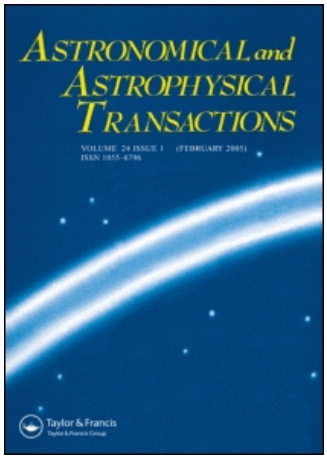

Astronomical & Astrophysical Transactions
The Journal of the Eurasian Astronomical Society
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713453505

A new approach to the large cosmological numbers coincidences

Y. V. Baryshev [a]; A. A. Raikov [a]; A. G. Sergeev [a]; A. A. Tron [a]
[a] Astronomical Observatory of the Saint-Petersburg State University, Scientific-Educational Union "Earth and Universe", Saint-Petersburg, Russia

Online Publication Date: 01 January 1994
To cite this Article: Baryshev, Y. V., Raikov, A. A., Sergeev, A. G. and Tron, A. A. (1994) 'A new approach to the large cosmological numbers coincidences', Astronomical & Astrophysical Transactions, 5:1, 27 - 29
To link to this article: DOI: 10.1080/10556799408245850
URL: http://dx.doi.org/10.1080/10556799408245850

Astronomical and Astrophysical Transactions, 1994,
Vol. 5, pp. 27–29
Reprints available directly from the publisher.
Photocopying permitted by license only

A NEW APPROACH TO THE LARGE COSMOLOGICAL NUMBERS COINCIDENCES

Y. V. BARYSHEV, A. A. RAIKOV, A. G. SERGEEV
and A. A. TRON

Astronomical Observatory of the Saint-Petersburg State University, Scientific-Educational Union "Earth and Universe", Saint-Petersburg, Russia

(9 December 1992)

A new line of interpretation of the Large Numbers coincidences based on the order of magnitude comparison of the Planck and Eddington luminosities is considered.

1. INTRODUCTION

The problem of striking large cosmological numbers coincidences (LNC) was often discussed in recent years in connection with the anthropocentric principle. These numbers are combinations of the fundamental constants of physics such as G, h, c, e, m_e and m_p and cosmological parameters H, R, ρ and M (Gorelic, 1986; Barrow, 1990). The famous coincidence is the order of magnitude equality of the electron's electromagnetic to gravitational radii ratio and that of the cosmological horizon to the electron's electromagnetic radius:

$$Q_1 \equiv \frac{r_e}{r_{ge}} \approx \frac{e^2}{Gm_e m_p} \approx 10^{40} \approx \frac{R}{r_e} \equiv Q_2, \tag{1}$$

where r_e and r_{ge} are the electromagnetic and gravitational radii of the electron, respectively. Q_1 represents the ratio of electromagnetic and gravity interactions at atomic level and Q_2, the ratio of the Metagalaxy size to the atomic scale. The value of Q_2 depends not only on fundamental constants but also on the Hubble constant H ($R = c/H$) or the age of the Universe $t \simeq H^{-1}$ which follow from astronomical observations. That is why Eq. (1) needs a theoretical explantion.

Such an explanation was suggested by Dicke (1961). It was based on Dirac's expression for Q_2 as a function of cosmological time ($R = ct$), where t was believed to be equal to the average estimated main-sequence star lifetime to ensure the abundance of heavy elements required for organic life and the observer existence.

In this note we suggest a purely physical approach to the LNC interpretation based on the idea first suggested by Baryshev and Raikov (1988).

2. INTERPRETATION

Let us consider the observable Metagalaxy as an extreme selfgravitating and selfluminous object containing all its radiation and gravitation in itself in a

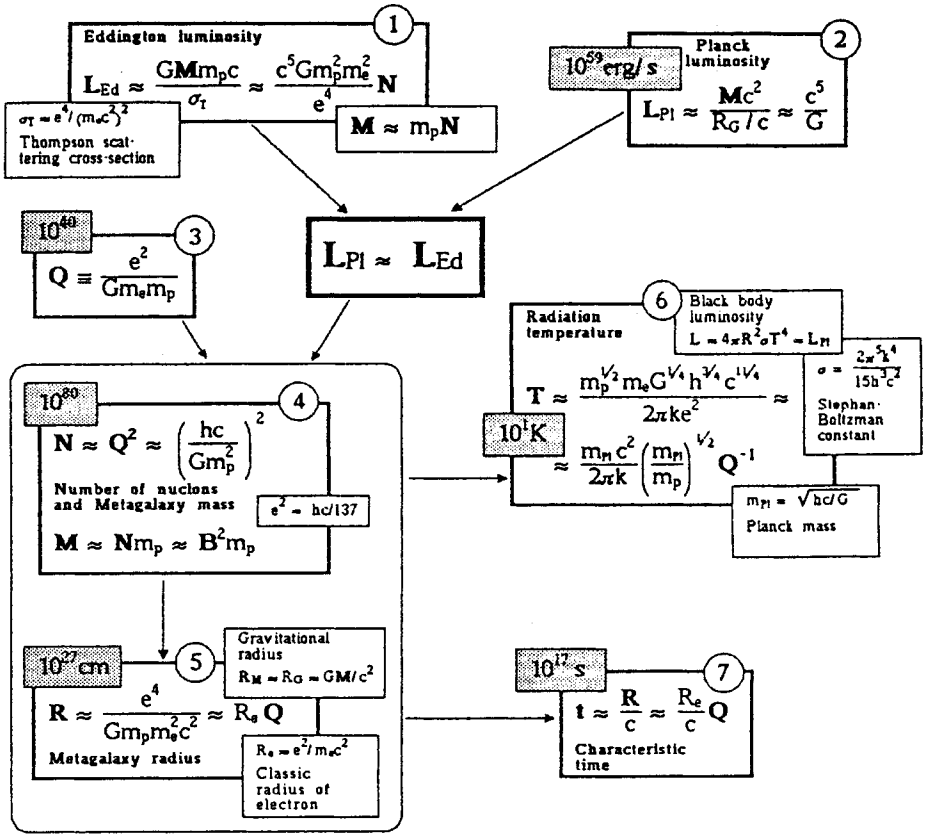

Figure 1 The diagram demonstrating relations between Large Numbers and physical constants under the assumption of the Planck to Eddington luminosities equality.

self-consistent way. In such a "superobject", one can expect the order of magnitude balance of gravitation and radiation pressure, i.e., its luminosity is close to the Eddington limit $L_{\rm Edd} \propto M$ (see Figure 1). At the same time, the total maximum luminosity of any physical object, i.e., a complete transformation of the rest mass to radiation in the period equal to the time required for light to cross the object's gravitational radius and known as the Planck Luminosity, is given by $L = c^5/G$ and depends only on fundamental physical constants.

Equalizing the Eddington and Planck luminosities to each other we receive the estimation of the "superobject" mass which gives the number of protons equal to the square of the Large Number Q_2 (see Figure 1). Thus, the macroscopic Large Number Q_2 is expressed through the microscopic one, the Large Number Q_1.

This means that, in the present interpretation, the LNC is not a chance coincidence but a natural consequence of general laws of physics.

References

1. Gorelic, G. E. (1986). *Einshteinovski sbornik 1982–1983,* Moscow, p. 302.
2. Barrow, J. D. (1990). *Modern cosmology in retrospect,* ed. by B. Bertotti *et al.*, Cambridge Univ. Press, p. 67.
3. Dicke, R. H. (1961). *Nature,* **192,** p. 440.
4. Baryshev, Yu. V. and Raikov, A. A. (1988). *Astrofizika,* **28,** 3, p. 689.