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The Redshift of Light Emitted by Nearby and Distant Galaxies in the Observable Universe

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So, we are an observer on a planet traveling in an unknown direction at an unknown speed and we are observing galaxies also traveling in unknown directions at unknown speeds and still not knowing how fast they are moving away from us. The only thing we do know in a few cases their approximate distance. This is inspired by Andy Bradford, March 7, 2015.

Most cosmologists consider that the expansion of the Universe from the initial Big Bang causes that a wavelength of light coming from nearby and distant galaxies[1] to increase or shows the cosmological redshift (or more commonly just redshift) z_G. This expansion is caused by the stretching of space (or better space-time) itself

However, the ultraviolet surface brightness data of nearby and distant galaxies, over a very wide redshift range imply that the observable Universe is the non-expanding (Euclidean) Universe (NEEU) [1, and references therein]. Moreover, a detailed analysis of the gamma-ray burst sources performed by Sanejouand [2] suggests that this Universe has been Euclidean and static over the last 12 Gy. To explain the redshift, Premović [3] hypothesized that the speed of light emitted by nearby and distant galaxies in NEEU is superluminal.

In general, we can assume that the measured wavelength, λ_G, of nearby and distant galaxies, comprises two parts: the first one, λ_{BB}, which results from the Big Bang Universe (hereinafter BBU) expansion and the second one, λ_{AC}, arises from another cause. So, we write that the measured wavelength

$$\lambda_G = \lambda_{BB} + \lambda_{AC} \quad \ldots (1).$$

There are three possible cases: (a) there is no additional cause $\lambda_{AC} = 0$ or its contribution to the measured wavelength λ_G is negligible, then the observable universe is the Big Bang type; (b) a contribution of the BBU expansion λ_{BB} to the measured wavelength λ_G is negligible or equal zero, then the observable universe is NEEU; and, (c) though the BBU expansion contributes

[1] We will define nearby galaxies as those whose redshift z_G is from 0.001 to 0.1 (or $0.001 \leq z_G \leq 0.1$) and distant galaxies with $z_G > 0.1$. Of course, there is no sharp boundary between nearby and distant galaxies.

predominantly to the measured wavelength λ_G the wavelength contribution of another cause is not negligible.

Similarly to the above-measured wavelength λ_G, we can assume that this redshift of light coming from nearby and distant galaxies z_G[2] is made of two parts: first one, z_{BB}, which results from BBU expansion and the second one, z_{AC}, derived from another cause

$$z_G = z_{BB} + z_{AC} \quad \dots (2).$$

The three possible cases, which correspond to the above cases for the wavelengths λ_G, λ_{BB} and λ_{AC}, can also be derived for z_G, z_{BB} and z_{AC}. They are: (a) there is no additional cause $z_{AC} = 0$ or its contribution to the redshift z_G is negligible, the observable universe is BBU; (b) there is no wavelength contribution $z_{BB} = 0$ of BBU expansion to the redshift z_G or this contribution is negligible, then the observable universe is NEEU; and, (c) though the redshift of BBU expansion, z_{BB}, is predominant to redshift z_G the redshift contribution of another cause, z_{AC}, is not negligible.

Since we cannot separate these wavelength or redshift contributions of nearby and distant galaxies to their corresponding total counterparts (λ_G and z_G), we do not know if the observable Universe: BBU or not.

Hubble's law states that a distance D_G from Earth to nearby galaxies in BBU or NEEU is linearly related to its redshift z_G [3]. It can be written as

$$D_G = z_G c/H_0 \quad \dots (3).$$

where c (= 299792 km sec^{-1}) is the speed of light and H_0 is the Hubble constant. The value is still uncertain and ranges from 50 km sec^{-1} (Mpc)$^{-1}$ – 100 km sec^{-1} (Mpc)$^{-1}$). This law is valid for nearby galaxies. As we noted previously, once z_G becomes ≥ 0.1 and we are dealing with distant galaxies[3], this relationship is no longer linear and becomes dependent on the particular cosmological model.

Combining the equations (2) and (3) we get

$$D_G H_0/c = z_{BB} + z_{AC}$$

Of course, this equation is only valid for nearby galaxies in BBU. If a contribution to the redshift z_G of another cause z_{AC} is equal to zero then $D_G H_0/c \approx z_{BB}$ and the Hubble constant H_0 represents the constant rate of BBU expansion.

For convenience, we write the above equation as

$$z_{AC} = D_G H_0/c - z_{BB} \dots (4).$$

[2] Of course, λ_G and z_G are related to each other.

[3] A contribution of their peculiar motion to the redshift is negligible [3].

To estimate the contribution other than the contribution of BBU expansion to the measured redshift z_G we have to know the distance of nearby galaxies – D_G. This distance is rather uncertainly known except for a few of these galaxies whose distance is directly measured by the megamaser method [3, and references therein]. However, since the Hubble constant is also quite uncertain, the contribution of another cause z_{AC} is also quite uncertain.

For example galaxy NGC 6264 with $z_G = 0.03384$, the farthest "megamaser" galaxy, is at distance 447 Mly [3, and references therein]. Using eqn. (3) and the Hubble length $c/H_0 = 72$ km sec^{-1} we calculate $z_G = D_G H_0/c = 447$ Mly/13.65 Gly = 0.03275. The difference is 0.03384 – 0.03275 = 0.0109 or the percentage difference is about 30 %.

References

[1] E. J. Lerner, *Observations contradict galaxy size and surface brightness predictions that are based on the expanding universe hypothesis*. Monthly notices the Royal Astron. Soc. (MNRAS) 477, 3185-3196 (2018).

[2] Y. –H Sanejouand, *About some possible empirical evidences in favor of a cosmological time variation of the speed of light*. Europhys. Lett., 88, 59002 (2009).

[3] P. I. Premović, *Distant galaxies in the non-expanding (Euclidean) Universe: the light speed redshift.* General Science Journal, May 2020.

In 2013, the European Space Agency's Planck space mission released the most accurate and detailed map ever map of the universe's oldest light. The map revealed that the universe is 13.8 billion years old. Planck calculated the age by studying the cosmic microwave background.

"The cosmic microwave background light is a traveler from far away and long ago," Charles Lawrence, the U.S. project scientist for the mission at NASA's Jet Propulsion Laboratory in Pasadena, California, said in a statement. "When it arrives, it tells us about the whole history of our universe."

Because of the connection between distance and the speed of light, this means scientists can look at a region of space that lies 13.8 billion light-years away. Like a ship in the empty ocean, astronomers on Earth can turn their telescopes to peer 13.8 billion light-years in every direction, which puts Earth inside of an *observable* sphere with a radius of 13.8 billion light-years. The word "observable" is key; the sphere limits what scientists can see but not what is there.

But though the sphere appears almost 28 billion light-years in diameter, it is far larger. Scientists know that the universe is expanding. Thus, while scientists might see a spot that lay 13.8 billion light-years from Earth at the time of the Big Bang, the universe has continued to expand over its lifetime. If inflation occurred at a constant rate through the life of the universe, that same spot is 46 billion light-years away today, making the diameter of the observable universe a sphere around 92 billion light-years. [VIDEO: Oldest Light in the Universe: How it Traveled to Us]

Centering a sphere on Earth's location in space might seem to put mankind in the center of the universe. However, like that same ship in the ocean, we cannot tell where we lie in the enormous span of the universe. Just because we cannot see land does not mean we are in the center of the ocean; just because we cannot see the edge of the universe does not mean we lie in the center of the universe