OPEN ACCESS

Indian Journal of Advanced Physics (IJAP)
ISSN: 2582-8983 (Online), Volume-5 Issue-1, April 2025

The Cosmological Constant (s) vs. the Evolution of Our Black Hole Universe

Paolo Christillin

***Abstract:** The necessity of an ad-hoc repulsive cosmological constant in the standard treatment of cosmology is questioned. The time dependent age of the Universe is considered and shown to be accounted for by the black hole model without such a term. Elementary considerations, backed up by explicit calculations, are used to confirm the black hole nature of our Universe. Consideration of the Hubble parameter in terms of cosmological quantities backs up this picture, requiring matter creation. This implies that at present times the Universe can be conceived as a gigantic vacuum fluctuation, evolution from the one at the Planck era. The repulsive force attributed to the cosmological constant is accounted for by the energy conservation of the model. Thus the dramatic difference between the present matter density and its estimate, essentially corresponding to the Planck one, find here a natural justification. This solves the cosmological constant problem.*

***Keywords:** Hubble parameter, Universe expansion, Gravitational self-energy, Black hole (BH) model, Matter creation, Dark energy, Standard model.*

Abbreviations:
BH: Black Hole

I. INTRODUCTION

Fundamental cosmological information has come from the Hubble-Lemaitre parameter [1]. Its present value H_0 can be used to determine the approximate age of the Universe. Indeed since $[1/H_0] = [t]$, the first obvious candidate is R/c, where R stands for the dimension of the visible Universe (U) and c for the velocity of light [2]

$$t_U = \frac{1}{H_0} = \frac{R}{c} \qquad (1)$$

Numerically, with the value $R \simeq 10^{26}$m it yields

$$t_U \simeq .3 \times 10^{18}\,\text{s}$$

The fact that the form of the Hubble parameter does not privilege any point assures us that the previous semiquantitative estimate makes sense. Of course, the certainty that the age must have been smaller in earlier times implies that the visible radius must have been smaller, down to the smallest possible one, i.e. the Planck ($R_P \simeq 10^{-35}$m), where QM prevents smaller dimensions.

$$t'_P = \frac{1}{H_P} = \frac{R_P}{c} \qquad (2)$$

The same result comes also from an additional dimensional argument

$$\frac{GM_P}{C^3} = t'_P \quad (3)$$

$$Where\ M_P = \sqrt{\frac{hc}{G}}$$

The two estimates coincide not accidentally, as confirmed by the explicit calculation
of the BH lifetime in the Painleve'- Gullstrand Euclidean space metric [3], proving the BH nature of the Planck fluctuation

$$\frac{GM_P}{c^2 R_P} = 1$$

But the same BH fluctuation happens also at present times , where $M = 10^{80} m_N$ which proves that one can have a black hole with relatively little mass in a tiny region and big mass in a large volume and backs up the prediction, via other arguments [4], of the constancy of the BH quantity

$$M_U = \frac{c^2}{G} R$$

The consequences of this seemingly unassuming relation are paramount. Indeed it shows that matter is not conserved, since a variation of the Universe dimensions implies a variation of the mass, and the density varies as

$$\rho \simeq \frac{1}{R^2}$$

The previous results are confirmed by the alternative equation

$$\frac{1}{t^2} = G\rho'$$

$$\text{where } \rho' = 4\frac{\pi}{3}\rho$$

This result was derived also in [5] as an outcome of the correct treatment of the Newtonian potential, yielding no acceleration, equality of gravitational and inertial mass, and proving at the same time that energy conservation, inherent in the model, provides at the same time the repulsive force necessary to allow expansion even in the presence of of attractive potential.

As a consequence, a Planck vacuum (V) density results

$$\rho'^{\rho}_{v} = \frac{M_P}{R_P^3} = \frac{c^2}{G}\frac{1}{R_P^2} \simeq 10^{97} \quad (4)$$

compared to the present one

Manuscript received on 25 March 2025 | First Revised Manuscript received on 05 April 2025 | Second Revised Manuscript received on 10 April 2025 | Manuscript Accepted on 15 April 2025 | Manuscript published on 30 April 2025.
*Correspondence Author(s)
Paolo Christillin*, Department of Physics, Universita` di Pisa, Italy, Email ID: christ.pao@gmail.com, ORCID ID:0000-0003-4953-0873

$$\rho'_{v} = \rho'_{m} = \frac{M_{U}}{R^3} \simeq 10^{-25} = \Omega\frac{1}{R^2} \quad (5)$$

whereas the final equality in Eq. (5) holds true in terms of estimated present quantities if the proportionality coefficient Ω is again $c^2/G \simeq 10^{27}$. All exponential coefficients have an uncertainty of order one.

In this connection, consider Friedman's energy equation, which, slightly rearranged and with the introduction of the cosmological constant Λ, reads.

$$1 = \frac{G\rho'}{H^2} + \frac{\Lambda}{H^2} \quad (6)$$

The R^2 dependence of H^2 implies that this equation can be obeyed by $\rho' \simeq 1/R^2$ but not by a constant Λ. In addition, the fact of not considering the linear radius dependence of the mass would yield the traditional GR singularity of gravitation which is not present here, even apart from the previous QM based argument.

Thus the fact that Λ is of the same order of magnitude of $\rho'm$ (the so called coincidence problem) suggests that the two quantities are the same and that the repulsive force, due to the energy balance of receding constituents, is "contained " in the self energy as explained in Ref.[4].

The ratio of Eq. (4) to (5) yields the notorious factor

$$10^{122} = \left(\frac{R}{R_P}\right)^2$$

This result is dubbed as the worst prediction of all in physics since the value of Eq. (5), i.e. the experimental present matter density of the Universe is identified with the cosmological constant Λ, whereas theoretical evaluations of Λ [6], essentially agree on the value of Eq.(4).

The fact that the present theoretical framework is inadequate at a 10^{122} level prevents us to take seriously the presumed estimate of the dark energy contribution to the Universe balance [7].

The previous outrageous ratio is on the contrary a confirmation of the soundness of the present treatment. The vacuum energy density is necessarily a function of time in an evolving Universe [8], corresponding to vacuum fluctuations both at Planck time and at present times, resulting in matter creation [9].

The GR assumption of matter conservation would leave the prediction of the Hubble term at earlier times essentially constant as contradicted by what happens in the BH model where the varying matter content is just of the right amount to produce it and no dark energy is needed [10]. In particular the"disappearance" of dark matter and of dark energy eliminates the claimed cosmological problems in the standard model [11]. Mass conservation can be assumed to be valid at most at present in a limited time span.

II. CONCLUSION

In conclusion, the present elementary considerations confirm the success of the BH description of the Universe, in particular as regards the problem of the cosmological constant.

ACKNOWLEDGMENTS

It is a pleasure to thank once more P. Amato, L. Bonci and E. Cataldo (ABC) for continuous help and support.

DECLARATION STATEMENT

I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** Based on my understanding, this article has no conflicts of interest.
- **Funding Support:** This article has not been funded by any organizations or agencies. This independence ensures that the research is conducted with objectivity and without any external influence.
- **Ethical Approval and Consent to Participate:** The content of this article does not necessitate ethical approval or consent to participate with supporting documentation.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Authors Contributions:** The authorship of this article is contributed solely.

REFERENCES

1. Hubble, Edwin, Proceedings of the National Academy of Sciences of the United States of America, Volume 15, Issue 3, pp. 168-173 , (1929), DOI: http://doi.org/10.1073/pnas.15.3.168
2. Age of the universe, From Wikipedia, the free encyclopedia, https://en.wikipedia.org/wiki/ Age of the universe
3. Christillin, P. (2024). Spooky Black Holes and Gravitomagnetism. In Indian Journal of Advanced Physics (Vol. 4, Issue 2, pp. 21–26). Lattice Science Publication (LSP). DOI: https://doi.org/10.54105/ijap.b1053.04021024.
4. Christillin P. Gravitation for the simple mind(ed), Ed. Aracne, Rome. (2022), ISBN: 979-12-5994- 705-5. https://www.researchgate.net/publication/387558894
5. Christillin, P. (2016). Cosmogonic Speculations: Particle Creation from Energy Conservation in the Universe Evolution. In Journal of Modern Physics (Vol. 07, Issue 11, pp. 1331–1344). Scientific Research Publishing, Inc. DOI: https://doi.org/10.4236/jmp.2016.711119
6. Zee, A. (2004). Dark energy and the nature of the graviton. In Physics Letters B (Vol. 594, Issues 1–2, pp. 8–12). Elsevier BV. DOI: https://doi.org/10.1016/j.physletb.2004.04.087
7. Cosmological constant, From Wikipedia, the free encyclopedia https://it.wikipedia.org/wiki/ Cosmologi calconstant
8. Bandyopadhyay, Prof. (Dr.) S. N., Tiwari, Miss. P., Bandyopadhyay, Prof. (Dr.) M. N., & Maity, Prof. (Dr.) S. K. (2020). Time & Light Dilation in Black Hole-An Understanding of the Known and Unknown Facts. In International Journal of Innovative Technology and Exploring Engineering (Vol. 9, Issue 6, pp. 710–714). DOI: https://doi.org/10.35940/ijitee.f3912.049620
9. Saranya, R., & Rajesh, R. S. (2019). Utilization of Energy Consumption Metric to Detect Black Hole Attacker in DSR Routing Protocol. In International Journal of Recent Technology and Engineering (IJRTE) (Vol. 8, Issue 3, pp. 6116–6120). DOI: https://doi.org/10.35940/ijrte.c5662.098319
10. More, R. (2024). Exploring Mathematical Models of Dark Energy: A Comprehensive Literature Review. In International Journal of Basic Sciences and Applied Computing

(Vol. 10, Issue 10, pp. 1–4). DOI: https://doi.org/10.35940/ijbsac.k0522.10100624

11. Agrawal, S. K. (2019). Energy Conservation and Efficiency by Energy Efficient Motor in India. In International Journal of Engineering and Advanced Technology (Vol. 9, Issue 1, pp. 3917–3926). DOI: https://doi.org/10.35940/ijeat.a1321.109119

AUTHOR'S PROFILE

Paolo Christillin, Student from 1964 at the Physics Faculty of the University of Pisa as a pupil of the Scuola Normale Superiore. Graduated in 1968 and Associate Professor in 1982. Visiting professor at Niels Bohr Institute, CERN and Orsay. Main interests: photoreactions and lately gravitation. The results of the first line of research are summarized in the Physics Reports article "Nuclear photoreactions at intermediate energies" (1990). As regards gravitation he is the author of the book "Gravitation for the simple mind(ed)" (2022) Aracne Ed., where all aspects of gravitation are considered, the present popular theoretical treatment is critically examined and the effective vector formulation with Mach's principle to predict the experimental results is emphasized.