Non-Dopplerian cosmological redshift parameters in a model of graviton-dusty universe

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November 29, 2013

Abstract

Possible effects are considered which would be caused by a hypothetical super-strong interaction of photons or massive bodies with single gravitons of the graviton background. If full cosmological redshift magnitudes are caused by the interaction, then the luminosity distance in a flat non-expanding universe as a function of redshift is very similar to the specific function which fits supernova cosmology data by Riess et al. From another side, in this case every massive body, slowly moving relatively to the background, would experience a constant acceleration, proportional to the Hubble constant, of the same order as a small additional acceleration of Pioneer 10, 11.

1 Introduction

In this paper, possible manifestations of the graviton background in a case of hypothetical super-strong gravitational quantum interaction are considered.

From one side, the author brings the reasons that a quantum interaction of photons with the graviton background would lead to redshifts of remote objects too. The author considers a hypothesis about an existence of the graviton background to be independent from the standard cosmological model. One cannot affirm that such an interaction is the only cause of redshifts. It is possible, that the one gives a small contribution to an effect magnitude only. But we cannot exclude that such an interaction with the graviton background would be enough to explain the effect without an attraction of the big bang hypothesis. Comparing the own model predictions with supernova cosmology data by Riess et al [1], the author finds here good accordance between the redshift model and observations.

From another side, it is shown here, that every massive body, with a non-zero velocity v relatively to the isotropic graviton background, should experience a constant acceleration. If one assumes that a full observable redshift magnitude is caused by such a quantum interaction with single gravitons, then this acceleration will have the same order of magnitude as a small additional acceleration of NASA deep-space probes (Pioneer 10/11, Galileo, and Ulysses), about which it was reported by Anderson's team [2].

For more details, one can find a preprint of my full original paper [3] in the e-print archive [4].

2 An interaction of photons and of massive bodies with the graviton background

If the isotropic graviton background exists, then, due to photon scattering on gravitons, average energy losses of a photon with an energy E on a way dr will be equal to $dE = -aEdr$, where a is a constant [5, 4, 3]. It is shown here, that such an interaction with single gravitons should be super-strong to provide a full redshift magnitude. As it was reported by Anderson's team [2], NASA deep-space probes experience a small additional constant acceleration, directed towards the Sun. It follows from an universality of gravitational interaction, that not only photons, but all other objects, moving relatively to the background, should loss their energy too due to such a quantum interaction with gravitons. If $a = H/c$, massive bodies or particles must experience a deceleration w of the same order as an additional acceleration of cosmic probes:

$$w = -ac^2(1 - v^2/c^2).$$

The acceleration w is directed against a body velocity in a special system of reference, in which the graviton background is isotropic. It is for small velocities:

$$w \simeq -Hc \simeq -4.8 \cdot 10^{-10} m/s^2,$$

if Hubble's constant $H = 1.6 \cdot 10^{-18} s^{-1}$, that corresponds approximately to one half of the observed acceleration for NASA probes.

It is possible, that an annual periodic term in the residuals of the both Pioneers (see plot B in the Figure 1 [6]) may be caused by own additional acceleration of the Earth under its motion relatively to the graviton background.

3 Comparison of the redshift model with supernova cosmology data

In a case of flat non-expanding universe, a photon flux relaxation, due to non-forehead collisions of photons with gravitons, can be characterized by a factor b, so that the luminosity distance D_L [1] is equal in our model to:

$$D_L = a^{-1} \ln(1+z) \cdot (1+z)^{(1+b)/2} \equiv a^{-1} f_1(z; b),$$

where z is a redshift. The theoretical estimation for b is:

$$b = 3/2 + 2/\pi = 2.137$$

[4, 3]. Thus, the redshift

$$z = \exp(ar) - 1$$

and the luminosity distance D_L are characterized in the model by two parameters: H and b (r is a geometrical distance). One can introduce an effective Hubble constant

$$H_{eff} \equiv cdz/dr = H(z+1);$$

in a language of expansion it can be interpreted as "a current deceleration of the expansion".

High-z Supernova Search Team data [1] give us a possibility to evaluate H in our model. We can use one of the best fits of the function $D_L(z; H_0, \Omega_M, \Omega_\Lambda)$ from [1] (see Eq.2 in [1]) with $\Omega_M = -0.5$ and $\Omega_\Lambda = 0$, which is unphysical in the original work. For $1 - \Omega_M > 0$ and $1 + \Omega_M z > 0$, the function $D_L(z; H_0, \Omega_M, \Omega_\Lambda)$ is equal to:

$$D_L = a^{-1}(1+z)m^{-1}\sinh(\ln|(k-m)/(k+m)| - \ln|(1-m)/(1+m)|)$$

$$\equiv a^{-1} f_2(z; H_0, \Omega_M, \Omega_\Lambda),$$

where $m \equiv (1 - \Omega_M)^{1/2}, k \equiv (1 + \Omega_M z)^{1/2}$. Assuming $b = 2.137$, we can find H from the connection:

$$H D_L / H_0 D_L = f_1(z; b) / f_2(z; H_0, \Omega_M, \Omega_\Lambda)$$

(see Table). We see that $H/H_0 \simeq const$, a deviation from an average value $< H > \simeq 1.09 H_0$ is less than 5%. If one would suggest that $f_1(z; b)$ describes

z	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
f_1	0.110	0.242	0.396	0.570	0.765	0.983	1.222	1.480	1.759	2.058
f_2	0.103	0.219	0,359	0.511	0.677	0.863	1.074	1.301	1.565	1.854
H/H_0	1.068	1.105	1.103	1.115	1.130	1.139	1.138	1.138	1.124	1.110

results of observations in an expanding universe, one could conclude that it is "an accelerating one". But a true conclusion may be strange: our universe is not expanding, and redshifts have the non-Dopplerian nature.

4 Conclusion

If further investigations display that an anomalous NASA probes' acceleration cannot be explained by some technical causes, left out of account today, it will give a big push to a further development of physics of particles. Both supernova cosmology data and the Anderson's team discovery may change a gravity position in a hierarchy of known interactions, and, possibly, give us a new chance to unify their description.

References

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[6] Turyshev, S.G. et al, *http://arXiv.org/gr-qc/9903024 v2*.