Mach principle based explanation for the 'cosmological red-shift' and it's evidence

By

Hasmukh K. Tank

Indian Space Research Organization, 22/693 Krishna Dham-2, Ahmedabad-380015 India

e-mail: tank.hasmukh@rediffmail.com, hasmukh.tank1@gmail.com

Abstract

We first find here that the ratio of: (loss in energy of cosmologically red-shifting photon) and (loss in electrostatic potential-energy of an electron at the same distance *D*) remains equal to the famous ratio $(G\, m_e\, m_p) / e^2$ leading us towards a possibility that 'cosmological red-shift' may be due to gravitational effect. Also the ratio $h\, H_0 / m_e\, c^2 = (G\, m_e\, m_p) / e^2$. Starting with Mach's principle, that 'mass' of an object is because of its 'cosmic gravitational potential energy', we arrive at a possibility that every chunk of matter and energy should experience a fixed value of acceleration $H_0\, c$. For the purpose of comparison we express the 'cosmological red shift' as deceleration of the photon, and find that the deceleration experienced by the photon matches perfectly with the expected value $H_0\, c$. Then it is argued that if such a deceleration is true for a chunk of energy called photon, then it must be true for every particle of matter too. Strikingly, the decelerations experienced by the space-probes Pioneer-10, Pioneer-11, Galileo and Ulysses, as carefully measured by Anderson J.D. ET. Al. match perfectly with the deceleration of the 'cosmologically red-shifting photons'; thus providing supportive evidence for the explanation proposed here.

Introduction

Since the date Edwin Hubble published his paper on the 'cosmological red-shift', at least sixty different explanations have been proposed by different scientists. Out of them the 'expansion of space' is currently most popular. This writer has been of the opinion that 'time' is not a physical entity; so Einstein's 'space-time-continuum' is a mathematical model. 'Space-time-continuum' is not a physical entity, so 'expansion of space' may also be a 'mathematical term' not a physical reality. It was also noticed by this writer that the ratio $z_c / z_e = (G m_e m_p) / e^2$, that is: the ratio of (loss in energy of cosmologically red-shifting photon at any distance D) and (the loss in electrostatic potential-energy of the electron at that distance D) strikingly remains equal to the famous ratio $(G m_e m_p) / e^2$. So I have been trying to think in terms of possible 'gravitational effects' on the inter-galactic photons, e.g. [1-2-3]. Now, in this paper, Mach's principle based new explanation for the 'cosmological red shift' is proposed, which explains quantitatively why the value of cosmological red shift is this much. For the purpose of comparison we express the 'cosmological red shift' as deceleration of the photon, and find that the deceleration experienced by the photon matches perfectly with the expected value. Then it is argued that if such a deceleration is true for a chunk of energy called 'photon', then it must be true for every chunk of energy and 'matter'. Strikingly, the decelerations measured for Pioneer-10, 11, Galileo and Ulysses space-probes match perfectly with the value of deceleration of the photons [4-5]. This writer is aware of various explanations for Pioneer anomaly proposed; like 'gas leaks' and 'thermal radiations', but they cannot be the same for all the space-probes. Matching of decelerations of four space-probes itself is a striking phenomenon; and its matching with the deceleration of the photon cannot be ignored by a scientific mind as a coincidence. So in the humble opinion of this writer these observations should be considered as evidence for the new explanation for the 'cosmological red-shift' proposed here. After a lengthy survey of several years of debate by the authors of the original 1998 paper documenting the Pioneer-anomaly, the authors conclude,[4]: "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.')" The writer of this paper humbly feels that the correct explanation for the pioneer anomaly is found only now in this paper.

(ii) Another interesting observation [3] has been that 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 $H_0 c$! We find here an explanation, that all these stable structures have established equilibrium between the cosmic gravitational acceleration and their own 'self gravitational acceleration'.

1. Derivations

For the purpose of comparison with 'cosmological red-shift' let us define the reduction in electrostatic potential-energy of the electron z_e as:

The reduction $z_e = [(e^2/ r_e) – e^2 / (r_e + D)] / [e^2 / (r_e + D)]$

i..e. $z_e = D / r_e$ (1)

And the linear part of the 'cosmological red-shift' is expressed as:

Cosmological red-shift:

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

Where H_0 is Hubble's constant and c is the speed of light.

i..e. $z_c = D / R_0$ (2)

Where R_0 is known as 'Radius of the universe'; $R_0 = c / H_0$

So the ratio $z_c / z_e = r_e / R_0$

And from the 'Large-Number-Coincidence' of Dirac, and its explanation proposed by this writer [6] we know that:

$r_e / R_0 = (G m_e m_p) / e^2$

So the ratio: $z_c / z_e = (G m_e m_p) / e^2$ ……(3)

That is, the ratio of: (Reduction in energy of the 'cosmologically red-shifting photon at a distance D) and (The reduction in electrostatic potential-energy of the electron at the same distance D) remains equal to the famous ratio $(G m_e m_p) / e^2$.

Also the ratio: $h H_0 / m_e c^2 = (G m_e m_p) / e^2$ .....(4)

So the expressions-3 and 4 suggest that 'cosmological red-shift' can be due to some gravitational effect. We wish to consider here the Mach's principle based explanation, as follows:

According to Mach's principle, 'mass', (Rather 'Energy) of any object is because of its 'cosmic gravitational potential energy'. So, total energy of the universe ($M_0 c^2$) should be equal to total gravitational potential energy of the universe. That is:

$G M_0 M_0 / R_0 = M_0 c^2$ Here, M_0 is total mass, and R_0 radius of the universe. This relation helped this writer to explain the recurrences of the large-number 10^{-40} in astrophysics, known as large number coincidence (LNC) [6]

Now, for any chunk of matter, of mass m :.

$G M_0 m / R_0 = m c^2$

So, the 'cosmic gravitational force experienced by every object is:

$G M_0 m / R_0^2 = m c^2 / R_0$

i.e. $G M_0 m/R_0^2 = m (H_0 c)$, Because, $R_0 H_0 = c$ ……..(5)

The expression-5 suggests that every object is expected to feel the acceleration: $H_0 c$ when it tries to move in any direction.

Now, let us express the 'cosmological red-shift' in terms of the 'deceleration' experienced by the photons:

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:

$(h f_0 – hf) = (h f / c^2) (H_0 c) D$ ……(6)

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.

So the expression-6 shows that the photon does experience the deceleration expected from the expression-5.

Now, if our hypothesis is correct, then each and every linearly moving object should also experience the deceleration ($H_0\ c$). Strikingly, the carefully measured anomalous decelerations experienced by the Pioneer-10, 11, Galileo and Ulysses spacecrafts, match perfectly with the numerical value of $H_0\ c$.

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, thus providing supportive evidence for our simple explanation! The carefully measured values of accelerations experienced by the space-probes Pioneer-10, Pioneer-11, Galileo, and Ulysses are [4-5]:

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

For Pioneer-11, a = (8.56 ±0.15) x 10^{-10} meter/sec^2,

For Ulysses, a = (12 ±3) x 10^{-10} meter/sec^2,

For Galileo, a = (8.0 ±3) x 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 be partly affected by thermal radiation or gas-leaks too!

Matching of decelerations of four space-probes itself is a striking phenomenon; and its matching with the deceleration of the photon cannot be ignored by a scientific mind as a coincidence. So in the humble opinion of this writer these observations should be considered as evidence for the simple explanation for the 'cosmological red-shift' proposed here. Thus we have four more readings supporting our hypothesis of Mach's principle based explanation for the 'cosmological red shift'.

Conclusion

We first found that the ratio of: (loss in energy of cosmologically red-shifting photon) and (loss in electrostatic potential-energy of an electron at the same distance D) remains equal to the famous ratio $(G\ m_e\ m_p) / e^2$ leading us towards a possibility that 'cosmological red-shift' may be due to gravitational effect. So we considered Mach's principle based explanation for the 'cosmological red shift'. The carefully measured decelerations of the Pioneer 10/11…space-probes provide supportive evidence for the new explanation proposed here.

Acknowledgements

I take this opportunity to express my sincere thanks to Professor Abhas Mitra from BARC Mumbai, Engr. Bhagirath Mankad from ISRO, Shri Basudeba Mishra from Kolkata, and Prof. Satya Seshavatharam from Hyderabad for their encouraging responses. And I feel extremely thankful to the organizers and managers of the pre-print server site viXra.

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