A new basis for cosmology without dark energy

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Abstract

It is shown that small quantum effects of the model of low-energy quantum gravity by the author give a possibility of another interpretation of cosmological observations without an expansion of the Universe and dark energy.

Twenty years ago it was difficult to suppose that cosmology may dictate fundamental tasks for other fields of physics, but now many people are searching for dark matter and dark energy or are inventing new scenarios of inflation. They admit that known matter amounts only about five per cent of a full matter content of the Universe, and that the Big Bang is a true event. But it is easy to note that deep roots of the problem lie in the assumed nature of redshifts of remote objects, such as galaxies. All other top-hampers of the current standard cosmological model - the Big Bang, inflation, dark matter and dark energy - are based on this assumption and on the hypothesis about the validity of general relativity on an arbitrary big scale of distances. These two basic assertions are not justifiable in the commonly accepted in physics manner.

Some doubts in acceptability of general relativity even on the galactic scale of distances arise due to successes of MOND [1] to fit rotation curves of spiral galaxies without dark matter. The problem of missing mass (dark matter) in spiral galaxies appears only at very low accelerations less than some boundary acceleration [2]; the motivation of an introduction of this boundary acceleration is absent in MOND. The main fact which triggered the famous claim about dark energy accelerating the whole Universe was observed specific dimming of remote supernovae 1a [3, 4].

In the model of low-energy quantum gravity by the author [5], the mechanism of classical gravity is quantum. Due to interactions of photons with gravitons of the graviton background, which insures the gravitational attraction of big bodies in the model, there exist the two small effects: a redshift of spectrum of remote sources and a very specific dimming of them. Both effects lead to the following luminosity distance:

$$D_L = c/H \ln(1+z) \cdot (1+z)^{(1+b)/2},$$

where r is the redshift, H is the Hubble constant and c is the light velocity. The relaxation factor b for a soft radiation is equal to 2.137. The comparison of the Hubble diagram of the model with Supernovae 1a observational data by Riess et al [6] (corrected for no time dilation) is shown on Fig.1. The

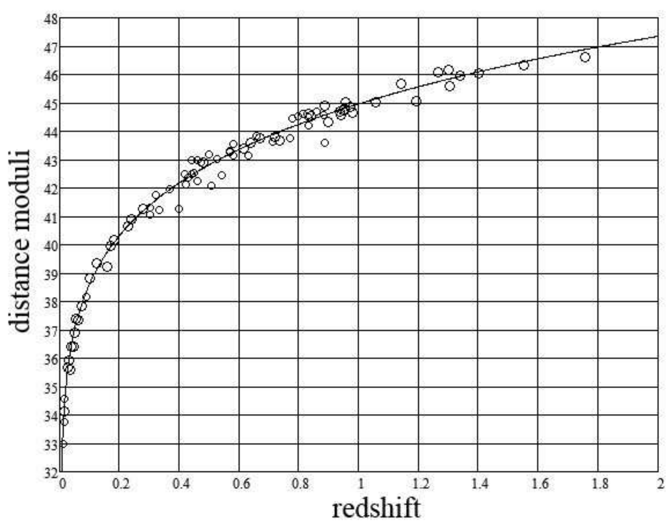

Figure 1: The theoretical Hubble diagram $\mu_0(z)$ of this model(solid); Supernovae 1a observational data (circles, 82 points) are taken from Table 5 of [6] and corrected for no time dilation.

theoretical curve fits observations very well without any expansion of the Universe and without any dark matter and dark energy; the same may be done for GRB observations. It is very difficult to expect that it is simply some chance coincidence. The same mechanism as giving redshifts leads to the new effect for big bodies: all of them should be decelerated when the ones move relative to the graviton background. A magnitude of this deceleration is universal and equal to $\sim Hc = 6.419 \cdot 10^{-10}\ m/s^2$ if we accept the theoretical value for H of this model: $H = 2.14 \cdot 10^{-18} s^{-1}$. The Hubble constant is not connected with the expansion here; it may be computed in the model as well as the Newton constant G. This universal deceleration of bodies should lead in any bound system to an additional acceleration of them relative to the system's center of inertia. A magnitude of this acceleration has the same order as the boundary acceleration for galaxies mentioned above.

The model of low-energy quantum gravity promises not only to stay an absolutely new basis for future cosmology without dark energy, but it gives a possibility to look from another point of view on the quantum behavior of micro particles. In the model, namely gravity is the strongest interaction of nature, and its description may be made without divergences due to the fact that carriers of interaction belong to the external (relative to bodies) graviton background a spectrum of which has natural smooth cut-offs from both sides. Small quantum effects of this model make general relativity to be invalid for cosmological distances.

References

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