СООБЩЕНИЯ
ОБЪЕДИНЕННОГО
ИНСТИТУТА
ЯДЕРНЫХ
ИССЛЕДОВАНИЙ

ДУБНА

E2 - 9804

R.M.Muradyan

COSMIC NUMBERS AND ROTATION OF THE METAGALAXY

1976

E2 - 9804

R.M.Muradyan

COSMIC NUMBERS AND ROTATION OF THE METAGALAXY

It has been recognized that there must be deep relationships between fundamental constants of the microphysics and megaphysics /1/. Many attempts were made to obtain the physical and astrophysical information from the mathematical relations between "large numbers", constructed as the combination of the fundamental constants /2a–2j/. In this note on the basis of the results of our preceding paper /3/ the new approach is offered to the derivation of the main "cosmological coincidences". Namely the relations of Stewart /4/, Dirac /5/ and the new relation for the possible angular momentum of the Metagalaxy (see below formula (12)) are obtained, in this way.

By definition the Eddington number N_E, the total number of nucleons in the Metagalaxy, is equal to the ratio of the mass of the Metagalaxy $m_{MG} = 10^{56}$ g to the nucleon (proton) mass $m_p = 1.67 \times 10^{-24}$ g:

$$N_E = \frac{m_{MG}}{m_p} \approx 10^{80}. \tag{1}$$

Dirac shows /5/ that Eddington 's number can be expressed as the following combination of the fundamental constants:

$$N_E = \left(\frac{\hbar c}{G m_p^2}\right)^2, \tag{2}$$

where

$$\hbar = 1.05 \times 10^{-27} \frac{g \cdot cm^2}{sec}, \qquad \text{Plank's constant,}$$

$$c = 3 \times 10^{10} \frac{cm}{sec}, \qquad \text{velocity of light,}$$

$$G = 6.7 \times 10^{-8} \frac{cm^3}{g \cdot sec}, \qquad \text{constant of gravitation.}$$

There is another independent cosmological coincidence found by Stewart [4] in 1931 using the dimensional analysis, which connects the elementary particle mass with the fundamental constants $\hbar$, c, G and Hubble's constant $H_0 = 50 \frac{km}{sec} \frac{1}{Mpc} = 1.62 \times 10^{-18} \frac{1}{sec}$:

$$m_p = \left(\frac{\hbar^2 H_0}{Gc}\right)^{1/3}.^{*} \tag{3}$$

Let us show, that relations (2) and (3) can be derived on the basis of the hypothesis of the possible rotation of the Metagalaxy.

It was shown in [3], that the angular momenta of the galaxies, their clusters and superclusters, having mass m, are given by the relation:

----

* The original Stewart's relations reads

$$m_e = \alpha \left(\frac{\hbar^2 H}{Gc}\right)^{1/3}, \tag{3'}$$

where m_e is electron mass and $\alpha = \frac{e^2}{\hbar c} = \frac{1}{137}$ is fine structure constant. The relation (3) corresponds to the replacement $m_e \to m_p$, $\alpha \to 1$.

$$J = \left(\frac{m}{m_p}\right)^{3/2} \hbar \ . \qquad (4)$$

Suppose, that this relation can be extrapolated to the whole Metagalaxy. Then for the angular momentum of the Metagalaxy we find:

$$J_{MG} = \left(\frac{m_{MG}}{m_p}\right)^{3/2} \hbar \ . \qquad (5)$$

On the other hand the angular momentum of the Metagalaxy can be estimated by means of the generalized dimensional amalysis introduced by Huntley /6/. Using vector units of length, which take into account anisotropy due to rotation, we obtain (compare also /7/):

$$J_{MG} = G^{-1/2} m_{MG}^{1/2} c^2 r_{MG}^{3/2} \equiv \frac{G m_{MG}^2}{c} \left(\frac{G m_{MG}}{c^2 r_{MG}}\right)^{-3/2} . \qquad (6)$$

Here $r_{MG} = \frac{c}{H_0}$ is the radius of the Metagalaxy.

According to the Mach principle in the formulation of Siama and Dikke, the gravitational radius of the Metagalaxy is equal to the observed radius

$$\frac{G m_{MG}}{c^2 r_{MG}} = 1 \ . \qquad (7)$$

From (6) and (7) it follows, that the angular momentum of the Metagalaxy can be represented in the following equivalent forms:

$$J_{MG} = \frac{G m_{MG}^2}{c} \qquad (8)$$

and

$$J_{MG} = G^{1/2} m_{MG}^{3/2} r_{MG}^{1/2} \ . \qquad (9)$$

Equating relations (5) and (8), we derive

$$m_{MG} = m_p \left(\frac{\hbar c}{G m_p^2}\right)^2, \tag{10}$$

which is familiar Dirac's relation (2) for the Eddington number (see [3] the footnote on p. 240).

Equating (5) and (8) we obtain Stewart relation (3). Excluding from (3) Hubble's constant by means of equation $H_0 = \frac{c}{r_{MG}}$ we deduce the connection between the radius of the Metagalaxy and the proton compton wave length $\lambda\!\!\!^{-}_p = \frac{\hbar}{m_p c}$:

$$r_{MG} = \frac{\hbar c}{G m_p^2} \lambda\!\!\!^{-}_p \,. \tag{11}$$

We can substitute Dirac's relation (10) into (5) and thus obtain

$$J_{MG} = \left(\frac{\hbar c}{G m_p^2}\right)^3 \hbar \,. \tag{12}$$

Finally, let us collect the derived relations for the parameters of the Metagalaxy-angular momentum, mass and radius

$$J_{MG} = N_E^{3/2} \hbar = \left(\frac{\hbar c}{G m_p^2}\right)^3 \hbar \approx 10^{120} \hbar \approx 10^{93} \frac{g \cdot cm^2}{sec},$$

$$m_{MG} = N_E m_p = \left(\frac{\hbar c}{G m_p^2}\right)^2 m_p \approx 10^{80} m_p \approx 10^{56} g,$$

$$r_{MG} = N_E^{1/2} \lambda\!\!\!^{-}_p = \frac{\hbar c}{G m_p^2} \lambda\!\!\!^{-}_p \approx 10^{40} \lambda\!\!\!^{-}_p \approx 10^{26} \text{ cm} .$$

In conclusion note, that the rotation of the Metagalaxy is not observed yet /8/. But there are some indirect evidences for the possible existence of the rotation of the Metagalaxy based on the preference orientation of the minor axes of the Galaxy clusters in Zwicky's catalogue and Lick's counts /9/.

In this note we derive the basic cosmological coincidences using the hypothesis about the rotation of the Metagalaxy. This could throw some light on the fundamental problem of the connection between physical constants of microphysics and megaphysics.

The author is indebted to Academicians V.A.Ambartsumian, and N.N.Bogolubov and Dr. V.A.Matveev for useful discussions and comments.

References

1. *V.A.Ambartsumian. Filosofskie voprosy nauki o Vselennoy, Erevan, 1973, p. 38.*
2. *a) F.J.Dyson, in "Aspects of Quantum Theory", Cambridge University Press, 1972, p. 213.*
   b) E.R.Harrison. Physics Today, 25, N. 12, 30 (1972).
   c) R.A.Alpher. American Scientists, 61, 52 (1973).
   d) P.A.M.Dirac. Proc. R.Soc., A333, 403 (1973); A338, 439 (1974).
   e) G.Gavallo. Nature, 245, 313 (1973).
   f) J.K.Lawrence, G.Szamosi. Nature, 252, 538 (1974).
   g) B.Carter. IAU Symposium N. 63, Dordrecht-Holland, 1974, p. 291.
   h) J.V.Narlikar. Nature, 247, 99 (1974).
   i) M.Alexanian. Phys.Rev., D11, 722 (1975).
   j) P.T.Landsberg, N.T.Bishop. Phys.Lett., 53A, 109 (1975).
3. *R.M.Muradyan. Astrophysica, 11, 237 (1975).*
4. *J.Q.Stewart. Phys..Rev., 38, 2071 (1931).*
5. *P.A.M.Dirac. Nature, 139, 323 (1937); Proc.R.Soc., A165, 199 (1938).*

6. *H.E.Huntley. Dimensional analysis, Dover, N.Y.,1967.*
7. *A.Trautman. Nature, Phys.Sci., 242, 7 (1973).*
8. *C.B.Collins, S.W.Hawking. Mon. Not, R. astr. Soc., 162, 307 (1973).*
9. *A.V.Manjos, V.V.Telnyk-Adamchuk. Vestnik Kievskogo Universiteta, ser. "Astronomia", 16, 58 (1974).*

Received by Publishing Department
on May 21, 1976.