

The Cosmological Coherence Principle

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Abstract. A Cosmological Coherence Principle (CCP) is proposed, meaning each well-defined phenomena is mono-frequency. When applied in the steady-state critical cosmology, with scale factor $\exp(t/T_U)$, the CCP leads to three independent formula for T_U compatible with the so-called Universe age 13.80(4) Gyr, estimated by the recent Planck's mission, so refuting the Primordial Big Bang model, in favor of the Vibrating Universe model with frequency 10^{103} Hz and pseudo-period T_U . The matter density is simply shown to be $\Omega_m = 3/10$ and the bayonic one $\Omega_b \approx \Omega_m^2/2 = 0.0450$.

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Modern cosmology is generally considered as an application of General Relativity. But the mainstream six-parameters Λ -CDM model is unable to explain neither the dark energy density, nor the baryon one. A great simplification is the admittance of an euclidean geometry (critical condition $\Omega = 1$), so it is worth considering the simplest cosmology: a galilean one based on the critical steady-state model [1][2], which is characterized by a scale factor $\exp(t/T_U)$, with an unique parameter T_U , such that the galaxy recession law writes

$$l/T_U = v/r = c/R_U \quad (1)$$

with an invariant-in-time-and-space mean critical energy density:

$$\nu_c = 3c^2/(8\pi GT_U^2) \quad (2)$$

where notations are usual.

A sphere of sufficiently large radius r , corresponding to a redshift speed v , contains the energy $E(r) = r^3 c^2/(2GT_U^2)$ and an equivalent mass $m(r)$ such that

$$m(r)G/r = v^2/2 \quad (3)$$

so the sum of the non-relativistic equivalent cinetic energy and the non-relativistic gravitational potential energy is null. Now, the latter is given by the well-known formula $E_{gr}(r) = -3GE^2(r)/(5rc^4)$, whose modulus is $3E(r)r^2/(10R_U^2)$. For $r = R_U$, this is

$$-E_{pot} = E_{kin} = \Omega_m E_U \quad ; \quad \Omega_m = 3/10 \quad (4)$$

This is interpreted as the manifestation of a Cosmological Coherent Principle (CCP): *each well-defined phenomena is characterised by a unique frequency*. Note that the factor 2 of the virial theorem is absent, calling for further study, probably tied to a repulsive gravitation at cosmic distances, so explaining directly the above one-parameter exponential recession, *without any need*

to a primordial Big Bang, which is radically refuted by the present study, since the three following independent formula (9), (10), (13) are compatible with the so-called "Universe age" 13.80(4) Gyr [3].

There is thus a fraction 7/10 of excess energy, which is compatible with the so-called "present day dark energy" density $\Omega_\Lambda = 0.73(3)$ of the official Λ -CDM model [3]. The fit is better with the most recent estimation [4] after the Planck mission: $\Omega_\Lambda = 0.692(10)$.

Now, applying the CCP by equalizing the classical and quantal energies in $E_U = M_U c^2 = E_{cl} + E_{qu}$

$$E_{cl} = E_{qu} \quad (6)$$

this means $M_U c^2/2 = p_{cir}^2/2m_e'$, with the classical reduced electron mass $m_e' = m_e m_p/m_H$ and p_{cir} the de Broglie impulsions $p_{cir} = h/\lambda_{cir}$ with λ_{cir} given by the resonance condition $\lambda_{cir} = 2\pi R_U/N^{(eq)}$, where $N^{(eq)} = 2N_H^{(eq)} = 2M_U/m_H$ is the total *equivalent* number of protons plus electrons in the R_U -radius Universe, - in conformity with the basic Eddington's symmetry between proton and electrons [5]. Note that $N_H^{(eq)} = M_U/m_H$ is the 'atomic number of Universe', this does not mean they are *this* number of Hydrogen atoms: here m_H is used as a unit mass (the usual 'Dalton' of chemists). This leads to:

$$E_{cl} = E_{qu} = M_U c^2/2 = 2(\hbar N_H^{(eq)})^2/m_e' R_U^2 \quad (7)$$

Taking account of (4), replacing $N_H^{(eq)}$ by $\Omega_m N_H^{(eq)}$, one gets a relative density compatible with the relative baryon density [3] $\Omega_b \approx 0.045(3)$:

$$\Omega_b \approx \Omega_m^2/2 = 0.0450 \quad (8)$$

This is an unnoticed relation between material (essentially dark matter to be defined), and baryon densities. Moreover, Eq. (7) comes back to the formula obtained by considering the Universe as equivalent to a gravitational Hydrogen molecule, by using CCP in the manner of Haas, who calculated the atom diameter 3 years before Bohr [6]:

$$R_U = 2\hbar^2/(Gm_e m_H m_p) \approx 13.816(2) \text{ Gyr} \quad (9)$$

Moreover, the value associated with the non-Doppler Coherent Cosmic Oscillation period $t_{cc} = 9600.606(12)$ s is, with $t_{eF} \equiv \hbar \lambda_e^3/G_F$ the electron Fermi time, with Fermi constant $G_F \approx 1.4358505(7) \times 10^{-62} \text{ J m}^3$ [3]:

$$T_U \approx 2t_{cc}^2/t_{eF} \approx 13.81225 \text{ Gyr} \quad (10)$$

Identifying (9) and (10), this would imply the following G value, which will be used in the following [7]:

$$G \approx 6.67546 \times 10^{-11} \text{ kg}^{-1} \text{ m}^3 \text{ s}^{-2} \quad (11)$$

at $+2\sigma$ the PDG value $G \approx 6.6738(8) \times 10^{-11} \text{ kg}^{-1} \text{ m}^3 \text{ s}^{-2}$ [3].

Applying again the CCP, by extending the energy equality (4) to the Eddington's one:

$$-E_{pot} = E_{kin} = E_{Ed} \quad (12)$$

with $E_{\text{Ed}} = M_{\text{Ed}}c^2$, corresponding to the mass $M_{\text{Ed}} = N_{\text{Ed}}m_{\text{H}}$ with Eddington's Large Number of Hydrogen atoms [5] $N_{\text{Ed}} = 136 \times 2^{256}$, this leads to, with $t_{\text{H}} = 2Gm_{\text{H}}/c^3$, the transit time in the Schwarzschild radius of the Hydrogen atom :

$$T_{\text{U, Ed}} = (10/3)N_{\text{Ed}}t_{\text{H}} \approx 13.79384 \text{ Gyr}, \quad (13)$$

The deviation from (10) is very close to the proton-neutron mass ratio $m_{\text{p}}/m_{\text{n}}$, so that:

$$R_{\text{U, Ed}} \approx 2\hbar^2/(Gm_{\text{e}}m_{\text{H}}m_{\text{n}}) \quad (14)$$

meaning the Eddington's Theory seems to apply to a correspondence with a gravitational Deuterium atom. The forgotten Eddington's Theory must be revisited.

In the *six-parameters* Λ -CDM model, the recession timescale H_0^{-1} (called 'present day inverse Hubble constant') and the so-called 'Universe age' are close to each other, but distinct and variable. The above results, in the frame of the *one-parameter* steady-state cosmology predict that they are *identical and invariant*, with:

$$H_0 \approx 70.79 \text{ km s}^{-1} \text{ Mpc}^{-1} \quad (15)$$

Note that the H_0 Planck's result is in high tension with the supernovae type 1a one [4], a sign of the desegregation of the mainstream model, unable to realize neither that H_0 is invariant nor to derive the above *trivial* values for Ω_m and Ω_b .

The CCP implies that the Universe is vibrating [6] with the period $t_{\text{U}} = h/E_{\text{U}} \approx 0.838 \times 10^{-103} \text{ s}$, while mainstream physics considers the Planck time $t_{\text{P}} \equiv (hG/c^5)^{1/2}$ as the most basic trimescale. The critical condition writes $2t_{\text{P}}^2 = t_{\text{U}}T_{\text{U}}$. So, with (10):

$$T_{\text{U}}/2 = t_{\text{P}}^2/t_{\text{U}} = t_{\text{cc}}^2/t_{\text{eF}} \quad (16)$$

whose simplest interpretation, in a further application of CCP, is that T_{U} is itself a non-linear beatnote *period*. The mainstream Λ -CDM model must be reinterpreted by assuming the Universe is vibrating with the frequency about 10^{103} Hz , which is the natural physical idea behind the ad-hoc inflation, and more physical than the continuity concept.

Considering, in a non-reductionism way, that cosmology is the base for all Science, the Coherence Principle could apply in Biology, answering the Schrödinger question [8] "*how can the events in space and time which take place within the spatial boundary of a living organism be accounted for by physics and chemistry?*". An organism could be driven by a unique frequency. As holography needs the coherence condition, the DNA chain could be a 1D line-hologram [9]. Indeed the study of DNA vibrations is now an important research domain, but not considered from the coherent, or holographic, point of view.

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