Some clues to understand connection between gravitational and electric forces

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Abstract

Until the perfect connection between gravitational and electric forces in known, it is advisable to pay attention to various coincidences and clues. With this philosophy in mind this letter points out some interesting correlations among cosmological parameters, like Hubble's constant H_0, radius of the universe R_0 and total-mass of the universe M_0 which may be a clue to deeper understanding of the gravitational and electric forces. Earlier, this writer had presented some expressions of gravity without the gravitational constant big G [1]. This letter reports some further thinking in this direction.

Introduction

Unification of gravity with quantum mechanics is one of the major goals of physics. Until this goal is reached, it is advisable to be aware of various coincidences noticed by different researchers. With this philosophy in mind this letter points out some interesting correlations among cosmological parameters, which may be a clue to deeper understanding of the gravitational and electric forces. Earlier, this writer had presented some expressions of gravity without the gravitational constant big G [1], which suggested that if we express masses in the units of 'total-mass of the universe' M_0, and express distances in the units of 'radius-of-the- universe' R_0 , then there is no need for the gravitational constant G in Newton's law of gravitation. This letter reports some further thinking in this direction.

Derivations

We know that the product of wavelength (λ) and frequency (f) of every electromagnetic wave remains equal to the speed of light c. It means that neither the wavelength nor the frequency of the wave can ever be zero. So they may be having some minimum and maximum values. It is proposed here that physically-meaningful maximum value of frequency is $M_0 c^2/ h$, where M_0 is total mass of the universe, h is Planck's constant, and c the speed of light. And physically-meaningful minimum value of frequency is the Hubble's constant H_0, of the order

of magnitude 10^{-18} per second. Similarly, the physically-meaningful maximum value of wavelength, $\lambda_{max} = R_0$, the radius of the universe, of the order 10^{26} meters; and physically-meaningful minimum value of wavelength is Compton-wavelength corresponding to total mass of the universe; i.e. $\lambda_{min} = h / M_0 c$. Now, it was noticed earlier [2] that the product $M_0 (h H_0 / c^2) = m_{Pl}^2$, where m_{Pl} is Planck's unit of mass = $[h c / G]^{1/2}$. Also, the product of gravitational radius ($G m / c^2$) and Compton wavelength ($h/m c$) of every particle of mass m is always equal to Planck's length squared. So the product of gravitational-radius of the universe and Compton-wavelength of total-mass of the universe, $R_0 (h / M_0 c)$, = l_{Pl}^2, where l_{Pl} is Planck's unit of length = $[h G / c^3]^{1/2}$.

Moreover, gravitational radius of the universe (R_0) is equal to Compton wavelength corresponding to the mass ($h H_0 / c^2$), we can call it mass of the 'Hubble-tron' and:

Compton-wavelength $h / M_0 c$ = the gravitational-radius of the Hubble-tron, $G (h H_0 / c^2) / c^2$.

In astrophysics, Hubble's constant H_0 is the 'experimentally measured quantity', whereas R_0 and M_0 are mathematically-derived quantities based on expanding model of the universe, and the mass required for its closure. If the model is not correct, then they may have no meaning, other than the maximum values of wavelength $\lambda_{max} = R_0$ and frequency $f_{max} = (M_0 c^2 / h)$. In that case, they may only be useful for finding the connection between gravitational and electric forces. The model-independent relations of H_0 with the other well-established physical-constants are:

$$G m_e m_p / (h / m_e c) \sim h H_0 \qquad \text{.....(2)}$$

$$G m_p / (h / m_p c)^2 \sim H_0 c \qquad \text{.....(3)}$$

Not only that, but also:

The accelerations $G M / R^2$ at the surface of the electron, the proton, the nucleus-of-atom, the globular-clusters, the spiral galaxies, the galactic-clusters and the whole universe too are of the same order of magnitude as $H_0 c$! [3]

Numerically, the quantity ($H_0 c$) = 6.87 x 10^{-10} meter/second^2, and the decelerations experienced by the Pioneer 10, 11, … space-probes were also of the same order of magnitude 10^{-10} meter/second^2 as follows: [4-5]:

For Pioneer-10, a = (8.09 ±0.2) x 10^{-10} meter/sec^{2,}

For Pioneer-11, $a = (8.56 \pm 0.15) \times 10^{-10}$ meter/sec^2,

For Ulysses, $a = (12 \pm 3) \times 10^{-10}$ meter/sec^2,

For Galileo, $a = (8.0 \pm 3) \times 10^{-10}$ meter/sec^2, and

The values of deceleration experienced by the space-probes are slightly higher, because: when the inter-galactic photon enters our milky-way galaxy, it experiences certain amount of gravitational blue-shift. If we could launch Hubble-like telescope out-side our milky-way galaxy, then the value of $H_0\, c$ may match perfectly with the value of space-probes. Values of decelerations of the space-probes may have been partly affected by thermal radiation or gas-leaks too!

The 'cosmological red-shift' too, can be viewed as the 'deceleration' experienced by the photons [6] as follows:

The linear part of the cosmological red shift is:

$z_c = (h f_0 - h f) / h f = H_0\ D / c$

So the loss in energy of the photon:

$(h f_0 - hf) = (h f / c^2) (H_0\ c) D$ ……………………………..………(4)

That is, the loss in energy of the photon is equal to its mass ($h f / c^2$) times the acceleration ($H_0\, c$) times the distance D traveled by it. This writer has proposed many possible mechanisms for deceleration of the photon, currently posted at the pre-print-server site viXra.

Mc Culloch [7] has derived an expression for Newton's law of gravitation from Heisenberg's uncertainty principle. The mistake made by him is that he assumed a physically real particle of Planck-mass, whereas Planck-mass is just a mathematical-mass equal to an electric charge. In the introduction he has described an experiment of neutrons falling under gravity in the manner of quantum jumps; whereas in the conclusion he writes that masses smaller than Planck-mass may not be affected by gravity, which is obviously not correct. Moreover, in the beginning he calculates the numbers N and n by dividing the masses *M* and *m* with Planck's-mass; and in the end he replaces N and n by substituting *M* and *m* divided by Planck-masses. Thus I could not find anything other than mathematical exercise in the paper, but the question, whether

Heisenberg's uncertainty principle can cause gravitational force, should be reconsidered by the scientists.

References

1. Tank, Hasmukh K. "Some expressions of gravity without the big '*G*'" *Astrophysics and Space Science* December 2011, Volume 336, Issue 2, pp 345-346 First online: 19 October 2011

2. Tank, Hasmukh K. " An insight into Planck's Units" October, 2011 *Progress in Physics*, Vol. **4**, pp 17-19. http://www.ptep-online.com/index_files/2011/PP-27-04.PDF

3. Tank, Hasmukh K. "Some clues to understand MOND and the accelerated expansion of the universe" *Astrophysics and Space Science* (December 2011) Vol 336, issue 2, pp 341-343 First Online 16 September 2011.

4. Anderson, J D.; Laing, P. A.; Lau, E. L.; Liu, A. S.; Nieto, M. M.; Turyshev, S. G. (1998). "Indication, from Pioneer 10/11, Galileo, and Ulysses Data, of an Apparent Anomalous, Weak, Long-Range Acceleration". Physical Review Letters 81 (14): 2858–2861. ArXiv: gr-qc/9808081. Bibcode:1998PhRvL..81.2858A. http://dx.doi.org/10.1103/PhysRevLett.81.2858.

5. Anderson, J D.; Laing, P. A.; Lau, E. L.; Liu, A. S.; Nieto, M. M.; Turyshev, S. G. (2002). "Study of the anomalous acceleration of Pioneer 10 and 11". Physical Review D 65 (8): 082004. ArXiv: gr-qc/0104064. Bibcode:2002PhRvD..65h2004A. "A lengthy survey of several years of debate by the authors of the original 1998 paper documenting the anomaly. The authors conclude, "Until more is known, we must admit that the most likely cause of this effect is an unknown systematic. (We ourselves are divided as to whether 'gas leaks' or 'heat' is this 'most likely cause.')".http://dx.doi.org/10.1103/PhysRevD.65.082004.

6. Tank, Hasmukh K. "Simple explanation for the cosmological red shift and it's evidence" *International Journal of Advanced Astronomy,* Vol.4 (1) (2016) pp 11-13. DOI: 1014419/ijaa.v4i1.5695

7. McCulloch, M. E. "Gravity from the uncertainty principle" *Astrophysics and Space Science* (February 2014), Vol. **349**, Issue 2, pp 957-959. First online: 08 November 2013 http://link.springer.com/article/10.1007%2Fs10509-013-1686-9#page-1