the total energy (mass) in the universe is really zero and very likely is always zero. This would mean, that the universe developed from empty space-time or from nothing (may be by quantum fluctuations). Looking on the development it could be that the average energy density is zero for each sufficient large part of the universe at any time, except for very local deviations (e.g. galaxies, black holes etc.). As a consequence the expansion of the universe is not retarded by gravity (thus the Friedmann equation and others do not apply). The expansion of the universe can be considered as driven by the pressure of a gas-like medium with positive masses as by intergalactic gas, dust, stars and galaxies. Conclusions are drawn as to the interpretation of the formation of voids in the universe, flat space etc..

Introduction

A. Assumptions.

A1 .
Instead of Einstein's General Relativity Theory (GRT) I will use the GEM theory (Gravito-Electro-Magnetism) [1], which is derived from the GRT and valid for small gravitational fields and uses λ=0. The GEM equations are a set of Maxwell-equations, where in Electro-Magnetism (EM) **E, H, D, B,** q (charge density), ε, μ are replaced by the corresponding gravito-electro-magnetic fields and parameters **g, h, d, b,** ρ, γ, η (ρ is the total mass density). Let us use the definitions

(a1.1) $4.\pi.\gamma_o = -1/G_o$, (G_o gravitational constant), G_o = 6,67. 10^{-11} $m^3/kg.s^2$
γ_o = - 1,193 10^9 $kg.s^2/m^3$ (gravito-electric constant)

(a1.2) $\gamma_o.\eta_o = 1/c_o^2$, c_o velocity of light , c_o = 3,00 10^8 m/s ,
η_o = - 9,33 10^{-27} m/kg (gravito-magnetic constant)

Thus the set of EM and GEM equations is a description of the fields in the universe.

Nuclear masses transform according to Einstein's Special Relativity Theory (SRT) [1].

A2 : Near to a big mass M the velocity of light c varies as given by Einstein's General Relativity Theory (GRT / Friedmann [2]). For spherical symmetric masses we have (r = radius from the centre) :

(a2.1) $c = c_o (1 - R_s / r)$, $R_s = 2.M.G_o / c_o^2$ (R_s Schwarzschild radius)

A3 : So, with **A1** the Gravito-MAXWELL equations for the GEM system are as follows [1]

(a3.1) $\nabla\times\mathbf{g} = - \delta\mathbf{b}/\delta t$, **g** = gravity (or gravito-electrc) vector , **b** defined by (a3.6)

(a3.2) $\nabla\times\mathbf{h} = 4.\delta\mathbf{d}/\delta t + 4.\mathbf{j}$, **h** = gravito-magnetic vector , **j** = total mass flux density

(a3.3) $\nabla. \mathbf{d} = \rho$, ρ = (total) mass density (from nuclear masses, EM- and gravitational fields; **d** defined by (a3.5)

(a3.4) $\nabla. \mathbf{b} = 0$, **b** defined by (a3.6)

(a3.5) $\mathbf{d} = \gamma . \mathbf{g}$, **d** = gravito-eielectric flux density, γ = gravito-dielectric constant, (a1.1)

(a3.6) $\mathbf{b} = \eta . \mathbf{h}$, **b** = gravito-magnetic flux density , η = gravito-magnetic constant (a1.2)

Then Newton's gravitational law reads [5]

(a3.7) $\mathbf{g} = m. \mathbf{r} / 4.\pi. \gamma. r^3$, (note : $\gamma < 0$!)

m is a point mass (or spherical homogeneously distributed mass within a sphere of radius R, r>R), **r** the radius vector from the centre of the sphere to a point **r** with r = |**r**|.
This has the same form as Coulomb's law [12] :

(a3.8) $\mathbf{E} = Q. \mathbf{r} / 4. \pi. \varepsilon. r^3$, where Q is a point charge (or sphere as before).

The main difference is, that ε is positive and γ is negative.

A4 : t = 13,8 Gy is the present age of the universe and $R = c.t = 1,3.10^{26}$m is the present (max.) radius of the universe (invcluding electromagnetic and gravitational energy).
The usual index "o" for present data will mostly not be used here. Variables will be used in a more mathematical way.

B. The energy density w in EM- and GEM-fields.

In the Electro-Magnetism Theory (EM, Maxwell) the energy density of EM-fields is given by [12]

(b1) $w_e = (\varepsilon. \mathbf{E}^2 + \mu. \mathbf{H}^2) /2 = \rho_e. c^2$,

where ρ_e is the EM mass density, which is always positive (may include nuclear mass).
For the GEM-fields the Poynting vector **S** we have [1]

(b2.1) $S = 4.|\mathbf{g x h}| = - \rho_g.c^2$,

which is by a factor of 4 larger than in EM. ρ_g is the density of the GEM-field mass.

On the other hand we get by scalar multiplying (3.1) by **h** and (3.2) by **g** and taking the difference of the equations

(b2.2) $X.\mathbf{S} + \delta w_g/\delta t = q$

This is the continuity equation for gravitational fields, where $q = - 16.\ \mathbf{g}\ .\ \mathbf{j}$ is the source and

(b2.3) $w_g = 2.(4.\gamma.\ \mathbf{g}^2 + \eta.\ \mathbf{h}^2) = \rho_g.\ c^2$ is the energy density of the GEM-field,

using Einstein's $W = m\ c^2$, where ρ_g is the GEM-field-mass density, which is always negative because of negative γ and η (see A1). Positive (nuclear) masses may be included in the EM-masses.

Thus $\mathbf{w_g}$ **is the the natural representative of the Dark Energy in the universe**, because it is always negative as expected [10] and the only negateve energy that stems directly from Einstein's GRT (with $\lambda=0$!).

Note :

Einstein (and others) considered only positive (i.e. mostly nuclear) masses and no (negative) mass from gravity fields, which was not known at that time. In so far the interpretation of Einstein's GRT in the past has been incomplete.

There has been e.g. a paper by G. Nordström [3] who aimed to prove that the gravitational field has no energy density, but he assumed that there is no positive (nuklear) mass density in the energy-momentum tensor (i.e. no nuclear mass - in the sense of Einstein), but this does not exclude negati9ve contributions and so he got what he wanted to show, i.e. this is no proof, it is a logic cycle with a wrong assumption.

Hence the total energy density w from EM- and GEM-fields is given by (b1) and (b2.3)

(b3) $w = w_e + w_g = \rho.\ c^2$,

where ρ is the total mass density of EM- and GEM-fields. A nuclear mass density w_n may be included in the EM-field masses (positive masses seem to stem only from electromagnetic fields)..

Since the negative part w_g/c^2 reduces the positive mass distribution, I will study the influence of w_g on the mass distribution in the universe.

C. The influence of the gravity-field mass distribution on Newton's law.

Let us accept that Newton's law (a3.7) is correct, if there would be no energy/mass density influence from around the central mass m. When we add the negative mass density around the central mass m, this will reduce the effective mass in Newton's law, i.e. the total (effective) mass m will be a function m(r). Let us take a mass m_o spherical symmetric distributed on a sphere of radius R , hence $m(R) = m_o$. If we step from r to r+dr, then the total mass m(r) changes by

(c1) $dm = 32.\ \pi.\ r^2.\ \gamma.\ g^2.\ dr\ /\ c^2$ and with g(r) from (a3.7). we get

(c2) $dm = 32.\ \pi.\ \gamma.\ m^2.G^2.\ dr\ /\ r^2.\ c^2$ - and by integration (see also (a1)) :

(c3) $1\ /\ m - 1\ /\ m_o = - 8.G.\ (1\ /\ r - 1\ /\ R)\ /c^2$ - or for m(r) :

(c4) $m(r) = m_o\ /\ (1 + K\ (1 - R\ /\ r))$

with $K = 4.R_s\ /\ R$ and $R_s = 2.m_o.\ G\ /\ c\text{^}2$ (see (a2.1)).

Rs is the Schwarzschild radius of m_o . Introducing m(r) from (c4) into Newton's basic formula (a3.7) we get Newton's corrected law :

(c5) $g(r) =- m(r). G / r^2$ with m(r) from (c4).

We note that $m(r) < m_o$ for r > R . This is opposite to the MOND-formula [7], which gives larger gravitational fields for larger r to cope with the "Dark Matter" problem, different from "Dark Energy" in the present paper. The gravitation law (c5) is a necessary correction of Newton's law and does not explain "Dark Matter" [14].

In most cases the correction by (c4) is very small - except for black holes and neutron stars in their neighbourhood. An example for our sun : with $m_o = 2.10^{30}$kg, $R = 7.10^8$m we get R_s = 3km and $K = 17.10^{-6}$, i.e. a maximum deviation of about -17ppm versus Newton's original law at large r values.

D. The total gravitational field of a homogeneous spherical positive mass distribution in the universe

Let us consider a sphere of radius R (the universe), filled with a homogeneous distribution of constant positive (mostly, nuclear) mass density ρ_n in the sense of Einstein, including kinetic energy). Let us exclude additional EM-fields – they may be included in the mass density ρ_n of nuclear masses. Let us assume that the universe does not rotate, so there is no h-field (see (a3.2)). We also neglect for a first approximation the corrections on Newton's law (c5) because the the average g-fields in the universe are small.

Then an increase of g (r-component of **g**) by δr will then increase the total mass m (nuclear = positive + gravito field mass = negative) inside the sphere of radius r<R according to (b3) and (b2.3) by

(d1) $\delta m = 4. \pi. r^2. (\rho_n + 8.\gamma. \mathbf{g}^2/c^2). \delta r$, or - with **g** from (a3.7), Newton's law :

$= 4. \pi. r^2. (\rho_n + m^2 / 2. \pi^2 .\gamma. r^4 .c^2). \delta r$.

This is a differential equation for the total mass m(r) inside of a sphere with radius r.

Let us look for solutions.

Near to r=0 we can neglect the contribution of g. Then by integration we get

(d2) $m_1(r) = 4. \pi. \rho_n. r^3 / 3$, 0<r<R ,

which we may regard as a first approximation for m(r). Inserting in (d1) - to get a second approximation $m_2(r)$ we get

(d3) $\delta m_2 = 4. \pi. r^2 .(\rho_n + 8.\rho_n^2 .r^2 / 9. \gamma. c^2). \delta r$.

For the maximum of m_2 we get from $\delta m_2=0$:

(d4) $r_m^2 = - 9. \gamma c^2 / 8. \rho_n$, where $\rho_n = 3.M_{n.} 4.\pi.R^3 = 1,2.10^{-26}$ Kg/m^3 and hence

$r_m^2 = 1,02.10^{52}m^2$ or $r_m = 1.0.10^{26}$m ($M_n = 1,1.10^{53}.10^{53}$.kg (estimated from [5]), $R=1,3.10^{26}$ m)

Where R is the present (total) radius and M_n the present estimated nuclear mass of the universe.

With these data from (d4) r_m is about 30% smaller than R (radius of the universe).

By integration of (d3) we get

(d5) $m_2 = 4. \pi. r^3 .\rho_n/3 + 32. \pi. \rho_n^2 \cdot r^5 / 45. \gamma. c^2$.

Let us lo0ok for the case m_2 =0 , then we get

(d6) $r_o^2 = - 1,88 .\gamma.c^2./\rho n =1,69.10^{52}.m^2$ or

(d7) $r_o = 1,30.10^{26}$ m which is equal to R (=$1,3.10^{26}$m) the radius of the universe.

So m_2 can get zero for values of M_n around $1,1.10^{53}$ kg, which is a good estimate for the total nuclear mass in the universe [5].

This means, that the total mass (nuclear, EM- and from gravity fields) is very likely zero in the universe **!** We might argue, that this is due to the 2nd approximation. But even higher or other better approximate solutions of (d1) behave similar by using another similar estimation for M_n , which is not known exactly at present. With a nuclear mass around $1,1.10^{53}$Kg there should be always a solution where this conclusion can be drawn.

Anyway I am pretty sure that the **present universe is very close to a universe with total mass zero**.

Hence, the gravitational field at the boundary of the universe and beyond is zero as well.

and there is no contraction of the universe by gravity, contrary to most assumptions up to now.

E. Conclusions :

Hence it seems very likely to assume, that the total mass (and energy) of the universe is really zero.

1. Note :

This would mean, that the universe could have been born from nothing - with respect to it's energy or mass - just by splitting space-time into positive and negative energy (EM and GEM fields). This view is near to the quantum-mechanical approach, where production and destruction of mass could be possible on the basis of a noise in space-time [6].

2. Note :

In my present theory the results are based on Einsteins General Relativity theory in the form of GEM with no other critical assumptions. It is obvious, that Einstein himself was not aware of these results of his theory, especially that the gravitational fields have a negative mass-/energy-density, but this is a result of his own GRT in the form of the GEM equations and was obviously not in the mind of Einstein at his time (see also [3]). For Einstein and others [3] mass obviously existed only in the form of nuclear mass or EM masses, i.e. positive masses. Einstein was not aware of the negative g- and h-field masses, which are a consequence of his own GRT.

If we accept the conclusion above, then we could immediately draw some interesting further conclusions:

(e1) There is practically **no resulting gravitational field in th universe** at least not at and near to the boundary of the universe and beyond (r=R , r>R). Hence there is no retardation of an expanding universe by gravitation, which has been assumed by Einstein, Friedmann and others up to now. An expansion of the universe can be only accelerated by the pressure of gas, nuclear mass in general or radiation This easily **explains the growing expansion of the universe** [8,9].

(e2) The **"Dark Energy/Mass"** which is a problem in the present cosmology
is due to the negative masses of the gravitational field energy from w_g/c^2.
So we can forget searching it with λ (λ–CDM-theory, [11]).

Negative masses in addition to the positive ones will repell the positive masses as stars, supernovae, galaxies etc. and so is acting against gravity. w_g is indeed more or less homogeneously distributed in the universe as expected [10].

(e3) When there are **(positive) mass concentrations** above the average concentration (clouds of galaxies etc.), **then there must be concentrations of negative mass (voids)** at other regions, which are acting against the regions of positive (nuclear) mass/energy.

(e4) An overall low mass distribution (around zero) explains easily, that the **universe is "flat" (nearly no curvature)**, except at very local deviations from the homogeneous mass distribution (black holes, neutron stars etc.).

F. The case of variable positive (nuclear) average mass distribution.

I can easily give a solution of (d1), where the mass/energy density is very low everywhere in the universe (which improves the consequences 1) - 4) in the preceding section).

Let us assume, that the positive (nuclear) mass density varies by

(f1) $\rho_n(r) = a / r^4$, $r<R$.

Then integration from a value R_{bh} (e.g. radius of a black hole at r=0) to R (radius of the universe) must give M_n, the present positive mass in the universe.

(f2) $a = M_n . R_{bh} / 4.\pi$ because $R_{bh}<<R$.

If we now set

(f3) $m^2 = 2. \pi. \gamma. c^2. M_n. R_{bh} = const.$, we get

(f4) dm = 0 **everywhere in the universe**, except at $r=R_{bh}$, where $M_{bh}= m$ is the mass of the black hole.

For m=const we get from (f3) with $M=4,4.10^{53}$ kg and R_{bh}=10km (estimated, [5])

(f5) $m = 5,4.10^{41}$kg << $M_n=1,1.10^{53}$kg ,

which is by more than 11 orders of magnitude smaller than the nuclear mass in the universe, hence very low or practically zero. So the **negative mass density** $w_{g/}c^2$ **(dark energy)** is continuously and nearly constant distributed in the universe as expected (but not constant as with Einstein's λ in GRT) [11].

Because of (f5) we have a practically flat universe and practically no retarding gravity on the expansion of the universe.

By integration over the universe we get $M_n= 4.\pi.a.R$ or $a = M_n/4.\pi.R = 2,7.10^{26}$kg/m^2

G. Proposals.

If the universe has been expanding from a point of nearly no volume and the total energy was always zero, then in (d6) we set exactly r_o=R

(g1) $M_n = - 10. \pi. \gamma. c^2. R$ or $dM_n/dt = - 10. \pi. \gamma. c^2. dR/dt$ or - if we use $dR/dt = c$:

(g2) $M_t = dM_n/dt = - 40 \pi \gamma c^3$ = or $M_n = M_t . t$

which means, that we had **always a constant production rate of nuclear mass since the beginning of the growth of the universe (and in the future)** with a rate M_t that is only determined by the global physical parameters γ and c !

(I have some ideas how this could work, but they are not totally convincing).

So the growth of the universe would be a very soft one - and not driven by an "explosion" or "inflation".

Note :

Let me come back to the idea of quantum fluctuations.

Since the growth of positive mass M_t is accompanied by a negative mass $-M_t$, the total mass change is $\Delta m/dt=0$. Thus the Heisenberg uncertainty relation gives $\Delta m.\Delta t >= h/4.\pi$ or Δt is infinite, i. e. quantum fluctuations after creation may exist for ever in the universe.

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