An alternative cosmological model with predictions similar to today's ΛCDM model

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Abstract

The theory of quantum mechanics and the theory of general relativity are both important with respect to the initial conditions of the universe and its evolution. In this paper we consider the question of how these theories might interrelate through a simple and didactic cosmological alternative model based on the Hubble time, Planck mass flow rate, and a variable coefficient α_H*. In doing so, we derive the parameters obtained by the Planck 2018 results using the Planck mass flow rate and Hubble time. By introducing a double universe theory (matter and antimatter universes arising from an initial instanton (i.e., half Planck mass) state, we sketch out a general framework for unifying***,** *in the cosmology, general relativity with quantum field theory.*

Keywords : cosmology, double universe theory, dark energy, Hubble constant, Planck mass flow rate, quantum mechanics, general relativity, antimatter, Big bang, instanton

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Introduction

The ΛCDM model based on Einstein's theory of general relativity and on observations is, to date, the most widely-accepted cosmology model to describe the universe, despite some ongoing puzzles. On the other hand, no quantum description of the universe is now in wide consensus. We can note that the Planck mass flux is both a relativistic quantity (c^3/G) and a quantum quantity (m_{Pl}/t_{Pl}). We will use this quantity associated to the Hubble time to propose a quasi complete alternative theoretical framework, relativistic and quantum, of the universe. Our alternative theoretical framework, which follows from the ΛCDM model, finds values consistent with the results of the Planck 2018 measurements, and may possibly explain what dark energy is. Our model also suggests a possible explanation for the disappearance of antimatter in the Big Bang model. Finally it recovers the cosmological diffuse background temperature determined by the WMAP satellite, in conjunction with the Planck 2018 results in a simple and easily understandable way.

A) A toy cosmological model compatible with the ΛCDM model after the decoupling.

It seems possible to obtain the critical mass of the universe which correlates with the ΛCDM model. This could eventually lead to the development of a simple toy cosmological model previously unknown to the author, which is built around the Hubble constant H_0, the Hubble time $t_H = 1 / H$, the Planck mass flow and a variable coefficient α_H.

α_H represents the scalar radius of the observable universe (following calculations in the ΛCDM model for example) and correlates the Hubble radius at time t_H for a flat universe, according to:

$$\alpha_H = \frac{c}{H_0} \int_{a=0}^{a=1} \frac{da}{a^2 \sqrt{\Omega_r a^{-4} + \Omega_m a^{-3} + \Omega_k a^{-2} + \Omega_\Lambda}} \bigg/ \frac{c}{H_0} \qquad \text{(Equation 1)}$$

where a is the scale factor, c is the speed of light, $H_0 = 67{,}4 \pm 0{,}5$ km s^{-1} Mpc^{-1}, is the Hubble parameter measured today[1], the Ω_i are the density parameters of the standard cosmological model, i.e. the ΛCDM model, measured today [1].

$$\alpha_H = \int_{a=0}^{a=1} \frac{da}{a^2 \sqrt{\Omega_r a^{-4} + \Omega_m a^{-3} + \Omega_k a^{-2} + \Omega_\Lambda}} \qquad \text{(Equation 2)}$$

$\delta = \frac{c^3}{G} = \frac{m_{Pl}}{t_{Pl}}$ is the Planck mass flow rate.

$t_{H_0} = \frac{1}{H_0}$ is the Hubble time (= 4,578 10^{17} s = 14,51 billion years today)

R_{H_0} is the Hubble radius.

$$R_{H_0} = \frac{c}{H_0} = c t_{H_0} \qquad \text{(Equation 3)}$$

The increase of the "total mass of Hubble volume", (i.e. dark energy + total matter), M_{H_0}, in the sense of the ΛCDM model, is determined for a flat quantum universe by the following relation with the critical density $\rho_c = \frac{3}{8\pi G\, t_{H_0}^2}$ and the Hubble volume $V_{H_0} = \frac{4\pi}{3} \left(c\, t_{H_0}\right)^3$

$$M_{H_0} = \frac{3}{8\pi G\, t_{H_0}^2}\, \frac{4\pi}{3} \left(c\, t_{H_0}\right)^3 \qquad \text{(Equation 4)}$$

$$M_{H_0} = \frac{1}{2}\, \frac{c^3}{G}\, t_{H_0} \qquad \text{(Equation 5)}$$

$$M_{H_0} = \frac{1}{2}\, \frac{m_{Pl}}{t_{Pl}}\, t_{H_0} \qquad \text{(Equation 6)}$$

$$\mathrm{M}_{\mathrm{H}_0} = \frac{1}{2}\, \delta\, \mathrm{t}_{\mathrm{H}_0} \qquad \text{(Equation 7)}$$

The mass of the observable universe in the sense of the ΛCDM model is :

$$M_{H_0} = \frac{1}{2}\, \delta\, t_{H_0} \alpha_{H_0}^3 \qquad \text{(Equation 8)}$$

α_{H_0} ≈ *4.399 10^{26} m / 1.372 10^{26} m, i.e.* $\alpha_{H_0} \approx$ *3.175 today if* $H_0 = 67{,}4 \pm 0{,}5$ km/s/Mpc, *Ωm=0,315* and *ΩΛ=0,685*[1].

$$M_{H_0}\alpha_{H_0}^3 \approx 2{,}959\ 10^{54} kg \qquad \text{(Equation 9)}$$

in other words, the mass of the observable universe ΛCDM today. (taking into account $e=mc^2$)

B) Value of α_H before the decoupling in the cosmological toy model and possible consequences.
The author hypothesize that, before and after the decoupling, the radius of the observable universe was equal to the Hubble radius. The ratio α_H was then normalized equal to 1.

B.1) Thus, the mass of the Hubble sphere at t_{H0} = Planck time is determined here by :

$$M_{Ht_{Pl}} = \frac{1}{2}\ \frac{m_{Pl}}{t_{Pl}}\ t_{Pl} \qquad \text{(Equation 10)}$$

$$M_{Ht_{Pl}} = \frac{1}{2} m_{Pl} \qquad \text{(Equation 11)}$$

This can be verified with the thermal energy :

$$E_{Th} = \frac{1}{2}\ m_{Pl}\ c^2 = \frac{1}{2}\ k_B\ T_{Pl} \qquad \text{(Equation 12)}$$

where k_B is the Boltzmann constant, with one degree of freedom assumed for the singularity and T_{Pl} the Planck temperature.

B.2) Mass of the universe at Hubble radius in this alternative cosmological model.
Starting with a "Planck time grain mass" or « instanton, » our proposed « singularity » state at the beginning of the Big Bang model, which we define as the beginning time of our universe, with our galaxy as center. Then by making the assumption that for each unit of Planck time that passes, a corresponding half Planck mass is added to the mass of the universe. It should be noted that the instanton, as we define it, has a Schwarzschild radius of a single Planck length, which is of some importance in our model in comparison to other similar models. In our toy cosmological model, the critical mass (energy) of the universe at the Hubble radius, before and after the decoupling, at time , t_{H_0} grows simply with the following formulas :

$$\mathrm{M}_{\mathrm{H}_0} = \sum_{i=1}^{i=\mathrm{t_H/t_{Pl}}} \left(\frac{1}{2} m_{Pl}\right)_i \qquad \text{(Equation 13)}$$

i.e.

$$M_{H_0} = \frac{1}{2}\ \frac{m_{Pl}}{t_{Pl}}\ t_{H_0} \qquad \text{(Equation 14)}$$

$$M_{H_0} = \frac{1}{2}\ \frac{c^3}{G}\ t_{H_0}$$ (Equation 15)

If $t_{H_0}$is the Hubble time today, $H_0 = 67{,}4 \pm 0{,}5$ km/s/Mpc[1], t_{H_0}= 4,578 10^{17} seconds today, so M_{H^0} 9,241 10^{52} kg.

With t_H = 1/H. So the Hubble radius in our toy universe is continually the same as the Hubble radius in the ΛCDM model.
We assume that it's valid, without recourse to cosmic inflation, from Planck time to the Hubble radius of the universe at the time of decoupling in the standard model (377 700 years) but also beyond. This is made possible by writing the "critical mass" (= critical energy) and the Hubble radius with δ and t_{H_0}. This has the consequence of limiting quantum phenomena in the universe to dimensions of the order of Planck units between $t_{H_0}$and $t_{H_0} + t_{Pl}$.

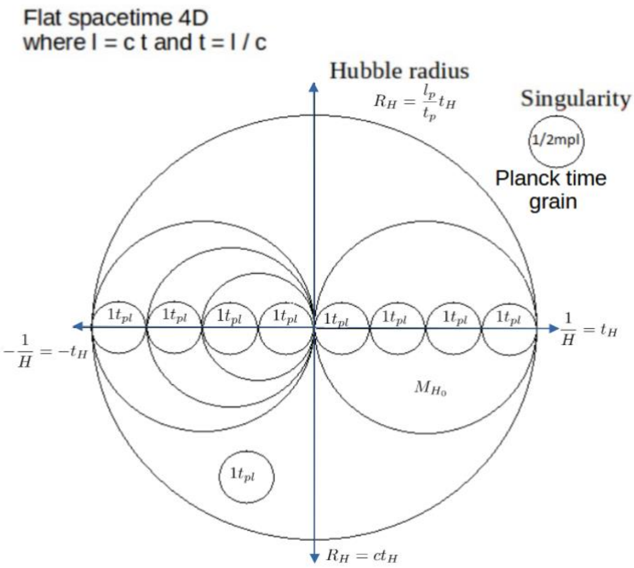


Figure 1: Hubble sphère

Figure 1 shows that the observation of the Hubble sphere is always done in a given direction whether along the axes t_H or along the axes R_H . When we look in the opposite direction, we observe a universe with the same characteristics, namely a Hubble universe whose mass increases as a function of t_H This toy model is therefore by construction isotropic, i.e. identical whatever the direction of observation. It is also homogeneous on a large scale by construction, i.e. for any considered time interval t_H, it contains a Planck half-mass.
In other words, there's always an observational bias that means part of the Hubble Universe is not visible to our observation for one observer, but it's there. The observer sees only one of these mini-spheres, depending on the direction of his observation. This observation is made according to an arrow of time that appears to be always positive.
We will simply note that the possibility of a double universe with two opposite time arrows was proposed by Soviet physicist Andreï Sakharov in 1967 is taken up here. The ideas that follow from

Andreï Sakharov's hypothesis should be re-examined according to the author, especially in order to account for dark matter and dark energy. The hypothesis of Andreï Sakharov has given rise to a few scientific works. Among the scientists who have worked on his hypothesis are Nathan Rosen, Jean Pierre Petit, Gabriel Chardin, Michael Boris Green, John Henry Schwarz, Abdus Salam (Nobel Prize in Physics in 1979), and Sabine Hossenfelder.
In this toy model, the red shift is due to time dilation and have for consequence the expansion of our visible universe in the 3 space dimensions (distance = c t) of our visible universe. In other words, in this toy model, the Doppler effect of space expansion is connect to the Doppler effect of time. We also note that matter translated into energy gives the negative energy first proposed by Stephen Hawking, but also proposed later by Tatum[6].

C) Proposal of determination of the cosmological constant in this toy cosmological model.

C.1) The Hubble sphere seen as a black hole.

We would therefore have a Hubble universe of mass $\rho_c V_{H_0}$ which have a diameter $D_{H_0} = 2\ c\ t_{H_0}$ and composed of two mini spheres S_H^+ and S_H^- .
M_{H0}= Hubble volume * critical density in kg, with large-scale homogeneous distribution for a flat quantum universe. We also have, Eq.15 : $M_{H_0} = \frac{1}{2}\ \frac{c^3}{G}\ t_{H_0}$
We can define two spheres H'_{left} and H'_{right} which :
- both have diameter $D'_{H0} = R_{H0}$ and mass M_{H0}.
- whose contact point is the center of the sphere with radius R_{H0}.
The invariant gravitational force that attracts these masses of the two mini-spheres M_{H0}^- on the left and M_{H0}^+ on the right is $FM_{H_0}^{\pm}$:

$$FM_{H_0}^{\pm} = \frac{G M_{H_0}^{+} M_{H_0}^{-}}{R_{H0}^2} \qquad \text{(Equation 16)}$$

$$FM_{H_0}^{\pm} = \frac{G\left(\frac{1}{2}\frac{c^3}{G} t_{H_0}\right)^2}{(c.t_{H_0})^2} \qquad \text{(Equation 17)}$$

$$FM_{H_0}^{\pm} = \frac{c^4}{4G} \qquad \text{(Equation 18)}$$

$$FM_{H_0}^{\pm} = \frac{F_{Pl}}{4} \qquad \text{(Equation 19)}$$

where F_{Pl} is Planck's force and where N is the Newton.

$$FM_{H_0}^{\pm} = 3{,}02564\ 10^{43}\ N \qquad \text{(Equation 20)}$$

The Planck force characterizes a property of space-time according to Barrow and Gibbons [2]. In general relativity, the limiting value it represents does not correspond to the Planck unit, but to the reduced Planck unit, where *G* is replaced by *4G*. The resulting reduced Planck force is four times weaker and is equal to Eq.16 to Eq.20 . This is a maximum limit in general relativity, attainable only at the horizon of a black hole. As the radius of a Schwarzschild black hole R_s is also its horizon R_h where it would appear to be permissible to model our universe as a Schwarzschild black hole, where the observer is operationally-defined as always being at the center of our Hubble sphere. All partial or entiere models [3] at the critical Friedmann mass with these characteristics could be valide. (See Section E). This one is only one of them.

$$R_h = \frac{2GM_{H_0}}{c^2} \qquad \text{(Equation 21)}$$

Considering the Hubble sphere as a Schwarzschild black hole expanding will be essential in a following paragraph to theorize the temperature of the cosmic microwave background, i.e. the CMB.

The two mini spheres can also be two complete Hubble spheres. Finally we note by examining two mini spheres that M_{H0}^{+} and M_{H0}^{-} can be seen as a mass of matter and a mass of antimatter.

C.2.a) Proposal of determination of the cosmological constant.

Here, we try to deal with dark energy. In classical mechanics, the gravitational interaction between two masses is instantaneous, but in general relativity this interaction cannot be faster than the speed of light. We will use this property of general relativity theory to propose a value for the cosmological constant. The value, which is questionable from a dimensional point of view, is nevertheless consistent with the results of Planck 2018, as we'll point out below.

Since the velocity of the gravitational interaction $FM_{H_0}^{\pm}$between M_{H0}^{+} and M_{H0}^{-} is limited to c we assume that the power of $FM_{H_0}^{\pm}$is $PM_{H_0}^{\pm}$Watts such that:

$$PM_{H_0}^{\pm} = FM_{H_0}^{\pm}c \qquad \text{(Equation 22)}$$

$$PM_{H_0}^{\pm} = 9{,}0706\ 10^{51} kg.m^2.s^{-3} \qquad \text{(Equation 23)}$$

We will look for what could balance this power. As we have already used the opposite with $\mathrm{M}_{H_0}^{+}$ M_{H0}^{+} and $M_{H0}^{-}$to find $FM_{H_0}^{\pm}$, this time we will try to use the inverse of $PM_{H_0}^{\pm}$ to get the neutrality egal to 1 of the mathematical operation and the dimension of $PM_{H_0}^{\pm}$

$$\frac{1}{PM_{H_0}^{\pm}} = 1{,}1025\ 10^{-52} kg^{-1}m^{-2}s^{3} \qquad \text{(Equation 24)}$$

The watt is also a measure of energy flux. The latter is by definition the measure of the total power of electromagnetic radiation emitted or received by a real or virtuel surface. We assume that this is electromagnetic radiation. We will also assume that the units of dimension [M-1 L-2 T3] are the units of dimension of the cosmological constant in our toy model. It should be noted here that this dimension for obtaining Λ is erroneous with respect to the ΛCDM model, but the value of retaining the numerical value of Λ from this model seems, to the author, to be more important at present because of its basis with $FM^{\pm}_{H_0}$. Later in this version, the author will show that this "anomalous" dimension of the cosmologie constant could be natural in quantum cosmology because it follows from the underlying dynamical reality of the cosmological constant that applies in the framework of this alternative model. See §C.2.c and section F.

Note that : $$PM^{\pm}_{H_0} = \frac{4}{P_{Pl}} \quad \text{(Equation 25)}$$
where P_{Pl} is the Planck power.

C.2.b) Validation of the value of the proposed cosmological constant.

The density parameter of the cosmological constant Ω_Λ in the ΛCDM model is defined by Friedmann equation for a flat relativistic universe as follows:

$$\Omega_\Lambda = \frac{c^2\Lambda}{3H_0^2} \quad \text{(Equation 26)}$$

i.e . with Planck 2018 results ($H_0 = 67{,}4 \pm 0{,}5$ *km/s/Mpc)*[1], $t_{H_0} = 4{,}578\ 10^{17}$ *seconds today)* and the proposed value of Λ from model standard formula is:

$$\Omega_\Lambda = \frac{299792458^2\ .\ 1{,}1025\ 10^{-52} .\ (4{,}578\ 10^{17})^2}{3} \quad \text{(Equation 27)}$$

$$\Omega_\Lambda = 0{,}6923 \quad \text{(Equation 28)}$$

By simplifying, today, the matter density parameter $\Omega_m = 1 - \Omega_\Lambda$, i.e. $\Omega_m = 0{,}3077$.
Planck 2018 results[1] give Ωm = 0.315 ± 0.007. If Ωm = 0.315 - 0.007, then Ωm = 0.3080. Our theoretical value of Λ gives a result extremely close to the lower bound of Ωm with the Planck 2018 results[1]. This is the main reason why the authors propose that the important open question about the dimensions of Λ could be as presented here. Our alternative cosmological model would then possibly account for the origin of dark energy where the ΛCDM model fails.

C.2.c) About the dimension of the proposed cosmological constant in this model.

The dimension of Λ in this toy model is $kg^{-1}m^{-2}s^3$. It can also be written: $\frac{\mathrm{s}}{\mathrm{kg^1\ m^2\ s^2}}$, i.e. time divided by energy.
The universe we see is only *our* universe, with our galaxy as center. *Our* universe is made up, as Sakharov and we assumed, of two time-dependent dynamic universes: M_H^+ and M_H^-, and 2 time arrows t_H^+ and t_H^-. Therefore, to explain its dimensions, we have a cosmological constant Λ of constant value, whose underlying reality is dynamic from $t\_H = 0$ to all $t\_H = 1/H$, and which is equal to:

$$\Lambda = \frac{2t_H}{M_H c^2} = 1.1024583\ ^{-52} kg^{-1}m^{-2}s^3 \quad \text{(Equation 29)}$$

Our measurable universe is simply a a universe expands critical of Friedmam, i.e. the contents of the Hubble sphere, as proposed, for example, by E. Haug in recent work. The ΛCDM model despite its success fails to find, unlike this toy model, the nature and dynamical origin of the cosmological constant as a function of time t_H, i.e. the Hubble parameter $H = 1/t_H$.

C.2.d) Proposal to redress the dimension of Λ in this toy model to ΛCDM model.

The power $4/PM^{\pm}_{H_0}$ (Dim : 1/W) or inverse energy flux of the cosmological constant and the fact that our observations of the universe are made in W/m².
Reference : https://www.pas.rochester.edu/~emamajek/IAUres_B2.pdf
We do $W\,m^{-2} * 4/P_{Pl}$ to find Lambda's dimension in the standard model. its dimension is then transformed into m^{-2} in the standard cosmological model from this toy model.
Moreover, as Lambda's Watts origin comes from a force times a velocity, we can't observe it directly, as it's a non-luminous phenomenon. It is therefore « black » with our current observational methods. It's observation is, at best, indirect.
In all cases, the cosmological constant of this model comes from a force multiplied by a speed. It is not related to the luminosity which we like to use in order to draw models from observations. It should be realized that an event where a force is multiplied by a speed would not necessarily be associated with light emission. We propose that this may be why cosmologists can only see indirect effects, such as a lack of cosmic acceleration, which they then, understandably refer to as the result of dark energy.

C.3) Proposed explantion of the vacuum catastrophe in this alternative cosmological model.

Let's consider the force that attracts our two mini spheres in contact and expanding, $M^{+}_{H_0}$ and M^{-}_{H0} at a distance $R^{\pm}_{H_0}$. At the point of origin of figure.1, this force crosses, at speed *c*, a quantum surface of Planck scale $(l_{Pl})^2$, where l_{Pl} is the Planck length. The power $PM^{\pm}_{H_0}$ or energy flux of the cosmological constant thus crosses orthogonally the irtual surface $(l_{Pl})^2$. Mathematically, this gives us:

$$\varphi = \frac{PM^{\pm}_{H_0}}{{l_{pl}}^2} \approx 3{,}5\ 10^{121} kg.s^{-3} \qquad \text{(Equation 29)}$$

The dimension of Eq.30 is that of a surface power density, i.e., that of the energy flux $PM^{\pm}_{H_0}$ that starts from the origin of the Hubble sphere to interact with its surface. $(l_{Pl})^2$ is the assumed value of quantum energy suggested by quantum field theory[4] with a cutoff at l_{Pl}. One writing of the vacuum catastrophe is divide the vacuum engrener suggested by quantum field theory by the energy of the cosmological constant Λ with the dimension [L-2] is:

$$\frac{l_{pl}^{-2}}{\Lambda} \qquad \text{(Equation 30)}$$

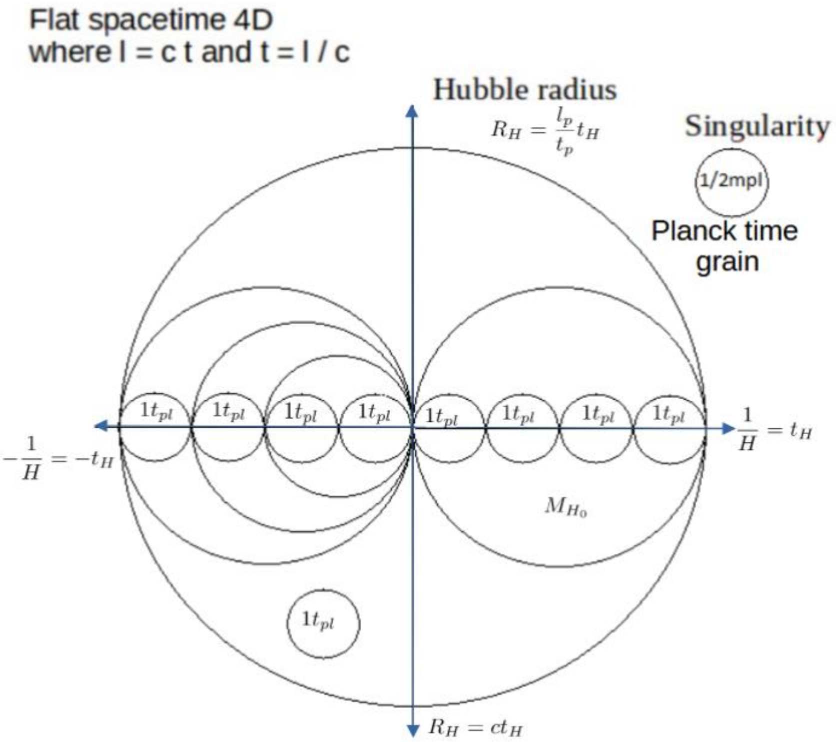
Another expression with energy densities, of dimension [M][L-1][S-2], is :

$$\frac{F_{Pl} l_{pl}{}^{-2}}{\frac{F_{pl} \Lambda}{8\pi}} \quad \text{(Equation 31)}$$

Considering the zero point energy suggested by the quantum field theory l_{Pl}^{-2}as the inverse of a surface and not as an energy should fit easily into the mirror theories that follow from Andreï Sakharov's hypothesis.

D) Proposal of explanation of the disappearance of antimatter in the Big Bang model.

To make this proposal we must refer to figure 1. To facilitate the understanding of what follows without having to navigate in this file, I make a copy here :



The resolution of this problem comes naturally when the human or instrumental observational bias is identified:
When we observe thé Hubble sphere in the "up" or "down" direction, the two masses M_{H0}^{+}, and M_{H0}^{-}, the two Hubble mini-spheres are not included in the field of view. They are there but the observer placed at the origin of the 4 directions of the figure does not see them. This is Schrödinger's cat, which is both dead and alive as long as you look in those "up" or "down" directions The time can pass as much as one wants, as long as the observer does not change

direction of observation, the observer does not know if he will see the matter $\boldsymbol{M}+$ or the antimatter $\boldsymbol{M}-$.The cat of the matter is thus at the same time dead ***M-*** and alive ***M+***. When the observer chooses to make the observation by turning 90°, he will see a dead cat or a living cat. This model of universe starts at $t_{H_0}=0$, $0{,}5m_{pl}^{+}$, the time being signed + or -, the observer will see, either matter M^+/t^+, or matter M^-/t, i.e. $0{,}5m_{pl}^{+}$. The mass $0{,}5m_{pl}^{-}$ is on the time line $-t_H$from the origin. It is located on the other side of the observer's time origin. He does not see it. This explains the infinitesimal amount of antimatter in the observed universe in the Bing bang model wich begin at t_{Pl} .

E) Proposal of a simple relationship between CMB temperature and the Hubble constant in our alternative cosmological model.

At the end of the paragraph in Section C.1), we stressed the importance of potentially modeling our Hubble sphere as an expanding black hole. Here, we will partially repeat the work of the article « The Basics of Flat Space Cosmology » by E.T. Tatum, U. V. S. Seshavatharam and S. Lakshminarayana [3]. This is because they accurately calculate the Hubble constant H_0 using only the Fixsen CMB temperature of 2.72548 K as their sole input. Their success in this regard appears to be from using their modified cosmological scaling temperature formula inspired by Hawking's temperature formula for black holes. Their formula, demonstrated by Haug and Wojnow recently[9] , is as follows:

$$T_{H_0}=\frac{\hbar c^3}{8\pi k_B G\sqrt{m_{Pl}M_{H_0}}} \quad \text{(Equation 32)}$$

where T_{H_0} is the Hubble sphere CMB temperature today, $\hbar$ is the reduced Planck constant (or Dirac constant) and k_B is the Boltzmann constant. The Planck 2018 results give a value of $H_0=67{,}4\pm 0{,}5$ *km/s/Mpc*. We use, H0 = 66.90 km s^{-1} Mpc^{-1} and $t_{H_0}=4{,}6124\ 10^{17}s$. We obtain with Eq.14, $M_{H0}=9{,}310\ 10^{52}kg$, which is identical to the number Tatum et al. also reported in 2015 [3]. The Hubble CMB temperature, for instance, is derived in the following way :

$$T_{H_0}=\frac{1{,}0545718\ 10^{-34}*299792458^3}{8\pi*1.380649\ 10^{-23}*6.6743\ 10^{-11}\sqrt{2{,}176434\ 10^{-8}*9{,}310}\ 10^{52}} \quad \text{(Equation 33)}$$

$$T_{H0}=2{,}7256\ K \quad \text{(Equation 34)}$$

The CMB temperature measured today for z=0, is : TCMB(z = 0) = 2.72548 ±0.0005 7 K [10]. The upper bound of the uncertainty error in our calculation is 2.72605 K. The above Fixsen CMB temperature is, therefore, in perfect agreement with the calculation made by modeling the Hubble sphere as a black hole and calculating its (modified) Hawking temperature. In like manor, by plugging the Fixsen CMB temperature into a rearranged Tatum et al. formula, and assuming a c/R_H value for the Hubble constant, a Hubble constant value of 66.89 km/s·Mpc can also be obtained. The above values can only be derived in a black hole cosmological model, such as the 2015 Tatum model. Thus, there is an extremely high correlation between the CMB temperature and the Hubble constant. This is the subject of a current letter under review authored by E.T. Tatum, E.G. Haug and S. Wojnow. [8]. This last paper highlights, with values from four studies of CMB temperature, a much more precise value of H0 . This would be the lower bound of H0=67.40±05 km/s·Mpc, i.e. : H0 = 66.90 km s^{-1} Mpc^{-1} used here.

F) Numerical and dimensional consistency of zero-point energy in this alternative model.

The dimension and value corresponding to vacuum energy in quantum field theory,i.e. the zero-point energy, is l_{Pl}^{-2} [4]. The dimension of the cosmological constant in this alternative model (Eq.24 and Eq.25) is

$$kg^{-1}.m^{-2}.s^{3} \qquad \text{(Equation 35)}$$

We have the value of l_{Pl}^{-2}, which is totally independent of Λ, so much so that it is referred to as the "worst prediction of theoretical physics" with regard to the gap between its cosmological measurement and the prediction in quantum theory. By setting the value of the zero-point energy equal to the dimension of the cosmological constant in this alternative model, in the same way that the Planck force transforms the dimension [L^{-2}] into an energy density...
...it becomes very simple to reconcile these two values using Planck units at the cut off :

$$\Lambda = \Lambda_{vacuum} = 2\frac{t_{Pl}^{3}}{m_{Pl}l_{Pl}^{2}} = 1{,}1025\ kg^{-1}.m^{-2}.s^{3} \qquad \text{(Equation 36)}$$

where Λ_{vacuum} is the value and dimension of the cosmological constant of quantum vacuum in this alternative model, which unifies general relativity and quantum field theory.

Conclusion.

In this alternative model, the mass of the Hubble sphere in the sense of the ΛCDM model is equal to the summation $\mathrm{M}_{\mathrm{H}_0} = \sum_{i=1}^{i=\mathrm{t_H}/\mathrm{t_{Pl}}} \left(\frac{1}{2}m_{Pl}\right)_i$ and appears as, a quantification i.e., as a "stacking" of Planck half masses on a Hubble timeline $t_H = 1/H$i nstead of a density multiplied by a spherical volume in the ΛCDM model. This stacking of masses is compatible with the apparent isotropy and homogeneity of the universe. This model starts at $t_{H,0}$, $t_H = 0$,contrary to the Big bang model, and goes until today. It gives results consistent with the observations made with the Planck satellite today. We take up the idea of doubles universes, and explore the relationship between the infinitely small in quantum mechanics and the infinitely large in general relativity. We hesitated for a while about the value proposed here of the cosmological constant because of its special dimension compared to the usual conventions, but we can be much more sure of its foundation (M_{H0}^{+} and M_{H0}^{-} with $FM_{H_0}^{\pm}$). We've established its underlying reality in this model. This model allows us to theorize about the CMB temperature measurement in relation to the Hubble constant measurement [8] and the interest in revisiting and renewing Andrei Sakharov's hypothesis.

Furthermore, we note that the idea of Bruno Valeixo Bento and Stav Zalel in their article "If time had no beginning"[5] seems correct. By linking it to quantum space universe , we can assume that a multiverse of universes could exist everywhere in a flat, infinite 4D spacetime, with no beginning and no end quantum space-time, as proposed in Figure 1 with singularities inside and outside the Hubble sphere. This is true for each unit of Planck time that elapses from the Big Bang, but also before the Planck time of the Big Bang.

Finally, we provide a solution to the "worst prediction of theoretical physics", also known as the vacuum catastrophe or cosmological constant problem in this model. In doing so, we find an a-dimensional factor of 1 between the measured cosmological energy and the vacuum energy suggested by quantum field theory, with an appropriate dimension.

In conclusion, our model is a potential candidate as a general framework for a cosmological model of relavistic and quantum cosmology. Among other things, it appears to provide possible validation for the zero-energy universe model of Tatum [6][7] and more simply of the zero-energy universe hypothesis of Pascual Jordan with $M_H^+c^2$ and $M_H^-c^2$.

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REFERENCES :

[1] Collaboration Planck : Y. Akrami and al. Planck 2018 results, https://arxiv.org/abs/1807.06209

[2] Barrow & Gibbons, Maximum Tension: with and without a cosmological constant, arXiv:1408.1820v3 , december 2014.

[3] E.T. Tatum and U.V.S. Seshavatharam,« The Basics of Flat Space Cosmology », Vol. 5 No. 2, June 2015, 10.4236/ijaa.2015.52015

[4] L. J. P. L. B. Lombriser, "On the cosmological constant problem," vol. 797, p. 134804, 2019.

[5] Bruno Valeixo Bento and Stav Zalel, If time had no beginning, Sept 27, 2021 https://arxiv.org/pdf/2109.11953.pdf

[6] E.T. Tatum, « How the Dirac Sea Idea May Apply to a Spatially-Flat Universe Model (A Brief Review »), Vol. 10 No. 8, July 2019, 10.4236/jmp.2019.108064

[7] E.T. Tatum and U.V.S. Seshavatharam, « Flat Space Cosmology as a Model of Light Speed Cosmic Expansion—Implications for the Vacuum Energy Density », International Journal of Astronomy and Astrophysics Vol.9 No.10, September 2018, 10.4236/jmp.2018.910126

[8] E.T. Tatum, E.G. Haug, S. Wojnow, « High Precision Hubble Constant Determinations Based Upon a New Theoretical Relationship Between CMB and H0 », https://hal.science/hal-04268732

[9] Haug E. G. and Wojnow S. « How to predict the temperature of the CMB directly using the Hubble parameter and the Planck scale using the Stefan-Boltzman law" Hal archive, hal-04269991v1 , https://hal.science/hal-04271060 2023

[10] D.J. Fixsen, « The Temperature of the Cosmic Microwave Background » Astrophysical Journal, Vol. 707 No. 2, November 2009, https://doi.org/10.1088/0004-637x/707/2/916

1999-2016 Edward L. Wright calculator. Wright (2006, PASP, 118, 1711)

used to translate french to english : Deepl.com and Google translate.

Readings done in connection with this document:

David W. Hogg , Distance measures in cosmology (14) and (15), 2000 December, https://arxiv.org/pdf/astro-ph/9905116v4.pdf,

https://fr.wikipedia.org/wiki/Densit%C3%A9_critique

https://fr.wikipedia.org/wiki/Volume_de_Hubble

https://fr.wikipedia.org/wiki/Force_de_Planck#Force_de_Planck_et_relativit%C3%A9_g%C3%A9n%C3%A9rale

https://fr.wikipedia.org/wiki/Trou_noir_de_Schwarzschild

https://fr.wikipedia.org/wiki/Watt

https://fr.wikipedia.org/wiki/Flux_%C3%A9nerg%C3%A9tique

https://fr.wikipedia.org/wiki/Densit%C3%A9_surfacique_de_puissance

https://www.techno-science.net/glossaire-definition/Modele-cosmologique-gemellaire.html

https://en.wikipedia.org/wiki/Zero-energy_universe

Author's final note:

So far, attempts to construct an alternative model to the ΛCDM model have not been able to account for the CMB temperature and a cosmological constant in agreement with the ΛCDM model *today*. To be sure, this alternative model is still incomplete. In particular, it lacks explanations of the power spectrum of the CMB polarization and the power spectrum of galaxies. Since this model does not the explanation of the power spectrum of galaxies is currently inaccessible. But according to ChatGPT, the power spectrum of the CMB polarization on the other hand could be accessible with this formula :

$$C_l = \frac{2k_B^4 T_{CMB}^4}{c^2 \hbar^3} \frac{\Omega_b^2}{\Omega_m^2} \int_0^\infty \frac{\Delta_{\mathcal{R}}^2(k)}{k^2} j_l^2(kr)dk$$

where :

C_l is the angular power spectrum of the CMB

$\Delta_{\mathcal{R}}(k)$ is the amplitude of the primordial power spectrum of density perturbations

k represents the wave number. It is a measure of the wavelength of the fluctuation in the early universe, where the initial density fluctuations were generated. In the case of the CMB, the wavenumber is often expressed in terms of angular scales, measured in degrees on the celestial sphere.

j_l is the spherical Bessel function

r is the comoving distance at redshift z corresponding to the angular scale

The verifications that I asked the ChatGPT to perform on the numerical application of his formula are obviously still open to question and are eventually to be explored by the scientific community.