Cosmological Constant and Universe

Mohammed A. El-Lakany
Email: mohammed_ellakani@yahoo.com

Abstract: Cosmological constant is proportional to the sum of binding energy and its absolute value. If we supposed that the absolute value of binding energy is a function of (A, Z') instead of (A,Z), we will have vacuum electric energy density ρ_1 being a function of (A, Z) and Vacuum magnetic energy density ρ_2 as a function of (A, Z'), and they are functions of the same atomic mass number A. Z is the number of protons for vacuum electric energy and Z' is the proton number for vacuum magnetic energy. ρ_1 is proportional to the square value of electric field in empty space and ρ_2 is proportional to the square value of magnetic field, If we used these definitions for ρ_1 and ρ_2 we will have the exponential formula for the cosmological constant. ρ_1 and ρ_2 are real values as we know from the first definition for the cosmological constant , these real values will lead to the sine function definition for it.

Keywords: Gravity and Electromagnetism; Nuclear and particle physics; Cosmic Rays; Astrophysics and cosmology.

1. Introduction

Our Universe is a huge collection of groups of nuclei. Cosmic rays are particles which have origin outside the Earth's atmosphere and they are nuclei of various kinds. Cosmic rays are outcome products of nuclear reactions and radioactive decay for gravitational objects [1-3]. Gravitational objects are nuclei having protons and neutrons numbers. Nucleus is a construction model for the universe, elementary particles, nuclei, planets, stars, black holes, galaxies and clusters are the constituents of the universe; These objects constitute groups of objects and every group have a number of subgroups.

2. Vacuum electric energy and vacuum magnetic energy

The ground state of the nucleus has $\rho_1(\mathrm{A},\mathrm{Z})$, $\rho_2(A,Z')$ which are functions of the same atomic mass number and also functions of the same protons number where ($Z'=Z$). Excited state of nucleus has protons number Z' and having $\rho_1(\mathrm{A},\mathrm{Z})$, $\rho_2(A,Z')$ which are functions of the same atomic mass number but of different numbers for protons (Z,Z'). Excited states of nuclei having number for electrons may be equal the difference between Z,Z' . Every atomic state and their isobars compose a subgroup, each subgroup have nuclei of $Z'=Z,Z_1',Z_2',Z_3'.....$ and containing one value for Z where $Z=Z_1,\mathrm{Z}_2,Z_3,.....$ [4]. Cosmological constant equal to zero in case of the ground state but doesn't equal to zero for excited states and can be positive or negative value. Cosmological constant isn't one value as discussed by previous papers in this context but every nucleus has a specific value for it and varies from nucleus to another.

3. Cosmological constant

The cosmological constant is given by

$$\Lambda=\frac{8\pi G}{c^4}\left(\frac{B.E.}{A}\right)+\frac{8\pi G}{c^4}\left|\frac{B.E.}{A}\right| \qquad (1)$$

If Z , Z' are the proton numbers for vacuum electric energy and vacuum magnetic energy for the same nucleus, we find

$$\frac{B.E.}{A}=\left[\frac{M_N}{A}-\frac{Z}{A}m_p-\frac{(\mathrm{A}-\mathrm{Z})}{A}\mathrm{m}_n\right]c^2 \quad (2)$$

$$\left|\frac{B.E.}{A}\right|=\left[\frac{Z'}{A}m_p+\frac{(\mathrm{A}-\mathrm{Z}')}{A}\mathrm{m}_n-\frac{M_N}{A}\right]c^2 \quad (3)$$

And cosmological constant become

$$\Lambda=\frac{8\pi G}{c^4}\left(\left[\frac{M_N}{\mathrm{A}}-\frac{Z}{\mathrm{A}}m_p-\mathrm{m}_n+\frac{\mathrm{Z}}{\mathrm{A}}\mathrm{m}_n\right]c^2+\left[\frac{Z'}{\mathrm{A}}m_p+\mathrm{m}_n-\frac{\mathrm{Z}'}{\mathrm{A}}\mathrm{m}_n-\frac{M_N}{\mathrm{A}}\right]c^2\right) \quad (4)$$

$$\Lambda=\frac{8\pi G}{c^4}\left(-\frac{Z}{\mathrm{A}}m_p+\frac{\mathrm{Z}}{\mathrm{A}}\mathrm{m}_n+\frac{Z'}{\mathrm{A}}m_p-\frac{\mathrm{Z}'}{\mathrm{A}}\mathrm{m}_n\right)c^2 \quad (5)$$

$$\Lambda=\frac{8\pi G}{c^4}\left(\frac{\mathrm{Z}c^2}{\mathrm{A}}\left(\mathrm{m}_n-m_p\right)-\frac{Z'c^2}{\mathrm{A}}\left(\mathrm{m}_n-m_p\right)\right) \quad (6)$$

$$\Lambda=\frac{8\pi G}{c^4}\left(\rho_1+\rho_2\right) \quad (7)$$

Cosmological constant also defined by

$$\Lambda=\frac{8\pi G}{c^4}\left(-\frac{1}{2}E^2+\frac{1}{2}B^2\right) \quad (8)$$

Density of vacuum electric energy is given by

$$\rho_1=-\frac{1}{2}E^2 \quad (9)$$

And Density of vacuum magnetic energy is given by

$$\rho_2=\frac{1}{2}B^2 \quad (10)$$

Vacuum electric energy has general coordinates (x_1,x_2,x_3,x_4) and vacuum magnetic energy has general coordinates (x_1',x_2',x_3',x_4'). Electric and magnetic fields in empty space are given by

$$\vec{E}=\vec{E}_{01}e^{i(k_1x_1-\omega_1x_4)}+\vec{E}_{02}e^{i(k_2x_2-\omega_2x_4)}+\vec{E}_{03}e^{i(k_3x_3-\omega_3x_4)} \quad (11)$$

$$\vec{B}=\vec{B}_{01}e^{i(k_1x_1'-\omega_1x_4')}+\vec{B}_{02}e^{i(k_2x_2'-\omega_2x_4')}+\vec{B}_{03}e^{i(k_3x_3'-\omega_3x_4')} \quad (12)$$

And their square values are given by

$$E^2=e^{2i(k_1x_1-\omega_1x_4)}+e^{2i(k_2x_2-\omega_2x_4)}+e^{2i(k_3x_3-\omega_3x_4)} \quad (13)$$

$$B^2=e^{2i(k_1x_1'-\omega_1x_4')}+e^{2i(k_2x_2'-\omega_2x_4')}+e^{2i(k_3x_3'-\omega_3x_4')} \quad (14)$$

Wave frequency and wave vector are given by

$\omega=\omega_1+\omega_2+\omega_3$, $\vec{k}=(k_1,k_2,k_3)$

The exponential formula for the cosmological constant can be written as

$$\Lambda=\frac{8\pi G}{c^4}\left[-\frac{1}{2}e^{2i(k_1x_1-\omega_1x_4)}-\frac{1}{2}e^{2i(k_2x_2-\omega_2x_4)}-\frac{1}{2}e^{2i(k_3x_3-\omega_3x_4)}\right.$$
$$\left.+\frac{1}{2}e^{2i(k_1x_1'-\omega_1x_4')}+\frac{1}{2}e^{2i(k_2x_2'-\omega_2x_4')}+\frac{1}{2}e^{2i(k_3x_3'-\omega_3x_4')}\right] \quad (15)$$

Let's suppose that $\omega_1=\omega_2=\omega_3$, $k_1=k_2=k_3$, $x_1=x_2=x_3$ and $x_1'=x_2'=x_3'$ we find

$$\Lambda = \frac{8\pi G}{c^4}\left(\frac{3}{2}e^{2i(k_1x_1'-\omega_1x_4')} - \frac{3}{2}e^{2i(k_1x_1-\omega_1x_4)}\right) \tag{16}$$

$$\Lambda = \frac{8\pi G}{c^4}\left(\frac{3}{2}\right)\left(e^{2i(k_1x_1'-\omega_1x_4')} - e^{2i(k_1x_1-\omega_1x_4)}\right) \tag{17}$$

The exponential formula for the two complex numbers in the previous equation can be written as

$$e^{2i(k_1x_1'-\omega_1x_4')} = \cos 2(k_1x_1'-\omega_1x_4') + i\sin 2(k_1x_1'-\omega_1x_4') \tag{18}$$

$$e^{2i(k_1x_1-\omega_1x_4)} = \cos 2(k_1x_1-\omega_1x_4) + i\sin 2(k_1x_1-\omega_1x_4) \tag{19}$$

Cosmological constant in terms of sine and cosine functions is given by

$$\Lambda = \frac{8\pi G}{c^4}\left(\frac{3}{2}\right)\left[\cos 2(k_1x_1'-\omega_1x_4') + i\sin 2(k_1x_1'-\omega_1x_4')\right.$$

$$\left.-\cos 2(k_1x_1-\omega_1x_4) - i\sin 2(k_1x_1-\omega_1x_4)\right]$$

$$= \frac{8\pi G}{c^4}\left(\frac{3}{2}\right)\left[\cos 2(k_1x_1'-\omega_1x_4') - \cos 2(k_1x_1-\omega_1x_4)\right.$$

$$\left.+i\left(\sin 2(k_1x_1'-\omega_1x_4') - \sin 2(k_1x_1-\omega_1x_4)\right)\right]$$

$$= \frac{8\pi G}{c^4}\left(\frac{3}{2}\right)\left[-2\sin\left((k_1x_1'-\omega_1x_4') + (k_1x_1-\omega_1x_4)\right)\sin\left((k_1x_1'-\omega_1x_4') - (k_1x_1-\omega_1x_4)\right)\right.$$

$$\left.+2i\cos\left((k_1x_1'-\omega_1x_4') + (k_1x_1-\omega_1x_4)\right)\sin\left((k_1x_1'-\omega_1x_4') - (k_1x_1-\omega_1x_4)\right)\right]$$

$$= \frac{8\pi G}{c^4}(-3)\left[\sin\left((k_1x_1'-\omega_1x_4') + (k_1x_1-\omega_1x_4)\right)\sin\left((k_1x_1'-\omega_1x_4') - (k_1x_1-\omega_1x_4)\right)\right.$$

$$\left.-i\cos\left((k_1x_1'-\omega_1x_4') + (k_1x_1-\omega_1x_4)\right)\sin\left((k_1x_1'-\omega_1x_4') - (k_1x_1-\omega_1x_4)\right)\right]$$

$$= -\frac{24\pi G}{c^4}\sin\left((k_1x_1'-\omega_1x_4') - (k_1x_1-\omega_1x_4)\right)\left[\sin\left((k_1x_1'-\omega_1x_4') + (k_1x_1-\omega_1x_4)\right)\right.$$

$$\left.-i\cos\left((k_1x_1'-\omega_1x_4') + (k_1x_1-\omega_1x_4)\right)\right] \tag{20}$$

[5].

It is appeared from eq.(6) that eq. (20) must be real number not complex number i.e.

$$\Lambda = -\frac{24\pi G}{c^4}\sin\left((k_1x_1'-\omega_1x_4') - (k_1x_1-\omega_1x_4)\right)\sin\left((k_1x_1'-\omega_1x_4') + (k_1x_1-\omega_1x_4)\right) \tag{21}$$

$$\cos\left((k_1x_1'-\omega_1x_4') + (k_1x_1-\omega_1x_4)\right) = 0 \tag{22}$$

$$\left((k_1x_1'-\omega_1x_4') + (k_1x_1-\omega_1x_4)\right) = n\frac{\pi}{2} \tag{23}$$

$$n = 1, 3, 5, 7, \ldots\ldots$$

$$k_1x_1'-\omega_1x_4' = n\frac{\pi}{2} - (k_1x_1-\omega_1x_4) \tag{24}$$

$$\Lambda = -\frac{24\pi G}{c^4}\sin\frac{n\pi}{2}\sin\left(\frac{n\pi}{2} - 2(k_1x_1-\omega_1x_4)\right) \tag{25}$$

Every group of nuclei have a level number n and if n=1, we find

$$\Lambda = -\frac{24\pi G}{c^4}\sin\left(\frac{\pi}{2} - 2(k_1 x_1 - \omega_1 x_4)\right) \tag{26}$$

If $Z' = Z$ then $\Lambda = 0$ and

$$\frac{\pi}{2} - 2(k_1 x_1 - \omega_1 x_4) = m\pi \tag{27}$$

$m = 0,1,2,3,.....$

For every sublevel number m we have a subgroup of nuclei, this subgroup is the ground state and their isobars and for $m = 0$, we have

$$\frac{\pi}{2} - 2(k_1 x_1 - \omega_1 x_4) = 0 \tag{28}$$

$$(k_1 x_1 - \omega_1 x_4) = \frac{\pi}{4} \tag{29}$$

Let n=3, we find

$$\Lambda = \frac{24\pi G}{c^4}\sin\left(\frac{3\pi}{2} - 2(k_1 x_1 - \omega_1 x_4)\right) \tag{30}$$

If $Z' = Z$ then $\Lambda = 0$ and then

$$\frac{3\pi}{2} - 2(k_1 x_1 - \omega_1 x_4) = m\pi \tag{31}$$

If m=0, we have

$$(k_1 x_1 - \omega_1 x_4) = \frac{3\pi}{4} \tag{32}$$

Cosmological constant is the curve of sine function and its interval values are given by

$$\left(-\frac{24\pi G}{c^4} \le \Lambda \le \frac{24\pi G}{c^4}\right) \tag{33}$$

4. Conclusions

Universe is a nuclear reactor contains infinite number of groups of nuclei, each group have infinite number of subgroups of nuclei. This paper created new study will be deeper, more comprehensive for the Universe and in the context of nuclear physics.

5. References

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