The Hubble Tension

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This title expresses an incompatibility, within the standard model of cosmology, between measurements of the Hubble constant from the CMB and those from the Red Shift.
We had previously proposed a new concept called the" Intrinsic Space" [1]; a fictitious Universe whose energy is only one of the void, which exclude masses and radiations.
In this article, we compare the evolution over time of the radius of the Universe, as analyzed in [2], between the real Space and this fictitious Space to calculate the Hubble constant in both cases. Thus we propose a solution to the problem .

Statement of the problem

This problem is well presented on Wikipedia [3]. Efforts to better understand the margins of uncertainty of the various measurements have not been conclusive; this is indeed a fundamental question that could call into question the validity of experiments or indicate an incompleteness of the Standard Model of Cosmology, which is what makes this question so interesting.

Importance of the intrinsic space

Recall that we considered the notion of intrinsic space in the context of the analysis of the electron [4]. This refers to real space from which the energy of masses and radiation is subtracted; in fact, it is the energy of the vacuum of the universe that occupies practically the totality of the Space.
The measurement of the Hubble constant (H) by analyzing the CMB, according to the ACDM model [5], is based on a completely different physical basis than the traditional measurement which incorporates the recession velocity of Cepheid variables (Red Shift) and the measurement of their distances. In this case, the cosmic microwave background radiation (CMB) plays no role, whereas it is the fundamental variable of the ACDM model. We will show that the value of H deduced from this model corresponds to that measured by the evolution function R(T) of intrinsic space; (R) is the radius of space and T its age.

Evolution curves, calculation of H in real and intrinsic spaces

The evolution curve of space R(T) corresponds to the function :
R = A [T(e^T-1).(B - e^T+1]^0.5 [2] , where A is a fitting coefficient and B represents the total energy. This is in a system of proportions where R and T are dimensioned respectively in meters and 10 billion years. The problem consists of evaluating H = (dR/dT) /R for both spaces (Hr and Hi) and for T = 13.8 × 10^9 years (4.35 10^17 s)
We know Rr = lo e^(omega1) and Ri = lo e^(omega2) [6] corresponding to T = 13.8 10^9 years, with omega1 = 137.036 and omega2 = 137.000 [4], lo = 0.81 10^-34 m [6], this allows us to calculate Rr and Ri . On the other hand, we know Br = 10 (see [2]) and
Bi = (10 – Em) = 8.1 (*) ; all these elements allow us to establish the evolution curves.

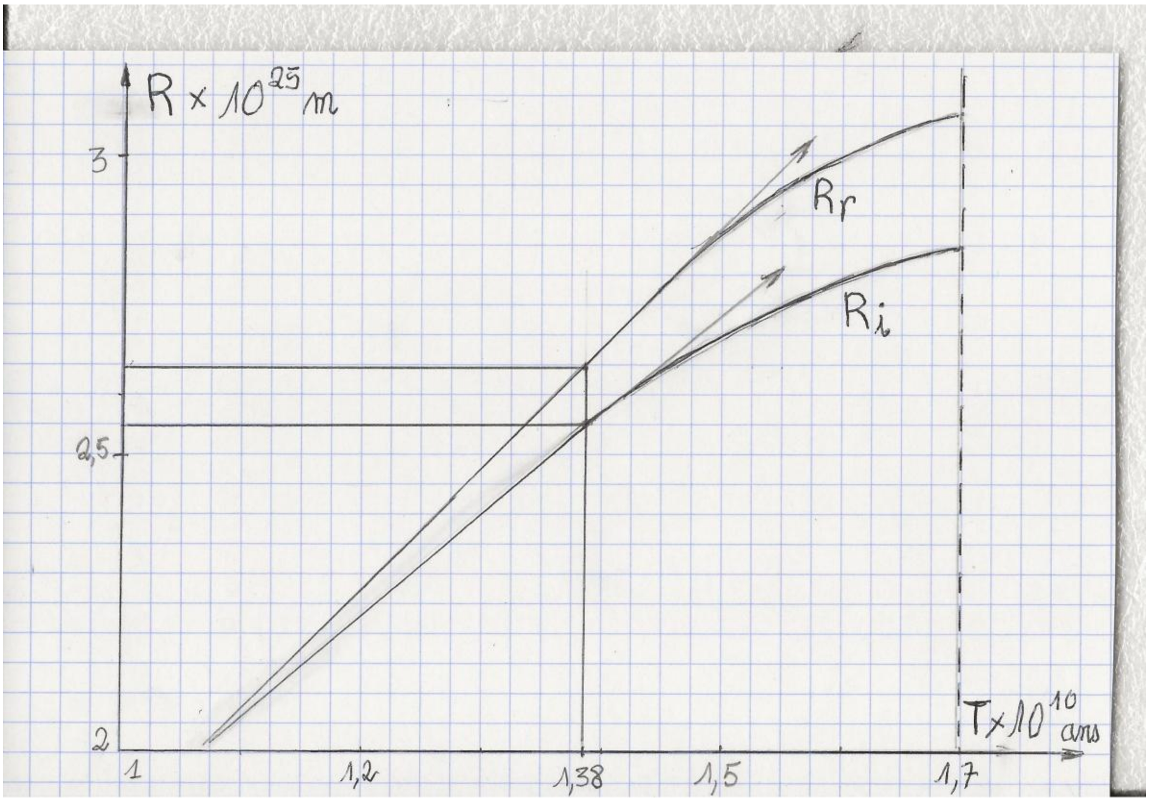
We will not go into the tedious calculation of the derivatives (dR/dT) and will give the results directly with a precision estimated at 2% .

Hr = 2.30 (+/- 0.05) and   Hi = 2.07 (+/- 0.05) in 10^-18/s, or, expressed in usual units:

Hr = 75 (+/- 2) and   **Hi = 67.5 (+/- 2)** in km/s/Megaparsec ;

These results are consistent with the measurements taken in both cases [7].

The following figure illustrates the difference between the two curves with reduced scales around T = 13.8 billions years, there are confused before T<10 billions years .



Conclusion

The results we obtained, both for the Electron mass and for the Hubble constant, raise the question of the presence and significance of electromagnetic energy (radiations and particles) of which intrinsic space which is a fictitious space is devoid . We can then understand that analyzing the evolution of the very first radiation (CMB) in this space, informs us about what the real universe will become : the creation of particles, protons, atoms, stars, etc., all electromagnetic entities within a substrate that is not electromagnetic; and this substrate is the intrinsic space. This space is not very different from real space; only a slight variation in physical constants (exemple : the fine-structure constant changes from 137.036 to 137.000) distinguishes it from real space. This is not surprising since electromagnetic energy, in all its forms, represents only 5% of the total energy.

We have simply shown here how the presence of this energy modifies the Hubble constant… traditional measurements of this constant (red shift) therefore address the reality of our Universe, which is not the case for those resulting from the analysis of the CMB which address a fictitious space, thus we solve the problem of the Hubble tension.

Important remark : Every physical quantities, coming from CMB analysis, have to be interpreted inside the intrinsic space because it is the basic medium where particles and radiations have been created .

(*) If Eg is the gravitational energy and Em the mass energy, we have Eg + Em = 0.32 [5] and Em = Eg + 0.05 (see [2]), so Em = 0.19 and Bi = 10 - 0.19 = 8.1

<u>References</u>

[1] YC Raverdy : *Intrinsic Vacuum Space and the problem of Hubble Constant* viXra : 2411.0120

[2] YC Raverdy : *The Evolution of the Universe from the Big Bang to the Big Bounce* viXra : 2509.0067

[3] Wikipedia, page : *The Hubble Tension*

[4] YC Raverdy : *The Intrinsic Vacuum Space* viXra : 2411.0030

[5] Wikipedia, pages : *Cosmological Microwave Back-ground* and *ΛCDM model*

[6] YC Raverdy : *A formula for electron mass calculation depending only on the four physical constants* viXra : 2208.0154

[7] Wikipedia, page : *The Hubble constant*