Logical vs Mathematical Universes

Edward G. Lake

Independent Researcher

February 5, 2020

detect@outlook.com

***Abstract**: It appears that certain fundamental properties of our universe cannot be expressed in mathematical equations, and as a result, mathematicians argue that the universe is preposterously different from how simple logic says it must be.*

Key words: Big Bang; observable universe; infinite universe; red-shift.

Countless discussions with mathematicians have led me to conclude that they cannot compute nor understand any speed or distance measurement that is not between objects. That causes a serious problem when talking about the apparently *infinite* universe around us. While mathematicians have no problem with something infinitely small, they have a serious problem with a universe that is infinitely large. And logic says that the universe is infinite. But it all depends upon which "universe" you are talking about.

Many years ago, I read Stephen Hawking's book "*A Brief History of Time*" and found this comment about an "infinite static universe" on page 6:

> The difficulty is that in an infinite static universe nearly every line of sight would end on the surface of a star. Thus one would expect that the whole sky would be as bright as the sun, even at night.[1]

That was something I could easily visualize and understand. If the universe was of infinite size and has existed for infinity, the night sky would be *white*, not black. There would be a star everywhere you look, with no blackness between stars, just more stars that are more and more distant. It is called "the dark night sky paradox."

A little additional research found that "the dark night sky paradox" first occurred to English astronomer Thomas Digges in 1576, but German astronomer Heinrich Wilhelm Matthias Olbers generally gets the credit, because Olbers first made it a public question. Then in 1848, American writer and poet Edgar Allan Poe proposed an answer: "The night sky is dark because the universe is not infinitely old but came into existence at some finite time in the past. The more distant stars are so far away that light from them has not yet reached Earth. That is, if you look

far enough away, the look-back time approaches the age of the universe, and you see to a time before the first stars began to shine. The night sky is dark because the universe had a beginning."[2]

I. The 3 Universes

The first problem you run into when discussing "the universe" is that the term doesn't usually have a specific meaning. It generally applies to everything you want to include. It is "The Everything Universe." But the term often only means "everything that is beyond the solar system and beyond the Milky Way galaxy," i.e., "the *rest* of the universe." However, when you talk specifics and details, you find that there are 3 "universes" out there. First of all, there is The Infinite Universe. Then there is The Big Bang Universe within The Infinite Universe. They can be envisioned as shown in Figure 1 below.

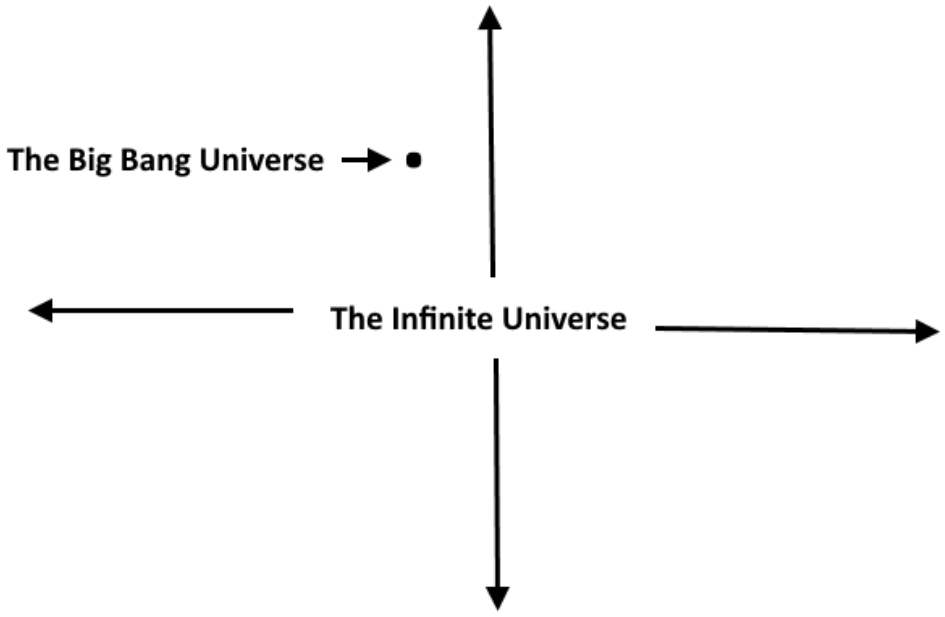

Figure 1

"The Infinite Universe" has no boundaries, is nearly empty, and almost certainly goes on forever in all directions. Logic says so. Logic also says that within The Infinite Universe there is The Big Bang Universe. The Infinite Universe is the endless empty space that The Big Bang Universe is expanding into.

From various observations and measurements, we know The Big Bang Universe began forming about 13.772 billion years ago, expanding outward from a "point" that some claim must have been a "singularity" of nearly infinite density. Or it may have been a ball of highly compressed elementary particles, like Quarks and Leptons, unable to fuse and unable to withstand the pressure of gravity compression. All we know for sure is that 13.772 billion years ago it suddenly and rapidly started decompressing, a process which is still continuing today. We

call it “The Big Bang,” but it was not an explosion where some form of ***explosive*** throws everything outward and leaves a hole behind. It was a ***decompression*** like unleashing a mass of compacted springs or rubber balls.

It is certainly possible that there are other Big Bang Universes out there in The Infinite Universe, but, if so, they are so far away that if any light from them could reach us, that light would appear to be nothing more than a very distant star.

Until evidence is found for additional Big Bang Universes, however, it is better to just focus on the “universes” the facts tell us must exist.

Within our Big Bang Universe is another kind of universe. It is what we now call “The Observable Universe.” Figure 2 below shows how The Observable Universe might be situated inside The Big Bang Universe.

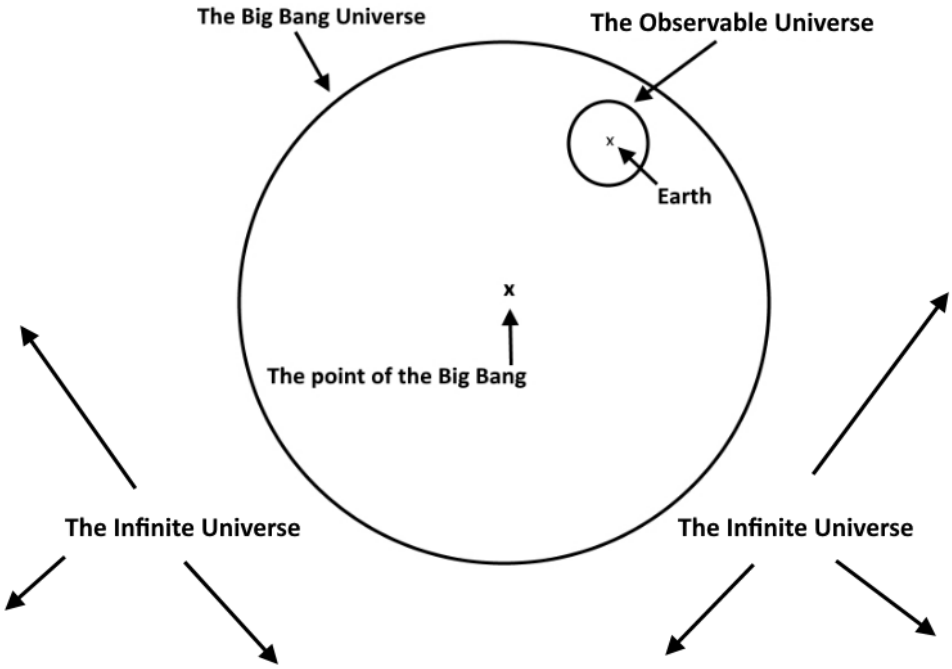

Figure 2

The Observable Universe contains everything we on Earth can see, detect and measure with telescopes of different kinds. We are at the center of that spherical universe, which we calculate to be 13.772 billion light years in diameter. That is as far as we can see in all directions, because before 13.772 billion years ago stars had not yet formed, and therefore there was no light. We can see only back to the point in time when the lights (i.e., the stars) were turned on.

In Figure 2 the spherical Big Bang Universe is halved like a melon, and the Observable Universe is shown as a half of a smaller sphere that is off-center and is calculated to be about 4% of the larger sphere. We know The Observable Universe is off center because we cannot see “the point of the Big Bang.” We see that the Earth is a planet orbiting the Sun, and the Sun

orbits the center of the Milky Way Galaxy, and the Milky Way galaxy moves through space in the general direction of galaxies within the massive constellation Hydra. It also appears that, with the exception of the Andromeda Galaxy and a few other galaxies in that same direction, all the other galaxies we can see are moving away from the Earth. Thus The Big Bang Universe is an "expanding universe" with all of its components moving away from "the point of the Big Bang." And, in doing so, most galaxies also appear to be moving away from the Earth.

Figure 3 below might help clarify how nearly every distant galaxy in The Observable Universe appears to be moving away from the Earth and the Milky Way Galaxy while, in reality, the Milky Way galaxy along with all of those distant galaxies and are actually moving away from the point of the Big Bang.

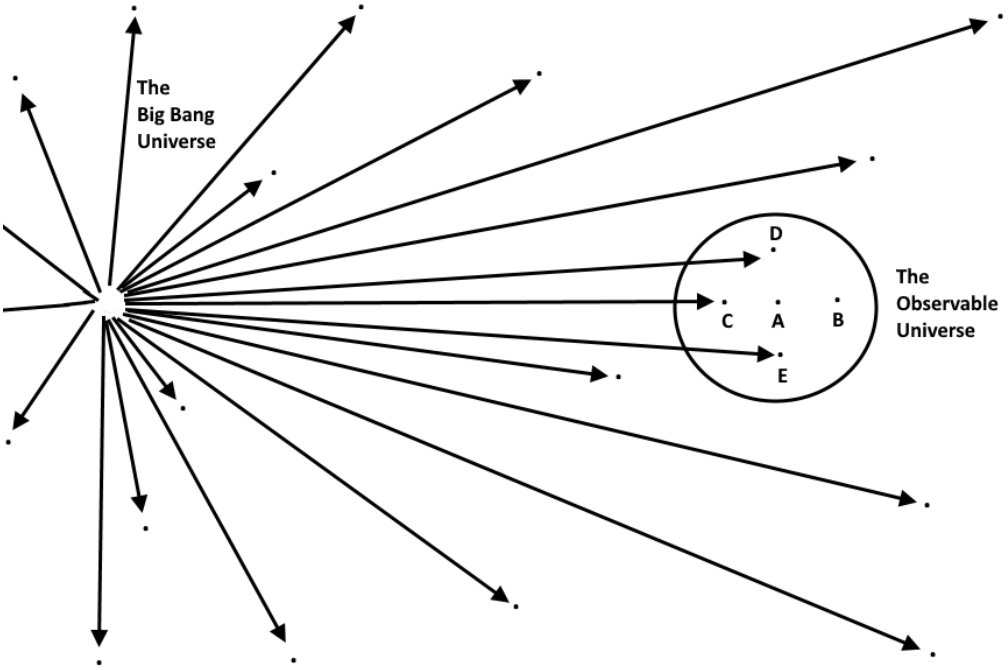

Figure 3

If the top or first elementary particles expanded (or were pushed) away from the point of the Big Bang faster than lower or later particles, then as those particles formed into stars and planets and galaxies, those objects would continue to move at the same average speeds away from the point of the Big Bang. Thus, if Object "A" in Figure 3 is the Earth, then Object "B" will appear to be moving away from the Earth because it is moving faster away from the Big Bang than the Earth. Likewise, Object "C" will appear to be moving away from the Earth because it is falling behind as the Earth moves faster away from the point of the Big Bang than does Object "C". Object "D" and Object "E" are moving away from the point of the Big bang at about the same speed as the Earth, but they are also moving away from the Earth because they are moving at a slightly different ***angle*** away from the point of the Big Bang.

It all seems very simple, straight-forward and easy to understand.

II. The problem.

The problem is easy to describe: For some unclear reason many physicists and astronomers seem to view "the everything universe" as consisting only of <u>two</u> universes, (1) The Observable Universe and (2) The Big Bang Universe. That generates two bizarre problems which should not exist: (1) The Big Bang Universe obviously must have begun at some point in space, a point which would logically be the center of The Big Bang Universe, but how can an ***<u>infinite</u>*** universe have a center? (2) The Infinite Universe has no center, but an expanding universe with no center is illogical, since it requires that empty space can only exist between objects that are moving away from one another. If all objects are moving away from each other, then at some point in the past they must have been together at some point in space, and that point would be the center of the universe - a center that cannot exist in an infinite universe.

To solve that dilemma or paradox, mathematicians have created what should probably be called "The Mathematical Universe."

III. **The Mathematical Universe**.

"The Mathematical Universe" is not a 4^{th} universe. It is a simply a claim by mathematicians that an Infinite Universe cannot exist.

It seems that many mathematicians can only compute distances between objects. There can be no "Infinite Universe" because such a universe contains no <u>object</u> which marks where the universe ends. To such a mathematician, "empty space" is only found ***<u>between</u>*** objects. That empty space increases as the two objects move farther and farther apart. What are the objects moving ***<u>into</u>***? That is simply not a valid question. If you ask it, you simply do not understand mathematics. Mathematics may not represent reality as others see it, but it is the only reality many mathematicians seem to understand.

Here is how one astronomy text book describes the problem:

> In your daily life you are accustomed to boundaries. Rooms have walls, athletic fields have boundary lines, countries have borders, oceans have shores. It is natural to think of the universe also as having an edge, but that idea can't be right.
>
> If the universe had an edge, imagine going to that edge. What would you find there: A wall of some type? A great empty space? Nothing? Even a child can ask: If there is an edge to the universe, what's beyond it? A true edge would have to be more than just an end of the distribution of matter. It would have to be an end of space itself. But, then, what would happen if you tried to reach past, or move past, that edge?
>
> An edge to the universe violates common sense, and modern observations indicate that the universe could be infinite and would therefore have no edge. Perhaps even more important, if the universe has no edge, then it cannot have a center. You find the centers of things — pizzas, football fields, oceans, galaxies — by referring to their edges. If the universe has no edge, then it cannot have a center.**[3]**

Unfortunately, that explanation just generates more questions. What is the difference between "space" and "emptiness"? Why does a "true edge" to the Big Bang universe "have to be more than just an end of the distribution of matter"? The book argues that there is no edge, but also says an edge cannot have only empty space beyond it? Why can't it? The only answer the book provides is the following:

> It is a **Common Misconception** to imagine that the universe has a center, but, as you just realized, that is impossible. As you study cosmology, you should take care to avoid thinking that there is a center of the universe.[4]

What they do not address is the apparent fact that The Big Bang Universe is not the entire universe. Logically, there *can* be - and almost certainly *is* - a center to The Big Bang Universe while there *cannot* be a center to The Infinite Universe.

According to Wikipedia[4]:

> "The Big Bang is not an explosion of matter moving outward to fill an empty universe. Instead, space itself expands with time everywhere and increases the physical distance between two co-moving points. In other words, the Big Bang is not an explosion *in space*, but rather an expansion *of space*."

According to *Scientific Amer*ican and Joel R. Primack, a cosmologist at the University of California at Santa Cruz:

> "According to modern cosmological theory, based on Einstein's General Relativity (our modern theory of gravity), the big bang did not occur somewhere in space; it occupied the whole of space. Indeed, it created space. Distant galaxies are not traveling at a high speed through space; instead, just like our own galaxy, they are moving relatively slowly with respect to any of their neighboring galaxies. It is the expansion of space, between the time when the stars in these distant galaxies emitted light and our telescopes receive it, that causes the wavelength of the light to lengthen (redshift). Space is itself infinitely elastic; it is not expanding into anything."[5]

According to a Cornell University web page:

> "The Big Bang is often described as a tiny bit of matter, but that's an oversimplification. If the Big Bang occurred in a specific point in space, spewing galaxies in all directions, then we would expect our galaxy to be one of many galaxies sitting on an expanding shell of galaxies, with the center of that shell being the point of the "Bang." This, however, is not what we see, and not what the BB predicts.
>
> "If we were on a shell of galaxies, we would see many galaxies when we looked in directions along the shell, and few galaxies when we looked perpendicular to (up out of or down into) the shell. Moreover, distances and redshifts in such a scenario would depend on the direction we were looking. As we looked tangent to the shell, we would see many nearby galaxies with small redshifts. As we looked down into the shell, we would see more

distant galaxies with higher redshifts. (Up out of the shell we would see only empty space.) This is not what we see. Galaxies, distant and nearby, are evenly distributed all around us. **The number of galaxies and their redshifts are completely independent of which direction we look (we say that they are "homogeneous"), and that homogeneous distribution is also "isotropic," meaning that no matter where in the universe you were, you would see exactly the same average distribution of galaxies and redshifts."[6]**

That same idea appears in many college textbooks. It appears to be the mathematicians' way of explaining the Big Bang without having a measurable size for "space." They cannot calculate the size of the universe if there are no edges to the universe, and we cannot even see most of it. So, instead, they calculate the size of the **observable** universe, and they extrapolate from those calculations that there can be no more to the universe. It ends where we see it end.

IV. Dark Energy

It appears that mathematicians once calculated how much matter can be seen in the **observable** universe and concluded that it was enough to predict that the universe would someday stop expanding and collapse back to a "singularity" once again, and perhaps initiate a new "Big Bang" to start the whole process over again.

> Then came 1998 and the Hubble Space Telescope (HST) observations of very distant supernovae that showed that, a long time ago, the universe was actually expanding more slowly than it is today. So the expansion of the universe has not been slowing due to gravity, as everyone thought, it has been accelerating. No one expected this, no one knew how to explain it. But something was causing it.[7]

No one knew what was causing those distant supernovae to appear to be moving at a different speed than newer and closer supernovae. But mathematicians dreamed up an explanation: Dark Energy.

What they appear to be saying is that, in the first few billion years after the Big Bang, things were moving apart at a much slower rate than they are today. In order for that to happen, some outside force (beyond the universe) must be pulling things toward it at a faster and faster rate. That mysterious face is called "Dark Energy."

Figures 2 and 3 indicate, however, that the imagined "Dark Energy" is simply the stars and galaxies that are in The Big Bang Universe but beyond The Observable Universe. Differences in "Dark Energy" may simply be the fact that the first material that left the point of the Big Bang moved faster than later material. And if you are looking at stars and galaxies behind us as we move away from the point of the Big Bang, those galaxies will be measured to be moving slower than galaxies that are ahead of us.

In addition, of course, objects that are far apart could exert less gravitational pull than objects that are close together.

V. Einstein's Second Postulate & Red-shifted Galaxies

Einstein's Second Postulate to his Theory of Special Relativity is another point of confusion, even though the postulate simply and clearly says,

> "light is always propagated in empty space with a definite velocity *c* which is independent of the state of motion of the emitting body."[8]

In other words, photons emitted from a moving object are no different from photons emitted from a stationary object, and more importantly, the speed of the emitter <u>*does not add to*</u> the speed of the photons that are emitted.

This means that light from a distant galaxy does not appear red-shifted because that galaxy is moving away from the observer on Earth, it is red-shifted because the Earth is moving away from that galaxy.

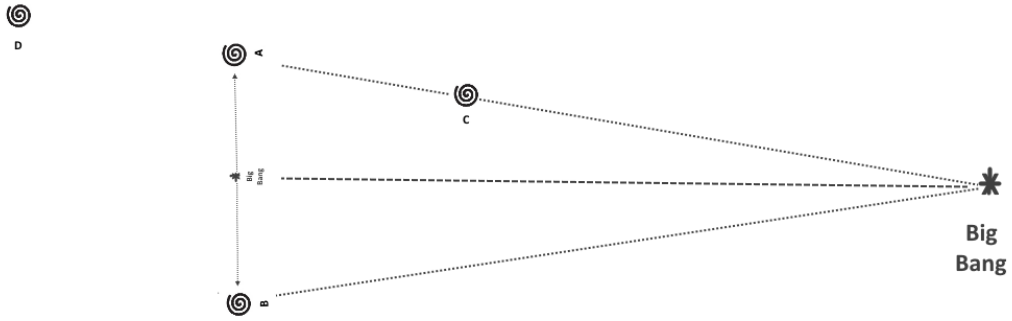

Figure 4

Figure 4 above shows how galaxies "A" and "B" move away from the Big Bang and get farther apart if they are equidistant from the point of the Big Bang. If Galaxy "A" contains the Earth, we on Earth would see Galaxy "B" as red-shifted because we are moving away from "B." However, the amount of "red-shift" would not represent how fast "A" is moving away from "B" but, instead, it represents how fast "A" is moving away from a point midway between "A" and "B." "A" and "B" are moving away from each other at <u>*twice*</u> the speed that each moves away from the center point. And it is only the speed away from that center-point that affects the red-shift, because, as Einstein's Second Postulate says, "B's" motion away from "A" does not change the light seen by "A," because <u>motion of the emitter does not add to the speed of the light that is emitted</u>. But motion of the observer <u>*does*</u> change how the light is observed. Light from "B" will be red-shifted when viewed by "A," but only according to the speed at which "A" is moving away from the mid-way point where both "A" and "B" where once together at the time of the Big Bang.

The same holds true, of course, for light from Galaxies "C" and "D." How much red-shift (or blue-shift) is observed by "A" depends upon how fast the galaxies are moving away from a point somewhere between them.

But, if the universe is expanding, how can there be blue-shifted galaxies?

VI. Blue-shifted galaxies.

Interestingly, all the blue-shifted galaxies observed from earth are in the same general area of our Observable Universe. According to a Cornell University web page:

> "There are in all about 100 known galaxies with blueshifts out of the billions of galaxies in the observable universe. Most of these blue-shifted galaxies are in our own local group, and are all bound to each other. Most are also dwarf galaxies which you've probably never heard of, although the Andromeda Galaxy, M31, is in there."[9]

In 1913, an astronomer at the Lowell Observatory near Flagstaff, Arizona, was the first to determine that Andromeda was blue-shifted. Vesto Melvin Slipher wrote a paper about it for the *Lowell Observatory Bulletin*[10], instead of some national scientific journal, which resulted in it being virtually unknown to the rest of the world for a long time. Using the same technique used for measuring the rotation speed of Saturn, Slipher concluded "that the Andromeda Nebula is approaching the solar system with a velocity of about 300 kilometers per second."

Today, using different methods to determine distances and speeds,[11][12] the Earth and Andromeda are measured to be traveling toward each other at 402,000 kilometers per hour, which computes to 112 kilometers per second (kps), or less than ½ of Slipher's calculated speed.

Studying Andromeda's unusual movement, Slipher speculated that "the nebula, in its swift flight through space, might have encountered a dark 'star'," which threw if off course and toward the Earth. It is now generally believed that Andromeda and the Milky Way are being drawn together by their mutual gravitational attraction.

While it is certainly possible "that Andromeda and the Milky Way galaxies are being drawn together by their mutual gravity attraction," it also seems quite possible that all the blue-shifted galaxies we see are simply ahead of us as we move away from the point of the Big Bang. If we view Galaxy "D" in Figure 4 as being Andromeda or <u>all</u> of the blue shifted galaxies, we should have a situation where the Earth is moving toward objects that are moving away from the Big Bang slightly faster than us. That should mean they should be red-shifted, but due to Einstein's Second Postulate, it is our speed <u>*toward the emitters*</u> that causes the color-shifting. And color-shifting is not actually determined by our speed toward those galaxies, but by our speed toward some point somewhere between us.

If Andromeda was moving away from the Big Bang at 100 kps, and we are behind Andromeda also moving away from the Big Bang at 100 kps, the Earth is actually stationary relative to Andromeda. But neither of us is stationary relative to the point of the Big Bang. That means that, due to Einstein's Second Postulate, our movement in the direction of Andromeda will result in blue-shifting <u>even if we are stationary relative to one another</u>. We are moving toward that source of light, and even though we are stationary relative to one another, their light will still be received at $c+v$ where v is the speed of the Earth in the direction of the emitter.

Photons travel at the speed of light. As stated above, Einstein's Second Postulate says the speed of the emitter does not add to the speed of the photons. They always travel at c. However, while the light is traveling at c in all directions from the emitter, the Earth is moving <u>*toward the*</u>

emitter at *v*. Thus the Earth will encounter photons from Andromeda as if those photons were traveling at *c+v*. The light will be blue-shifted.

VII. The Variable Speed of Light

If Andromeda and the blue-shifted galaxies are ahead of us as we move away from the point of the Big Bang, the red-shifted galaxies beyond the blue-shifted galaxies appear red-shifted for two reasons: (1) Those galaxies were moving away from the Big Bang significantly faster than we are, and (2) if #1 is true, then time dilation also plays a role because faster moving objects emit light that travels slower.

All stars and light sources emit light that travels at 299,792,458 meters *per second*. According to Einstein's Theory of Special Relativity, however, the faster an object moves, the slower time passes and the longer "a second" is for that object.[13] Light traveling at 299,792,458 meters *per one second* as one second is measured at the point of emission will be slower than light traveling at 299,792,458 meters per one second as emitted and measured on Earth. Therefore, because a fast-moving galaxy's light travels slower than it does on Earth, even if that light arrives at *c*, we will perceive it as being red-shifted because, when a comparison is made, the light is traveling slower than light travels here on Earth.

This, of course, conflicts with the beliefs of mathematicians who claim that a second is the same duration everywhere in the universe, and therefore the speed of light is the same everywhere in the universe. They make that argument because, to them, variable time and variable light requires a non-existent "stationary point" where time and light have maximum values. That point, of course, is the point of the Big Bang, which the mathematicians also claim does not exist.

At the point of the Big Bang, time passes at its fastest rate. It is a stationary point, which means the speed of an object at that point can be considered to be zero. When measuring velocity time dilation, all motion in the universe can be measured as being relative to that point. Time passes at a slower rate at any point that is *not* stationary relative to the point of the Big Bang.

In addition, at the point of the Big Bang all matter in The Big Bang Universe is equally distributed in all directions away from that point. Therefore, when measuring gravitational time dilation, the point of the Big Bang is again the point in the Big Bang universe where time passes at its fastest rate, and therefore an emitter of light at that point emits light at maximum *c*. The slowing of time and the speed of light due to gravitation at the point of emission, however, does not directly relate to measurements of the speed of light from distant galaxies

VIII. Conclusion

Logically, The Observable Universe is a small portion of The Big Bang Universe, and The Big Bang Universe is a very tiny portion of The Infinite Universe. The fictional Mathematical Universe described by mathematicians who cannot deal with infinity, variable time and the variable speed of light just creates illogical absurdities.

When measuring the red-shift of distant galaxies, it isn't just a matter of determining the rate of expansion away from the Earth, it is also a matter of measuring the rate of expansion away from the point of the Big Bang. And there is a significant possibility that the rate of expansion becomes faster with increased distance from the point of the Big Bang because the Big Bang universe expanded faster when it was younger. In addition, the faster the light source travels, the slower the speed of that emitted light will be *per second* due to velocity time dilation.

Mathematics will help confirm facts, but it won't help you understand those facts.

IX. References

[1] Stephen W. Hawking, *A Brief History of Time*, Bantam Books (1988), page 6

[2] Michael A. Seeds and Dana Backman, *Universe: Solar System, Stars, and Galaxies* (7th Edition), Brooks/Cole, Cengage Learning (2012), pp 426-429

[3] *Ibid*.

[4] https://en.wikipedia.org/wiki/Big_Bang

[5] https://www.scientificamerican.com/article/according-to-the-big-bang-1999-10-21/

[6] http://curious.astro.cornell.edu/about-us/102-the-universe/cosmology-and-the-big-bang/the-big-bang/592-can-we-find-the-place-where-the-big-bang-happened-intermediate

[7] https://science.nasa.gov/astrophysics/focus-areas/what-is-dark-energy

[8] Albert Einstein, *On the Electrodynamics of Moving Bodies*, Annalen der Physik 17 (1905) Translation by G. B. Jeffery and W. Perrett, *The Principle of Relativity*, London: Methuen and Company, Ltd. (1923) Page 1

[9] http://curious.astro.cornell.edu/ask-a-question/97-the-universe/galaxies/cosmology/539-why-are-there-blue-shifted-galaxies-intermediate

[10] Vesto Melvin Slipher, *The Radial Velocity of the Andromeda Nebula*, Lowell Observatory Bulletin No. 58, Vol. II, No. 8, (1913), page 56
https://www.roe.ac.uk/~jap/slipher/slipher_1913.pdf

[11] https://www.nationalgeographic.com/science/phenomena/2014/03/24/scientists-predict-our-galaxys-death/

[12] https://www.skyandtelescope.com/astronomy-news/milky-way-andromeda-merger-pushed-back/

[13] Edward G. Lake, *Variable Time and the Variable Speed of Light*, https://vixra.org/abs/1607.0289