Black Hole Universe and Hubble's Law

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Abstract

Within the framework of the black-hole model of the Universe, I gave the dependence of the redshift of light reaching the Earth versus the distance of the galaxy that is the source of this light. The linear fragment of the graph of this relationship corresponds with Hubble's observations. The non-linear part represents a sharp increase of the redshift.

Keywords: general relativity, Black Hole Universe, photon energy, redshift, Hubble's Law.

1. Introduction

In the e-book *Anti-gravity* [1] I proposed a black-hole model of the Universe. Our Universe can be treated as a gigantic homogeneous Black Hole with an anti-gravity shell. Our Galaxy, together with the solar system and the Earth, which in the cosmological scale can be considered only as a point, should be located near the center of the Black Hole Universe.

2. Photon energy

A widely prevailing view:

The photon energy emitted by a given source does not depend on the place of emission. Photon, entering the area of the weaker gravitational field, reduces its energy.

My hypothesis:

The energy of the photon emitted in a stronger gravitational field is smaller than in the weaker one. Photon, moving in a gravitational field, does not change its energy. Photons behave as if they remembered at what point of space they were created.

$$E = \frac{E_{max}}{\sqrt{|g_{11}|}} = \text{const}$$

E – photon energy
E_{max} – photon energy emitted from a source in the absence of gravitational field
g_{11} – component of metric tensor in a place of photon emission

3. How to define redshift?

$$z^* \overset{df}{=} \frac{E_{lab} - E_{out}}{E_{out}} = \frac{E_{lab}}{E_{out}} - 1$$

$$E_{lab} = \frac{E_{max}}{\sqrt{g_{11}^{lab}}}$$

$$E_{out} = \frac{E_{max}}{\sqrt{g_{11}^{out}}}$$

$$z^* = \frac{\sqrt{g_{11}^{out}}}{\sqrt{g_{11}^{lab}}} - 1$$

E_{lab} – photon energy emitted from a source that is in laboratory
E_{out} – photon energy emitted from a source that is outside laboratory
E_{max} – photon energy emitted from a source in the absence of gravitational field
g_{11}^{lab} – component of metric tensor in laboratory in a place of photon detection
g_{11}^{out} – component of metric tensor outside of laboratory in a place of photon emission

4. Redshift of light which comes to Earth from a distant galaxy

$$z^* = \frac{\sqrt{g_{11}^{out}}}{\sqrt{g_{11}^{lab}}} - 1$$

$$g_{11}^{out} = \left(1 - \frac{r^2}{R^2}\right)^{-1}$$

See [1], page 29

$$g_{11}^{lab} = \left[1 - \left(\frac{2GM_{Earth}}{c^2 R_{Earth}}\right)\right]^{-1} \approx \frac{1}{1 - 1.4 \cdot 10^{-9}}$$

See [1], page 45

$$z^* = \frac{\sqrt{1 - \left(\frac{2GM_{Earth}}{c^2 R_{Earth}}\right)}}{\sqrt{1 - \frac{r^2}{R^2}}} - 1 \approx \frac{\sqrt{1 - 1.4 \cdot 10^{-9}}}{\sqrt{1 - \frac{r^2}{R^2}}} - 1$$

r – distance of the source of light from the Earth
R – radius of Black Hole Universe
R_{Earth} – radius of the Earth
M_{Earth} – mass of the Earth
G – gravitational constant
c – standard value of the speed of light

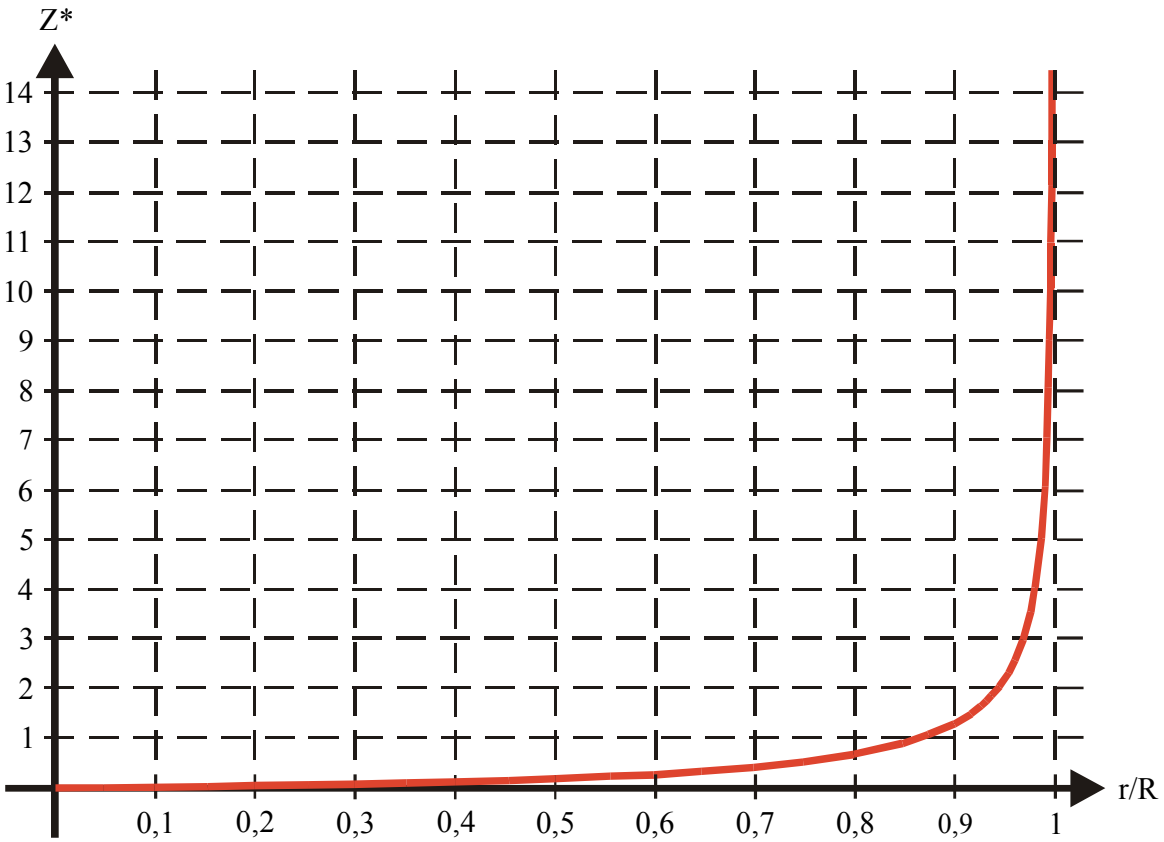

Diagram that shows dependence of redshift (z*) versus the distance (r) of the source from the center of Our Universe. [Attension: (z*) has negative values for ratio (r/R) approximate less than $3.74 \cdot 10^{-5}$.]

Below let's estimate redshift (z*) for case, when ($r^2 << R^2$).

$$z^* \approx \frac{\sqrt{1-1{,}4\cdot 10^{-9}}}{\sqrt{1-\frac{r^2}{R^2}}} - 1 \approx \frac{1}{\sqrt{1-\frac{r^2}{R^2}}} - 1 = \frac{1}{\sqrt{1-\frac{r}{R}}\cdot\sqrt{1+\frac{r}{R}}} - 1$$

$$\downarrow \quad \left(1-\frac{r}{R}\right)^{-\frac{1}{2}} \approx 1+\frac{1}{2}\cdot\frac{r}{R}$$

$$z^* = \frac{1+\frac{1}{2}\cdot\frac{r}{R}}{\sqrt{1+\frac{r}{R}}} - 1$$

$$\downarrow \quad \sqrt{1+\frac{r}{R}} \approx 1$$

$$z^* \approx \frac{1}{2}\cdot\frac{r}{R}$$

5. Hubble's law

First let's remind a definition of redshift (z) which bases on an assumption that photon energy doesn't depend on place of emission and changes during the movement of photon.

$$z \overset{df}{=} \frac{E_{emitted} - E_{observed}}{E_{observed}} = \frac{E_{emitted}}{E_{observed}} - 1$$

$$E = h\nu = \frac{h}{T} = \frac{hc}{\lambda}$$

$$z = \frac{\nu_{emitted}}{\nu_{observed}} - 1 = \frac{T_{observed}}{T_{emitted}} - 1 = \frac{\lambda_{observed}}{\lambda_{emitted}} - 1$$

Hubble's law [2] is a result of connection between Hubble's observations and non-relativistic Doppler law for light.

$$z = \frac{\lambda_{observed}}{\lambda_{emitted}} - 1$$

Hubble's observations: $z = k_H r$, $k_H \approx 0.81 \cdot 10^{-26} m^{-1}$, k_H = Hubble's coefficient

non-relativistic Doppler law for light: $z = \frac{v}{c}$

$$v = ck_H r = Hr, \quad H \overset{df}{=} ck_H \approx 75\,km \cdot s^{-1} \cdot Mpc^{-1} \approx 2.43 \cdot 10^{-18} s^{-1}$$ Hubble's law

In literature [3] given values of Hubble constant (H) are contained in wide range:

$$H = \left(60\,km \cdot s^{-1} \cdot Mpc^{-1} \approx 1.944 \cdot 10^{-18} s^{-1}\right) \div \left(75\,km \cdot s^{-1} \cdot Mpc^{-1} \approx 2.43 \cdot 10^{-18} s^{-1}\right)$$

Let's emphasize that proposed by us definition of redshift (z*) was basing on assumption that photon energy depends on place of emission and doesn't change during movement of photon. Redshift values (z) and (z*) are the same.

6. Discussion

In 1998, Saul Perlmutter [4] and independently Adam G. Riess and Brian P. Schmidt [5] discovered the sharp increase in redshift of light reaching the Earth from very distant sources. Because these scientists are supporters of the Big Bang theory based on Friedman's cosmological solution, they interpreted their observations as a sharp increase in the rate of expansion of the universe that occurred a few billion years ago.

The Big Bang theory dealt with Olbers' photometric paradox, the original versions of Hubble observations and law, and microwave background radiation. The solution to the problems of flatness and horizon required the use of an "intellectual prosthesis" of the inflationary phase of the creation of the Universe. The Big Bang theory "fell" in an attempt to interpret the sharp increase in the rate of expansion of the Universe. Rescue in the form of a postulate about the existence of dark energy is another "intellectual prosthesis".

The black-hole model of the Universe explains in a simple way the sharp increase in redshift of light from distant sources.

References

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