No-time-dilation corrected Supernovae 1a and GRBs data and low-energy quantum gravity

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Abstract

Earlier it was shown that in the model of low-energy quantum gravity by the author, observations of Supernovae 1a and GRBs, which are corrected by observers for characteristic for the standard cosmological model time dilation, may be fitted with the theoretical luminosity distance curve only up to $z \sim 0.5$, for higher redshifts the predicted luminosity distance is essentially bigger. The model itself has not time dilation due to another redshift mechanism. It is shown here that a correction of observations for no time dilation leads to a good accordance of observations and theoretical predictions for all achieved redshifts.

1 Introduction

A main element of the universe in the model of low-energy quantum gravity by the author [1, 2, 3] is the background of super-strong interacting gravitons. A pressure force of the background creates gravitation, and the Newton constant is computable in the model. From another side, collisions of photons with gravitons lead to a redshift of any remote object and to a specific relaxation of any light flux. The Hubble constant may be computed, too; it is not connected here with any expansion. The luminosity distance of the model increases quickly with a redshift, and any observer sees only a part of the big universe, when an invisible part of the one remains unknown.

I would like to describe here a result of correction of observations of Supernovae 1a and GRBs for no time dilation. This effect is absent in the model, but observations are usually corrected for it in a frame of the standard model; it means that a comparison of any model without time dilation and corrected in this manner observations is not valid in any case.

2 Correction for no time delation

In the standard cosmological model, the expansion of the Universe leads to the time dilation of $(1+z)$; due to it, for example, light curves of Supernovae 1a are contracted along the time axis by $(1+z)$ to return them to the rest frame [4, 5]. Nearby Supernovae 1a diversity may be taken into account with the help of the stretch factor s [4]: a fainter SN has $s < 1$, a brighter SN has $s > 1$, and to reduce them to a normal SN with $s = 1$, one should contract both quantities - the timescale and the magnitude of supernova light curve - in s times. This calibration relation was found empirically. High-z Supernovae light curves are characterized by observers with the timescale stretch factor $S = s \cdot (1+z)$, where the factor $(1+z)$ takes into account the effect of time dilation in the standard model [4]. The latter factor is introduced by hand. Now the timescale of light curve is corrected by the factor S, when its magnitude is corrected only by the stretch factor s. But the specific correction for the additional $(1+z)$ time-dilation factor - expected only in this class of models - is not needed in any model without time dilation. It means, that in models without time dilation one should use the same stretch factor S to correct the two quantities of the light curve. Of course, the question arises about possible differences of distributions of values of s and S for nearby and high-z Supernovae, but it is another story.

The luminosity distance D_L is defined as: $D_L = (L/4\pi F)^{1/2}$, where L and F are the intrinsic luminosity and observed flux of the SN 1a. If the observed flux is overestimated in $(1+z)$ times due to the described correction for time dilation, one should correct distance moduli $\mu_0 = 5 \log D_L + 25$ in the following manner [6]:

$$\mu_0^{'} = \mu_0 + 2.5 \log(1+z),$$

where $\mu_0^{'}$ are distance moduli in any model without time dilation. In this model, the luminosity distance is

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

where $a = H/c$, H is the Hubble constant and c is the light velocity. The theoretical value of relaxation factor b for a soft radiation is $b = 2.137$. The theoretical Hubble diagram of this model with $b = 2.137$ is compared with observational data by Riess et al [7] on Fig.1; if you compare this figure with Fig.2 of [3] where the same data are shown with time dilation correction, you may see that all the difference with theoretical predictions was caused namely by time dilation which is not "native" for this model.

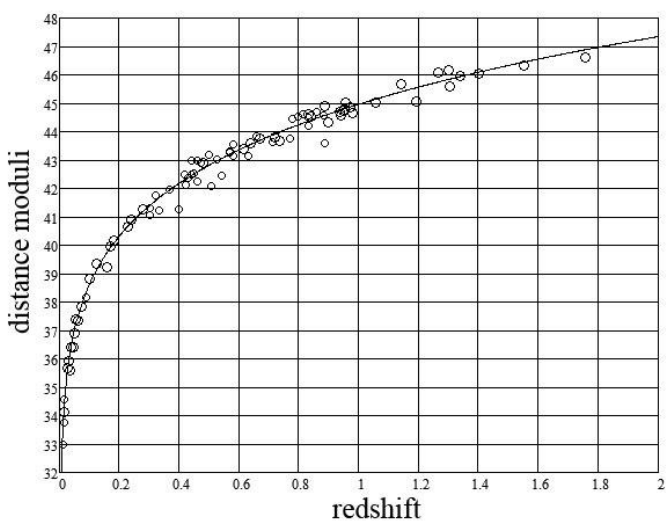

Figure 1: The theoretical Hubble diagram $\mu_0(z)$ of this model with $b = 2.137$ (solid); Supernovae 1a observational data (circles, 82 points) are taken from Table 5 of [7] and corrected for no time dilation.

The factor b of this model may have different values for soft and hard radiation [8]; the situation here differs very much from any model with the cosmological expansion. For very hard radiation, it should be: $b = 0$. Unfortunately, to evaluate distance moduli of GRBs one should use or theoretical values of the luminosity distance or calibrate data by nearby SN1a [9]. In the latter case, it is accepted that the luminosity distance is the same for sources with different spectra that is true in models with the cosmological expansion; but in the considered model, the Hubble diagram is a multivalued function of a redshift: for a given z, b may have different values for different sources [8]. It means that GRBs data of [9] calibrated with the help of the Union 2 compilation of nearby SN1a [10] are model dependent in this sense. As

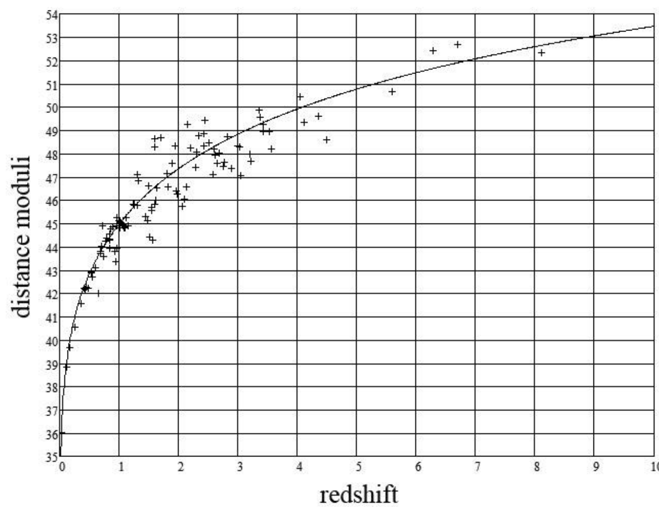

Figure 2: The theoretical Hubble diagram $\mu_0(z)$ of this model with $b = 2.137$ (solid); GRBs calibrated observational data (pluses, 109 points) from Tables 1 and 2 of [9] corrected for no time dilation.

you can see from Fig.2, the GRBs calibrated observational data (pluses, 109 points) from Tables 1 and 2 of [9] laid very accurately near the theoretical curve of this model with the same b after the correction for no time dilation. But it is not the last word of GRBs observations: if one is able to calibrate them in some independent of SN1a manner, we shall have a possibility to distinguish much surely this model from any model with the expansion.

3 Conclusion

As it is shown here, observational data of Supernovae 1a and GRBs corrected for no time dilation are in good accordance with theoretical predictions of this model. It would mean that the discovery of dark energy in a frame of the standard cosmological model is only an artefact of the conjecture about an existence of time dilation.

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