On the Absorber in Gravitation

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Assuming the big-bang is a periodic 4-dimensional event, we show that the main parameters of the ΛCDM model, namely matter, dark energy and total density, can be computed straightforwardly from Mach's principle and that the existence of dark matter is not necessary. As a result, we find that the cosmos expansion is the origin of mass and energy — but not the big-bang as a singular event.

1 Introduction

The object of this note is to show that once assumed that the big bang is a periodic event, and using absorber theory, the dark matter field is un-necessary in cosmology, and the dark energy is the natural free field of the absorber.

2 The Absorber and cosmology

Mach's principle states in a very general manner: *local physical laws are determined by the large scale structure of the universe*. This principle is the basis of the Wheeler-Feynman absorber theory [1, 2]. They suppose that the energy of particles is given by a time-symmetrical field; this interpretation was made by Tetrode and assumes that particles are not self-interacting. The main equations go as follows:

$$E_{total}(x_j, t) = \frac{\Sigma_{n\neq j}\left(E_n^{ret}(x_j, t) + E_n^{adv}(x_j, t)\right)}{2}, \tag{2.1}$$

$$E_{damping}(x_j, t) = \frac{E_j^{ret}(x_j, t) - E_j^{adv}(x_j, t)}{2}, \tag{2.2}$$

$$E_{total}(x_j, t) = E_{damping}(x_j, t) + \Sigma_{n\neq j}E_n^{ret}(x_j, t). \tag{2.3}$$

They define the energies of the damping (2.2) and the total field (2.1–2.3), from advanced and retarded components for each particle (index j). The central idea is that the advanced field not being causal, it can only have damping effects while energetic interactions are causal. The theory was designed in electrodynamics but here we assume the field at the origin of gravitation and energy (including mass-energy and inertia), and propagating on the light cone.

The standard model of cosmology is based on general relativity theory (GRT). The idea is that the cosmos is self-contained (no outer realm), and internal metric expansion. However, it requires a unique event at its beginning, the so called big bang, resulting in the conceptual problem of its cause. Here we use Mach's principle on a larger scale: we assume the observed cosmos part of a wider 4-dimensional area. A 4-space denoted universe which we assume Euclidean with its own time and evolves as follows:

- A central location exists at the origin of the cosmos; we shall call it the emitter;
- A new cosmos or membrane is emitted periodically; the membranes separation is constant;
- The membrane progression is radial; the emitter produces more membranes and so on.

This structure is reminiscent of a wave; it is a manner to solve the problems of origin (the system is permanent); the membranes separation, if large enough, avoids the problem of instantaneous inflation. It also has the elegance of simplicity and the expansion is immediately linear. The idea at the basis of this concept was triggered-off by the recent observation of cosmological oscillations by Ringermacher and Mead [3].

3 Gravitation and energy

Now evidently, we have to build a theory from scratch; that is to say from experimental evidences. We shall use the following: we know from experimental gravitation physics that fixed clocks at different heights in the field have different rates; and the pulsation of photons and material system are constant in free fall. Equivalently, it is said that gravitation defines the context in which the rest of physics lives. According to Mach's principle it implies only a local variation of density which depends on the structure of the universe.

Denoting the density g, it varies according to $1/r$ as it addresses energy. This is classically written with:

$$g(r) = g^{\infty}\left(1 - \frac{f(M)}{r}\right), \tag{3.1}$$

where $f()$ is an undefined function of mass. The Newton potential reads:

$$\Gamma = \Gamma^0 - \frac{G\,M}{r}. \tag{3.2}$$

Then G depends on $f()$, and Γ^0 is usually an arbitrary constant and the rest energy of a mass m is $E^0 = mc^2$. But now energy is given by the absorber mechanism and then the constant is $\Gamma^0 = c^2$. Then we write:

$$E = m\left(c^2 - \frac{G\,M}{r}\right). \tag{3.3}$$

Therefore the density g defined in (3.1) is linked to mass-energy and to the velocity of light.

In a relativistic manner we can for instance define a variable c^*, use invariant masses and write:

$$c^{*2} = c^2 - \frac{2\,G\,M}{r}\,. \tag{3.4}$$

Since frequencies and wavelengths evolve conversely in the gravitational field, we write:

$$c^2\,d\tau^2 = c^{*2}\,dt^2 - \frac{c^2}{c^{*2}}\,dr^2. \tag{3.5}$$

Substituting from (3.4) this is the Schwarzschild metric. The pulsations of photons and of material systems in free fall are constant and then this equation applies identically to any form of energy. The concept is different from general relativity (GRT) but the equation is experimentally verified exactly in the same manner — that is to say uniquely in the solar system since all other verifications lead to suppose the existence of dark matter.

4 Dark energy and matter density

The absorber is time-symmetrical with causal effects; it concerns the total currents within the event horizon, say $M_A\,c^2$ the absorber "free" mass/energy. Equilibrium exists in the absorber process, and then the currents interfering with a mass m depend on m/M_A. We assume linear expansion; the visible cosmos radius is then $R_U = c/H = c\,T$ where H is the Hubble parameter and T the age of the membrane. Then by symmetry, we write:

$$\frac{E_m}{M_A\,c^2} = \frac{m}{M_A} \times \left(1 - \frac{M\,R_U}{M_A\,r}\right). \tag{4.1}$$

This is the Newton potential but the standard cosmological model is based on GRT which gives a factor $2GM$ like from (3.4–3.5), then in the standard theory the absorber free energy will be estimated from:

$$\frac{R_U}{2\,M_A} = \frac{G}{c^2}\,. \tag{4.2}$$

Using c, G and H we can now compute the absorber free energy; we find:

$$M_A = \frac{R_U\,c^2}{2\,G} = 8.790 \times 10^{52}\,\text{Kg}. \tag{4.3}$$

Considering visible energies $M_V c^2$, the ratio M_V/M_A is geometrical as it corresponds to the surface of a 4-sphere ; it is then $1/2\pi^2$. Then the factor 2 in (4.2) becomes $4\pi^2$ in 3+1D where masses interact. It gives:

$$2M_A = 4\pi^2\,M_V \rightarrow M_V = 4.453 \times 10^{51}\,\text{Kg}. \tag{4.4}$$

Summing (4.3–4.4), we get the total energy of the cosmos:

$$M_{total} = M_A + M_V = 9.236 \times 10^{52}\,\text{Kg}. \tag{4.5}$$

It corresponds to a density $\rho = 9.91 \times 10^{-27}\text{Kg/m}^3$ and the visible part (4.2) is 4.82% of the total. The benchmark at this time is the Plank mission results [4] which is $\rho = 9.90 \times 10^{-27}\text{Kg/m}^3$ and 4.9% of visible energy.

Hence according to the most favored model in cosmology we get three valid quantities in (4.3, 4.4, 4.5) which are *deduced* from the absorber symmetry and depend on geometry, c, G and $H = 1/T$. We do not get any dark matter, and assuming those results are significant we cannot afford any — though one could think that it may hide in M_A. But here the concept is different; the field is time-symmetrical and it cannot be an independent field as its relative amplitude is given by geometry.

With the results in this section we face two possibilities:

- The ΛCDM model parameters are tuned to match a linear expansion and it results in (4.3, 4.4, 4.5); which is a little surprising.
- A simple coincidence for M_A, but maybe a relevant result for M_V.

One way to make our mind is to develop the theory and check if the field needs dark matter.

5 The short range gravitational field

In (4.1) it appears that either G or M_V is variable; if we consider M_V constant, then G is a scale factor in proportions of R_U, but it is scale-independent on cosmological scales where R_U/r is constant.

In standard physics, one uses G, c and masses constant; we can then use the same constant quantities and it should give the differences between the Newton theory and the gravitational field given by our equations, at least a short range. In this section we consider that only t evolves and $T \gg t > 0$; it is linked to the Hubble factor H or R_U since the scenario of emission gives:

$$H(T)\,R_U(T) = c \rightarrow H(T) = \frac{c}{(R_0 + c\,T)} \approx \frac{1}{T}\,, \tag{5.1}$$

where $R_0 = R_U(T = 0)$ and T is the elapsed time since the separation of our membrane. Then from (4.2–5.1), denoting $R_U(T) \rightarrow R_U$ we can also write:

$$\frac{G\,M_A}{(R_U - c\,t)} = c^2. \tag{5.2}$$

Now all is constant except t and we can take a second order limited development; then denoting $H(T) \rightarrow H$, and using (5.1–5.2) we get:

$$\frac{G\,M_A\,H}{c} \times \left(1 + \frac{H\,r}{c} - \frac{H^2\,r^2}{c^2}\right) = c^2. \tag{5.3}$$

Multiplying G in the Newton potential by the terms of the limited development in (5.3) we introduce retarded interaction and then causality in the field (which is not in Newton's theory). The potential is extended as:

$$\Gamma = \Gamma^0 - \frac{G\,M}{r} - \frac{G\,M\,H}{c} + \frac{G\,M\,H^2\,r}{c^2}\,. \tag{5.4}$$

Let us analyze how this potential works:

It first adds a constant negative energy term ($-G\,M\,H/c$) with no gravitational impact. It is then the contribution of the mass M to the constant c^2; it is the free absorber field and M must be summed to $2\,M_A$. Using (4.2) it leaves a negative constant $-c^2$ on the right-hand side. We get:

$$\Gamma = \Gamma^0 - c^2 - \frac{G\,M}{r} + \frac{G\,M\,H^2\,r}{c^2}\,.$$

Then $\Gamma^0 = c^2$ is immediate and the physical origin of energy is the expansion, not the big-bang.

The next term is then of identical nature and we sum again M to $2\,M_A$. Using (4.2) again yields $G\,M_A\,H^2\,r/c^2 = H\,c\,r$ (giving an acceleration $H\,c$). We now get:

$$\Gamma = \Gamma^0 - c^2 - \frac{G\,M}{r} + H\,c\,r\,. \tag{5.5}$$

But $\Gamma^0 = c^2$ and $\Gamma < 0$; then rescaling notations with $\Gamma + c^2 \to \Gamma$ and using (4.2) we choose to write:

$$\frac{\Gamma}{c^2} = 1 - \frac{M\,R_U}{2\,M_A\,r} + \frac{r}{R_U}\,. \tag{5.6}$$

It is well-known that stars at galaxies borders experience an anomalous centripetal acceleration in the range $H\,c$. This acceleration is the origin of the dark matter hypothesis by Oort in 1932.

Here the potential c^2 and the acceleration Hc are the effects of expansion and retarded interaction; it must be seen as the origin of energy and the known problem of conservation related to this acceleration is inexistent.

A second classical objection is that this anomaly is not observed in the solar system; however, we assume the absorber at the origin of mass/energy and the immediate consequence is that it transform in acceleration. We can directly transform the density g; that is, with acceleration $H\,c$ in any direction, a transformation L exists verifying:

$$L\left(Hc,\; g\left(T - \frac{r}{c}\right)\right) = g(T)\,. \tag{5.7}$$

The following transformation holds:

$$g\left(T - \frac{r}{c}\right) \times \left(1 + \frac{H\,r}{c}\right) = g(T)\,. \tag{5.8}$$

Because once extended to any acceleration A in place of $H\,c$, and replacing $r \to ct$, the non relativistic case gives:

$$g\,(T - t)\;\frac{A}{c} = \frac{g\,(T) - g\,(T - t)}{t}\,.$$

The right-hand of this equation is a time derivative, hence:

$$\frac{g\,A}{c} = \frac{dg}{dt} \to \frac{g}{c} = \frac{dg}{dv}\,. \tag{5.9}$$

It shows that a density obeying (5.8) creates resistance to acceleration and that mass increases with velocity. Hence the field is not Galilean, it is then a-priori relativistic. The equation (5.8) is equivalent to (and also justified by) the equation (5.2), but symmetrical where the field transforms in acceleration. This calculus shows, by symmetry, that a cosmological acceleration of the sun and its satellites in the direction of the galaxy core rescales the density and eliminates the term $H\,c\,r$; hence no second cosmological acceleration of its satellites can exist directed to the sun (and so on with planet's satellites).

6 Energy and the quantum world

6.1 Correspondence with the classical field

In this section, we shall continue using G constant and masses variable with time. The non-reduced Plank units and the Schwarzschild radius will be useful to the discussion. Recall:

$$M_P = \sqrt{\frac{h\,c}{G}}\,,\;\; l_P = \sqrt{\frac{h\,G}{c^3}}\,,\;\; t_P = \sqrt{\frac{h\,G}{c^5}}\,,\;\; R_S = \frac{2\,G\,m}{c^2}\,.$$

The equation (4.2) is equivalent to saying that the visible cosmos is defined by the Schwarzschild radius of M_A. The unique property of the Plank mass is that its Schwarzschild radius and wavelength are equal; it is then pivotal and using (4.2), we first write:

$$\frac{2\,M_A}{M_P^2} = 4\pi^2\frac{M_V}{M_P^2} = \frac{R_U\,c}{h}\,. \tag{6.1}$$

A similar equation can be written for any material system of mass m using its Schwarzschild radius:

$$\frac{2\,m}{M_P^2} = \frac{R_S\,c}{h}\,.$$

Hence, one could think that (6.1) is nothing new, but this is interesting firstly because this equation uses M_A and R_U, and not M_{total} as we may classically expect. It shows that any mass m and M_A come from the same mechanism, but in a reciprocal manner since the two quantities define opposite limit radius and obey the same equation. A complimentary equation gives unit-less ratios:

$$\frac{2\,M_A}{M_P} = \frac{R_U\,c^2}{G} \times \sqrt{\frac{G}{h\,c}} = \frac{R_U}{l_P} = \frac{T}{t_P}\,. \tag{6.2}$$

It expresses the same link with quantum physics; the system of units $[2M_A, R_U, T]$ is the time integral of the Plank system $[M_P, l_P, t_P]$. Again, it can be written with any mass m, but not with M_V or M_{total}. Now using $h = c = G = 1$ we have $M_P = t_P = l_P = 1$, and the only evolving quantities are:

$$T = R_U = 2\,M_A = 4\pi^2\,M_V\,. \qquad (6.3)$$

In the most natural system of units the cosmos energy is trivial and it appears to evolve. This is due to the choice of G constant. In facts, the cosmos expands exactly of one Compton wavelength of any massive system during one period of its pulsation (this is just $\lambda = h\,c/E$). The system $[2\,M_A, R_U, T]$ is just a time integral, and a system of units its differential. Consequently, the physical link with the quantum world is also trivial: *The cosmos expansion gives an action h at each period of any system pulsation.* It gives a very natural origin to the basics of quantum physic where energy is a time differential, $E = h\,\nu$.

We find identity of expansion, wave and energy, in perfect agreement with the results of the previous section.

6.2 The field

The Plank mass is pivotal in (6.1–6.2) then we model the absorber with an evolving field ϕ given by:

$$2\,M_A\,M_\phi = M_P^2 \rightarrow E_\phi = \frac{h\,c}{R_U} \approx 1.52\times10^{-51}\,\mathrm{J}\,. \qquad (6.4)$$

This is the energy of a field of wavelength R_U ($\approx 10^{-32}$ eV). Its energy is proportional to $1/R_U$ and decreases with time. But the laws of nature do not change; hence (6.4) is scale dependent but valid at any epoch and it is legitimate to write:

$$E_\phi(r) = \frac{h\,c}{r}\,, \qquad P_\phi(r) = \frac{h}{r}\,, \qquad (6.5)$$

which addresses identically a hypothetical cosmos of radius r, and the field at a distant r of any mass.

A spherically inflating membrane defines a frame which is moving at velocity $v = c\,r/R_U$ at distance r from the attractive body M; then notice:

$$\frac{h}{M_\phi\,v} = r, \qquad \frac{h}{M_\phi(r)\,v} = R_U\,, \qquad (6.6.1)$$

$$P_\phi(r) = \frac{h}{r} = M_\phi\frac{c^2}{v}\,. \qquad (6.6.2)$$

The two expressions in (6.6.1) are equivalent to a de Broglie wavelength and in (6.6.2) momentum transfers on the light cone but in proportions of the phase velocity of the de Broglie wave. Now on top of the potential c^2, gravitation can be seen as a negative energy field. The equation (6.6.2) then corresponds to negative momentum on the light cone where the exchanged quantum is given by the de Broglie wave phase velocity $V = c^2/v$, and its emission rate is the Compton frequency of its source. In this way, we can write the field equations in an interesting semi-classical manner where all quantities depend on pulsation and momentum:

$$\frac{G}{c^2} = \frac{1}{P_\phi(R_U)}\times\frac{1}{\nu_A(T)} = const, \qquad (6.7)$$

$$F = -\frac{P_\phi(r)^2}{P_\phi(R_U)}\times\frac{\nu_M(T)\,\nu_m(T)}{\nu_A(T)} = -\frac{GMm}{r^2}\,, \qquad (6.8)$$

$$\frac{\Gamma}{c^2} = 1 - \frac{P_\phi(r)}{P_\phi(R_U)}\times\frac{\nu_M(T)}{\nu_A(T)} = 1 - \frac{GM}{rc^2}\,, \qquad (6.9)$$

where notations are trivial for the Compton frequencies of the masses m, M, and $2\,M_A$ at the epoch T. From (6.4), the denominator is time independent, and then the choice of G constant is legitimate. (Though the alternate choice M_V constant where G is a scale factor also holds.)

6.3 Advanced and retarded components

Now let us show that the equations (6.8–6.9) are approximate *and come from causality*. Using constant masses, G is a scale factor and we can use the same limited development as before but with little interest; instead we shall use the absorber equations in section 2. In (6.8–6.9) the denominator is constant but the masses at the numerator evolve in proportion of time. Then using first (6.9) *without the potential* c^2, consider the distance $r = ct$ constant; at the time T the retarded and advanced momentum from M will be felt by m respectively like $P_\phi(r)\,\nu_M(T-t)$ and $P_\phi(r)\,\nu_M(T+t)$ in proportion of m. Recall also $\nu_M(T) = kT$, then we first write the damping potential; it gives the participation of M to the potential c^2 which we sum to the absorber mass:

$$\frac{\Gamma_{damping}}{c^2} = -\frac{P_\phi(r)\,\nu_M(T-t) - P_\phi(r)\,\nu_M(T+t)}{2\,P_\phi(R_U)\,\nu_A(T)}$$
$$= +\frac{P_\phi(r)\,\nu_M(t)}{P_\phi(R_U)\,\nu_A(T)} = +\frac{\nu_M(T)}{\nu_A(T)} \rightarrow +1. \qquad (6.10.1)$$

Now the retarded potential:

$$\frac{\Gamma_{retarded}}{c^2} = -\frac{P_\phi(r)\,\nu_M(T-t) + P_\phi(r)\,\nu_M(T+t)}{2\,P_\phi(R_U)\,\nu_A(T)}$$
$$= -\frac{P_\phi(r)}{P_\phi(R_U)}\times\frac{\nu_M(T)}{\nu_A(T)}\,. \qquad (6.10.2)$$

Of course their sum is causal and it gives:

$$\frac{\Gamma_{retarded}}{c^2} + \frac{\Gamma_{damping}}{c^2} = 1 - \frac{P_\phi(r)}{P_\phi(R_U)}\times\frac{\nu_M(T)}{\nu_A(T)}\,, \qquad (6.10.3)$$

which is causal, agrees with (6.9), and now includes the potential c^2 from integration; but it misses the acceleration $H\,c$. A similar exercise is then needed on energy but we shall use forces as it will give the orientation of the acceleration; here we have to evaluate these on the full system (m plus M) exerted by all masses of the cosmos at the instant T. We shall do as if M and m were in a circular orbit at equal distance r of a third object (or their center of mass) as it is a representative test case. The retarded force on the system corresponds to the force from $M(T-t)$ to $m(T+t)$, summed with the force from $m(T-t)$ to $M(T+t)$; using again $r = ct$ we get:

$$\frac{F_{ret}}{c^2} = -P_\phi(2r)^2\frac{\nu_M(T-t)\,\nu_m(T+t) + \nu_M(T+t)\,\nu_m(T-t)}{P_\phi(R_U)\,\nu_A(T)}\,.$$

The advanced forces are identical and exerted at $T - t$; we get:

$$\frac{F_{adv}}{c^2} = -P_\phi(2r)^2 \frac{\nu_M(T+t)\,\nu_m(T-t) + \nu_M(T-t)\,\nu_m(T+t)}{P_\phi(R_U)\,\nu_A(T)} .$$

The damping force is null as it is the difference between those two expression; the retarded force is their sum and we extract the part related to $\nu_M(t)\,\nu_m(t)$ as the rest of the expression is identical to the potential; we get:

$$\Delta F = +P_\phi(r)^2 \frac{\nu_M(t)\,\nu_m(t)}{P_\phi(R_U)\,\nu_A(T)} > 0 .$$

To simplify this expression we replace each momentum by its value (6.5) and use the linearity of $m(t) = m(T) \times t/T$:

$$\Delta F = + \frac{\nu_M(T) \times h\,\nu_m(T)}{\nu_A(T)\,R_U} \rightarrow -H\,c\,m(T) < 0 . \qquad (6.10.4)$$

This expression depends only on T and we sum (for instance) M to get the effect on m of all masses of the cosmos; the sum is valid since the expression is independent of r. The sign of the force is negative since the masses in the sum are geometrically external to the system (except for the system itself which is negligible).

6.4 The Plank scale potential

At the Plank scale, (6.5) yields:

$$E_\phi(l_P) = \frac{h\,c}{l_P} = M_P\,c^2 . \qquad (6.11)$$

This is the expected result in particles physics. But here the field is dependent on its source and this energy level does not pervade all space, the potential is c^2 and just multiplied by mass. Then, and more subtly, from (6.9), the main terms of the field potential cancel exactly at the Plank scale.

This section show the coherence of the classical field discussed in section 5 with the quantum world because the only equation introduced here is $Et = h$ or equivalently $P = h/r$.

7 Oscillations, expansion, black holes

A membrane of this kind has large thickness and the emission of the next membranes can be imprinted in the observable cosmos geometry; this imprint must be damped in proportions of the number of membranes existing between the emitter and ours. The oscillation recently observed by Ringermacher and Mead [3] corresponds to 7 minima and 6.5 ± 0.5 phases. The amplitude of the oscillations increases with distance. We interpret the minima as successive membrane emissions, and ≈6.5 visible oscillation phases for 7 membranes correspond to ≈ 50% of our membrane emission logically invisible, as a descending phase preceding its emission.

Now we want to understand the observation of 1A supernova since it leads to accelerated expansion and dark energy. The Chandrasekhar limit gives the mass of the type 1A supernova on which luminosity depends:

$$M_{limit} = \frac{k\,M_P^3}{(\mu_e\,m_h)^2} ,$$

where k is a constant factor, M_P the Plank mass, μ_e the average molecular weight per electron, and m_h the mass of a hydrogen atom. Hence, with variable masses, M_{limit} evolves like $1/T^2$, which is in contradiction with observation (constant chemistry and atomic physics). Therefore, as it should in a gravitation theory, the field defines the context in which the rest of physics lives. It means that the same field is also at the origin of all charges interaction; not only of mass but of all forms of energy.

Consider then M_{limit} constant; the expression is epoch-independent and then also the emission luminosity. Now assume all measured red-shift are given by linear expansion (neglecting oscillations). Then photons will disperse more than with a decelerating expansion. A linear expansion is almost in perfect agreement with observation as shown by Perlmutter & al [5] and more recent works.

The ΛCDM model also uses baryonic acoustic oscillations to evaluate the size of the large structures of the cosmos; it requires dark matter and our equivalent is the acceleration $H\,c$ which becomes infinite when $T \rightarrow 0$. Then, large anisotropies of matter density should already be present at a very early epoch and primordial black-holes are also possible.

At the Schwarzschild radius the field potential reads:

$$\frac{\Gamma}{c^2} = 1 - 1 + \frac{R_S}{R_U} . \qquad (7.1)$$

The field is then compatible with the existence of black holes, which is obvious, but also with their stability since R_S/R_U is epoch-independent. Since the exchanges are time-symmetrical it creates neither black holes inflation (a known problem of pushing gravity) nor deflation.

8 Conclusion

We showed that the theory holds with no dark matter. It comes as a pressure field given by the very first quantum equation $P = h/r$; the gravitational field agrees with GRT results on a short scale and cosmology is straightforward. The field is coherent with Mach's principle; the emitter creates dissymmetry and the differential between the advanced and retarded field components create energy, gravitation, and the acceleration $H\,c$.

Interestingly, this field necessarily defines the context in which the rest of physics lives; hence it is also the origin of particles interaction and therefore it interacts with charges. Firstly the potential c^2 comes as a pressure field and can be interpreted as the Poincaré stress [6] and secondly it implies bottom-up unification.

9 Addendum

Still considering G constant, and since $H = 1/T$ and $m(T) = kT$, the force in (6.10.4) is time-invariant. In this equation, summing $m(T)$ to the absorber mass M_A gives:

$$\Delta F_{MA} = H\,c\,M_A(T) = \frac{c^4}{2\,G} = \frac{M_p\,c^2}{2\,l_p}\,, \qquad (9.1)$$

which is half the Plank force; it also reads:

$$2\,\Delta F_{MA}\,l_p = M_p\,c^2\,. \qquad (9.2)$$

This is the work of a force $2\Delta F_{MA}$ over the Plank length. We also have $M_p\,c^2 = h\,c/l_p$, and then:

$$2\,\Delta F_{MA}\,l_p^2 = h\,c\,, \qquad (9.3)$$

which is the natural constant of the Yukawa interaction of the SM Higgs field. It also gives:

$$2\,\Delta F_{MA}\,l_p\,t_p = h\,. \qquad (9.4)$$

This is the action of a force $2\,\Delta F_{MA}$ over the Plank length in the Plank time. Those equations read as if in a cosmos which radius is expanding at light speed (of length l_p in time t_p), a scalar field of constant hc is creating an additional dark energy $M_p c^2/2$ with an action h; then the total energy created by $\Delta\,F_{MA}$ since the big bang is:

$$M = \frac{M_p\,R_u}{2\,l_p} \rightarrow M = M_A\,, \qquad (9.5)$$

which, of course, is identical to (4.2). Finally, we have just separated the forces of energy creation from the usual gravitation and then energy conservation.

This reasoning is circular as we introduce M_A at the beginning of the calculus; but there is no naturalness problem in the cosmology outlined here with respect to the constants of quantum physics (the cosmological constant and the so called "why now" problems are nonexistent). The novelty is the immediate significance of the Plank units and the permanence of energy creation; its power is constant and can easily be computed, it is half the Plank power which is then a constant of nature, and corresponds roughly to 2.4 W/Kg of dark or visible energy at the present epoch.

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References

1. Wheeler J.A., Feynman R.P. Interaction with the Absorber as the Mechanism of Radiation. *Reviews of Modern Physics*, 1945, v. 17(2–3), 157–161.
2. Wheeler J.A., Feynman R.P. Classical Electrodynamics in Terms of Direct Interparticle Action. *Reviews of Modern Physics*, 1949, v. 21(3), 425–433.
3. Ringermacher H.I. and Mead L.R. Observation of discrete oscillations in a model-independent plot of the cosmological scale factor versus loopback time and scalar field. *Astronomical Journal*, 2015, v. 149, no. 4.
4. The Plank Collaboration. Planck 2015 results. I. Overview of products and scientific results. arXiv: 1502.01582
5. Perlmutter S. et al. Measurements of Omega and Lambda from 42 high redshift supernovae. *Astrophysical Journal*, 1999, v. 517(2), 565–86; arXiv: astro-ph/9812133.
6. Poincaré H. Sur la dynamique de l'électron. *Rendiconti del Circolo Matematico di Palermo*, 1903, v. 21, 129-176.