

Is there an explanation for Hubble's constant crisis?

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Abstract

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The solution to this crisis is the modification of the Big Bang theory. I concur with the main claim of the Big Bang theory that there was an explosion that occurred ~13.7 billion years ago. The Cosmic Microwave Background Radiation (CMBR) is strong evidence that the visible universe started with an explosion. But, I differ from the BB on the question of what exploded. I do not accept the BB claim that what exploded was a singularity point. A singularity point is a mathematical construct that has no physical meaning. I describe later in this paper my hypothesis of what exploded.

My answer is divided into two topics:

- 1) Problems associated with Hubble's law.
- 2) A proposed structure of the universe that explains the problems described in topic 1).

Problems associated with Hubble's law

Hubble's law states that galaxies are receding from each other at a velocity that is linear to their relative distances $V=H*d$, where H is the Hubble constant, V is - the velocity of the receding galaxies, and d - is the distance between galaxies. Hubble also suggested measuring the receding velocities of galaxies (V) based on the Doppler effect $V=C*z$, where C - is the speed of light, and z - is the measured shift.

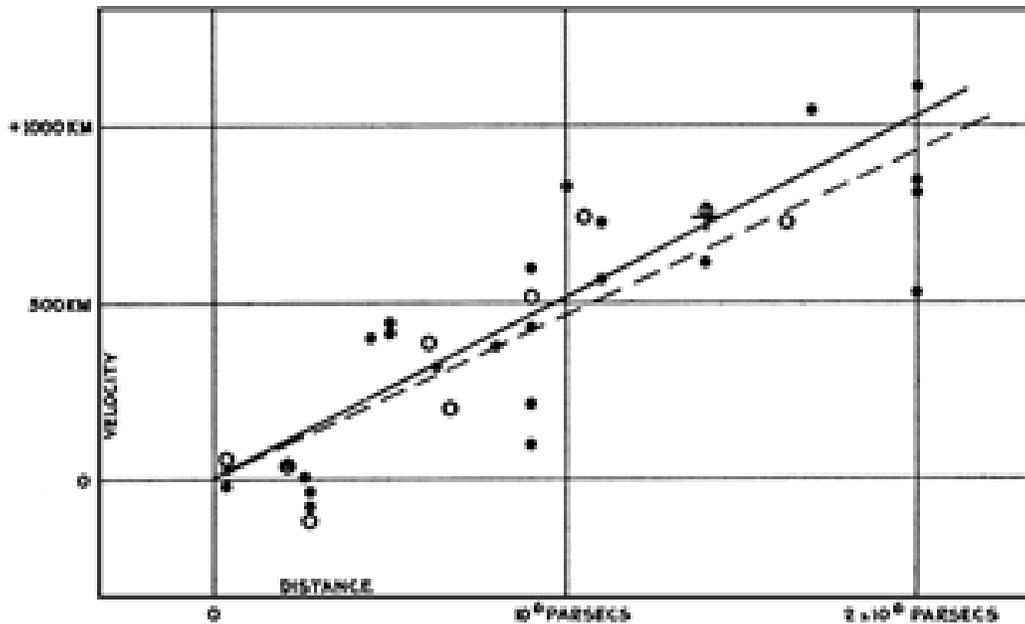
Problem (a): For the last two decades, the validity of Hubble's law is a serious dispute because accurate observations show that the Hubble constant has two values depending on the method it is calculated. This debate is serious because a physical constant cannot have two values depending on the method it is measured. In one method that is based on measurements in our local universe Hubble's constant is calculated to be 73.5 ± 1.4 km/sec/Mpc. In the second method which is based on measurement of the early universe, the value calculated is very different: 67.4 ± 0.5 km/sec/Mpc.

Some scientists call this discrepancy “The Hubble constant tension”, but others call it “The Hubble constant crisis”. One or both of the methods to calculate the Hubble constant may be flawed. Many scientists are working on this possibility, but it seems that the results are solid. There is another possibility - Hubble’s law is not valid. However, this possibility raises serious doubts about the BB theory. Hubble’s law is a cornerstone of the BB theory. If Hubble’s law is not valid then the BB theory must be modified or abandoned.

See [How a Dispute over a Single Number Became a Cosmological Crisis](#)

The above-mentioned Hubble constant crisis is one among other problems associated with Hubble’s law. Earlier problems were swept under the rug or downplayed by various explanations.

Hubble’s law has been problematic since it was postulated. Robert Kirshner - [Hubble's diagram and cosmic expansion](#) “Staring at his original Hubble diagram, you can see that there is a handful of nearby Galaxies with blue shifts, and a large scatter of velocities at any given distance. Hubble shrewdly used plausible methods to average the data for Galaxies that are at the same distance to make his result stand out more clearly from the noise. He was fortunate to have data that behaved so well.”



To sum up the discrepancies in Hubble's original diagram:

Problem (b): The BB theory postulates that all galaxies should be redshifted, i.e., receding from the Milky Way. The majority of galaxies are redshifted. Nevertheless, few galaxies are blue-shifted, i.e., approaching The Milky Way. The fact is vaguely explained by cosmologists as peculiar cases where for nearby galaxies the gravity attraction is bigger than the expansion of the universe. A known example is the Andromeda galaxy located 2.5Mly from the Milky Way that is approaching the Milky Way.

Problem (c): How come some galaxies are located at the same distance from the Milky Way, yet have varying velocities? It was explained that the measurements were not accurate and that with better techniques, this issue will be solved.

Additional problems in Hubble's law were found after Hubble's time.

Problem (d): There are observations of the galaxies in the Virgo Cluster. The cluster contains ~1500 galaxies and is located 50-60Mly away from the Milky Way. The conundrum is that although the majority of the galaxies in the Virgo Cluster are red-shifted, there are some (~40) that are blue-shifted galaxies.

Problem (e): Hubble's measurements were done on nearby galaxies (distances ~7Mly). However, when the velocities of receding galaxies at bigger distances have been measured the linearity between the speed and distance is not valid anymore.

Problem (f): Observations show that remote galaxies recede away faster the farther away they are from the Milky Way. The conclusion, based on Hubble's law, is that there is an additional source of energy designated "dark energy" that is responsible for the accelerated expansion of the universe. The dark energy hypothesis is a conundrum in cosmology. It was suggested that it is the space vacuum energy, and its existence has been verified by quantum physics. However, there is a discrepancy of 10^{120} between measured and theoretical values – the largest discrepancy in physics.

A proposed structure of the universe that explains the problems associated with Hubble's law.

I claim the following:

Hubble's claim that only the Doppler effect causes the redshift of Galaxies is wrong. Cosmology teaches that there are additional types of redshifts in the universe. One is the cosmological shift caused by the expansion of the universe and the other is the gravitational redshift that exists around any celestial body and was predicted by Einstein.

I claim that the cosmological redshift can be discarded because there is no accelerated expansion of the universe. The universe accelerated expansion gives rise to the dark energy conjuncture, which has no solid evidence for its existence.

I claim that besides the Doppler redshift there is also the gravitational redshift. However, to have a significant gravitational redshift, our universe must have a massive body at its center. I postulate that the universe comprises a massive spinning neutron star, I call the Pivot, at its center and a visible universe in the shape of a flat disk that contains all ordinary matter orbiting the Pivot. From GR's point of view, the Pivot is a rotating (or Kerr's) black hole. Structures like this are known in cosmology. The following is a picture of the Sombrero galaxy taken by a space telescope. It is seen that the galaxy is composed of a central massive body and a flat disk of matter

(stars, dust, etc.) orbiting the central mass. I claim that this is also the structure of our universe except that our universe is substantially bigger than the Sombrero Galaxy.



A schematic structure of our universe is shown in Fig. 1. Some of the above-designated problems will be explained using this Figure.

In the figure R_{in} is the inner radius of the flat disk of our universe, it must be greater than the event horizon of the Pivot. R_{out} is the outer radius of the flat disk. R_{mw} is the radius of the Milky Way. The numbers shown in the figure are calculated in [The structure of the Pivot Universe](#)

I would like to compare the z shift in the universe to a similar case that has been verified experimentally and is used

extensively - the GPS. The GPS uses satellites orbiting Earth at a given distance from Earth. The z shift is composed of the Doppler shift and the gravitational shift. The total z shift causes time dilation, which is included in the GPS software. Ignoring the time dilation renders the GPS useless. The resemblance to our universe is clear. Replace Earth with the Pivot and the satellite by a galaxy and you have the structure of our universe.

The Doppler effect exists because galaxies orbiting the Pivot have different velocities. However, I have calculated the maximal contribution of the Doppler effect to the total z shift in the universe and found it to be less than 0.3%. Thus, the main contributor is the gravitational shift.

There are some profound questions regarding the Pivot structure. The first is what is the origin of the Pivot? The second is how was the visible universe created. In a nutshell, I speculate that there was a primordial spinning neutron star that was built up gradually from the infinite vacuum space energy. It grew until it reached a physical limit and then it exploded. In this sense, it resembles the BB theory. However, it differs from the BB which assumes that the Big Bang started from a singularity point that contained very hot matter at an infinite density and that matter from the explosion flew radially in all directions. I claim that following the explosion of the spinning neutron star, the matter was flung off tangentially. The spinning primordial neutron star exploded into two distinct parts. The first is the Pivot that retained the major part of the primordial neutron star and the second is the visible universe.

The result was that the matter universe was arranged as a thin disk that is orbiting the Pivot.

The reader may wonder why the Pivot has not been observed in the universe. This question is addressed by GR: the Pivot can be considered as Kerr's black hole. The visible universe must reside outside the event horizon of the Pivot. An observer located in the visible universe cannot see what is behind the event horizon, hence the Pivot's mass can be considered "Dark matter". However, the gravitational influence of the Pivot is felt in the entire visible universe.

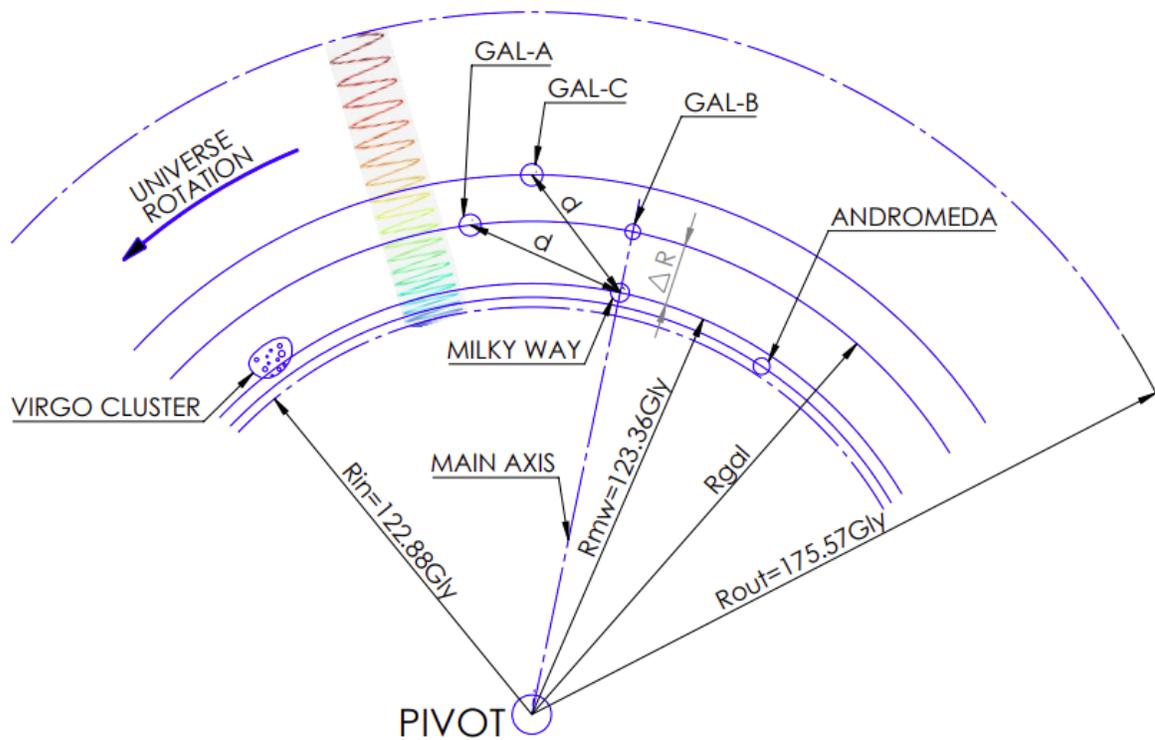


Fig. 1 – Structure of the Pivot universe

Based on the Pivot structure the above-mentioned problems can be explained.

Explanation of **problem (b)**.

The tangential velocity of the ordinary matter around the Pivot is a function of its distance from the Pivot. The bigger the distance the lower its velocity and vice versa. The gravitational redshift is also a function of the distance from the celestial body to the Pivot. Fig. 1 it is shown the spectrum of light. The closer a celestial body is to the Pivot it is blue-shifted, and for greater distances, the spectrum is redshifted. The Milky Way is located at a radius closer to the Pivot, all galaxies with a bigger radius are seen from the Milky Way redshifted. But galaxies that are closer to the Pivot than the Milky Way (e.g., Andromeda) will be seen from the Milky Way blue shifted. As the Milky Way is closer to the inner radius of the disk (R_{in}) the red-shifted galaxies outnumber the blue-shifted galaxies.

Explanation of **problem (c)**.

Fig. 1 shows two Galaxies GAL-A and GAL-C having the same distance (d) from the Milky Way, but are located at different radiuses. According to the Pivot theory, they have different z shifts. This is contrary to Hubble's law, where the two galaxies should have the same z -shift. So, staring at Hubble's original diagram the fact that there are several galaxies located at the same distance but have different velocities can be explained by the Pivot universe but not by Hubble's law.

Explanation of **problem (d)**.

In Fig. 1 it is shown that the Virgo Cluster orbits around the Pivot at approximately the same radius as the Milky Way. But as it is large and contains many galaxies, few galaxies are closer to the Pivot than the Milky Way but the majority of galaxies are with a bigger radius than the Milky Way. The galaxies of the Cluster with a bigger radius than the Milky Way are seen from the Milky Way redshifted. The galaxies with a smaller radius are seen as blue-shifted.

Explanation of **problem (a)**, **problem (e)**, and **problem (f)**.

These three problems are explained by the fact that Hubble's law is not valid. Namely, the velocity of a receding galaxy is not linear with its distance from the Milky Way.

The gravitational z shift of a galaxy Z_{gal} orbiting the Pivot at a radius R_{gal} is calculated by Eq. (1):

$$Z_{gal}(R_{gal}) = \frac{1}{\left(1 - \frac{2 \cdot G \cdot M_{pivot}}{R_{gal} \cdot C^2}\right)^{0.5}} - 1 \quad \text{Eq. (1)}$$

Where:

$M_{pivot} = 7.8 \cdot 10^{53} \text{ kg}$... Mass of the Pivot

$G = 6.67 \cdot 10^{-11} \frac{\text{m}^3}{\text{kg} \cdot \text{s}^2}$... Gravitational constant

$C = 299,792 \text{ km/s}$... Light velocity

Fig. (2) is the plot of Eq. (1)

In this graph, the distance of the orbital radius and the Z shift of the Milky Way are shown ($R=123.36\text{Gly}$ and $Z= 13.33$ respectively). It also shows the location of galaxy GN-z11. This galaxy has currently the highest measured redshift ~ 11.1 . The orbital radius and Z shift of GN-z11 are 135.66Gly and $Z =2.28$ respectively. Note: From the Milky Way the redshift of GN-z11 is $13.33-2.28=\sim 11.1$

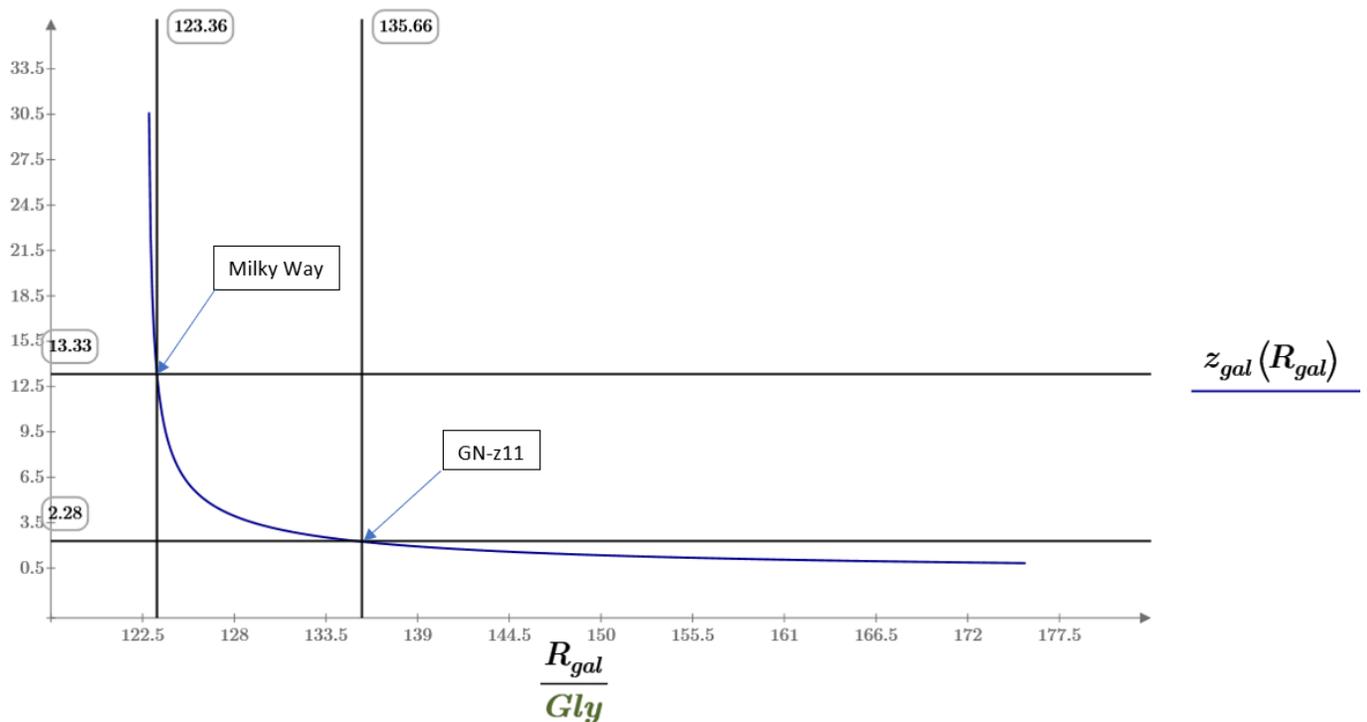


Fig. 2 – Z-Shift Vs. distance of a galaxy from the Pivot.

Explanation of **problem (e)**: Hubble's law is approximately correct for galaxies near the Milky Way (~7Mly). Zooming in the vicinity of the Milky Way gives approximately a straight line.

Explanation of **problem (f)**: It is clear from the graph that the relation between the distance of the galaxy and its redshift is not linear, contrary to Hubble's law. Hubble's constant is the slope of the graph at a given distance. This can explain the results that showed that the expansion of the universe is accelerated. Further galaxies have a smaller Hubble's constant than near galaxies. But when it is mistakenly assumed that Hubble's constant does not change with distance, it is concluded that the further the galaxy is it recedes at a higher velocity.

Explanation of **problem (a)**: From Fig. 2 it is clear that Hubble's constant varies and is dependent on the distance from the Milky Way. The value measured near the Milky Way (or the local universe) has a bigger slope (or Hubble's constant) than the slope at the furthest galaxies.

Summary

The Pivot structure explains the observations related to Hubble's law and is not explained by the Big Bang theory.

In addition, this model solves two conundrums of the Big Bang.

1) Where is the dark matter? I claim that dark matter resides in the Pivot and therefore cannot be observed.

2) What is dark energy? There is no need for dark energy, as the matter universe orbits the Pivot without the need for additional energy.