Estimating the Hubble constant on a base of observed values of the Hubble parameter $H(z)$ in a model without expansion

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July 10, 2014

Abstract

In the model of low-energy quantum gravity by the author, the ratio $H(z)/(1+z)$ should be equal to the Hubble constant. Here, the weighted average value of the Hubble constant has been found using 29 observed values of the Hubble parameter $H(z)$: $< H_0 > \pm\sigma_0 = (64.40 \pm 5.95)\ km\ s^{-1}\ Mpc^{-1}$.

Dark energy has become a very popular object after the famous claim of 1998 about its discovery [1, 2], and the majority of the physical society trust that it is *really discovered*. It is necessary *only to find* this big and absolutely unknown peace of energy content of the universe. The situation is strange. The Higgs boson has been discovered after half a century of searching, and nobody claimed its existence before the moment of truth. I think that dark energy and inflation are very speculative hypotheses, which are needed to serve the idea of expansion of the universe. This main hypothesis of the contemporary cosmology is not verified in any experiment, and, if the one fails, whole huge construction of the standard cosmological model will fail, too.

In my model of low-energy quantum gravity [3], there exists a local quantum mechanism of redshift which may be lain in the basis of a new cosmological paradigm without any expansion. This mechanism is based on energy losses of photons by forehead collisions with gravitons of the graviton background. In this case, the geometrical distance r depends on the redshift z as:

$$r(z) = \frac{c}{H_0} \ln(1+z), \tag{1}$$

where H_0 is the Hubble constant, c is the velocity of light. For a remote region of the universe we may introduce the Hubble parameter $H(z)$ in the following manner:

$$dz = H(z) \cdot \frac{dr}{c}, \tag{2}$$

to imitate the local Hubble law. Taking a derivative $\frac{dr}{dz}$, we get in this model for $H(z)$:

$$H(z) = H_0 \cdot (1+z). \tag{3}$$

It means that in the model:

$$\frac{H(z)}{(1+z)} = H_0. \tag{4}$$

The last formula gives us a possibility to evaluate the Hubble constant using observed values of the Hubble parameter $H(z)$. To do it, I use here 28 points of $H(z)$ from [4] and one point for $z < 0.1$ from [5]. The last point is the result of HST measurement of the Hubble constant obtained from observations of 256 low-z supernovae $1a$. Here I refer this point to the average redshift $z = 0.05$. Observed values of the ratio $H(z)/(1+z)$ with $\pm\sigma$ error bars are shown in Fig. 1 (points). The weighted average value of the Hubble constant is calculated by the formula:

$$< H_0 > = \frac{\sum \frac{H(z_i)}{1+z_i} / \sigma_i^2}{\sum 1/\sigma_i^2}. \tag{5}$$

The weighted dispersion of the Hubble constant is found with the same weights:

$$\sigma_0^2 = \frac{\sum (\frac{H(z_i)}{1+z_i} - < H_0 >)^2 / \sigma_i^2}{\sum 1/\sigma_i^2}. \tag{6}$$

Calculations give for these quantities:

$$< H_0 > \pm \sigma_0 = (64.40 \pm 5.95) \ km \ s^{-1} \ Mpc^{-1}. \tag{7}$$

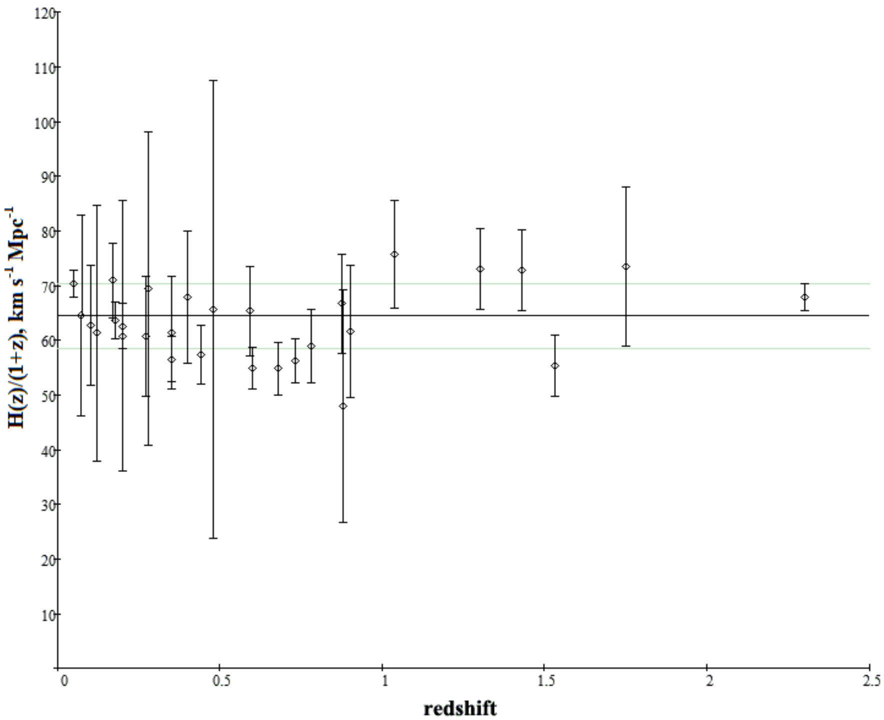

Figure 1: The ratio $H(z)/(1+z) \pm \sigma$ and the weighted value of the Hubble constant $H_0 \pm \sigma_0$ (horizontal lines). Observed values of the Hubble parameter $H(z)$ are taken from Table 1 of [4] and one point for $z < 0.1$ is taken from [5].

The weighted average value of the Hubble constant with $\pm\sigma_0$ error bars are shown in Fig. 1 as horizontal lines. The theoretical value of the Hubble constant in the model: $H_0 = 2.14 \cdot 10^{-18}\ s^{-1} = 66.875\ km \cdot s^{-1} \cdot Mpc^{-1}$ belongs to this range.

Calculating the χ^2 value as:

$$\chi^2 = \sum \frac{(\frac{H(z_i)}{1+z_i} - < H_0 >)^2}{\sigma_i^2}, \tag{8}$$

we get $\chi^2 = 16.491$. By 28 degrees of freedom of our data set, it means that the hypothesis described by *Eq.* 4 cannot be rejected with 95% C.L.

Some authors try in a frame of models of expanding universe to find deceleration-acceleration transition redshifts using the same data set (for example, [4]). The above conclusion that the ratio $H(z)/(1+z)$ remains statistically constant in the available range of redshifts is model-independent. For the considered model, it is an additional fact against dark energy as an admissible alternative to the graviton background.

References

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