Logical vs Mathematical Universes

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August 29, 2022

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***Abstract**: The conflict between Quantum Mechanics and Relativity has raged for about a hundred years and is interpreted in at least a hundred different ways. The key problem, however, seems to be very simple: Quantum Mechanics cannot quantify the things that are essential to Relativity, such as variable time, variable speed of light, empty space, and motion relative to the speed of light. 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 different from what logic and facts say.*

Key words: Quantum Mechanics; Relativity; light; time; space; relative motion; Big Bang; red-shift.

Endless discussions with Quantum Mechanics (QM) mathematicians have led me to conclude that they can neither compute nor understand any measurement of motion that is not about one object moving relative to another. That causes a serious problem when talking about the apparently *infinite* universe around us. While QM 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 must be 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.

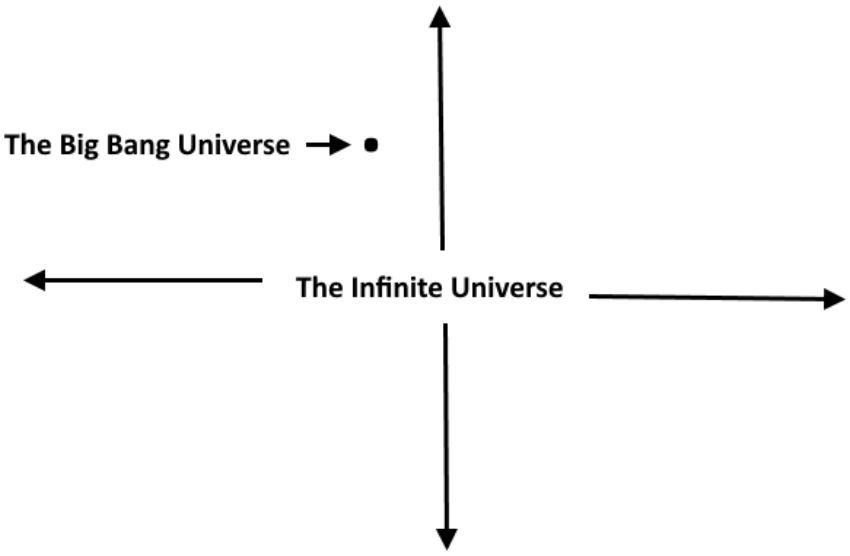

Figure 1

"The Infinite Universe" has no boundaries, is nearly empty, and almost certainly goes on forever in all directions. Logic says so. If the universe ends at some kind of wall, what is beyond that wall? 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 with relative certainty is that about 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 big hole behind. It appears to have been a *decompression*, like unleashing a mass of compacted springs, where the first springs released travel faster than those that follow because there were more compacted springs pushing them. The last springs may hardly have moved at all.

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 three "universes" the facts tell us must exist.

Within our Big Bang Universe is the third kind of universe. It is what we call "The Observable Universe." Figure 2 below shows how The Observable Universe might be situated inside The Big Bang Universe.

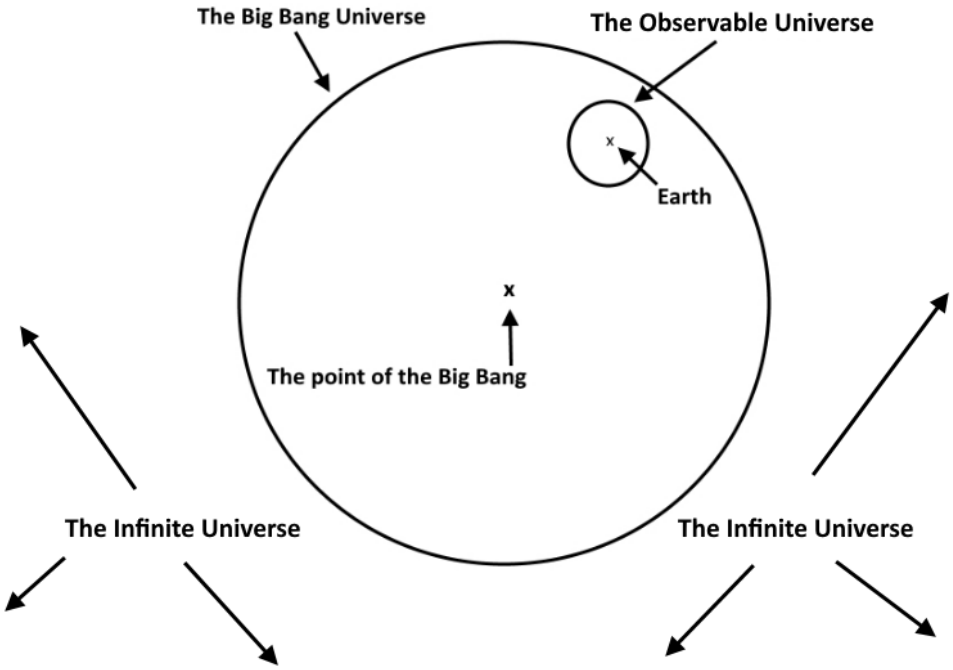

Figure 2

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.

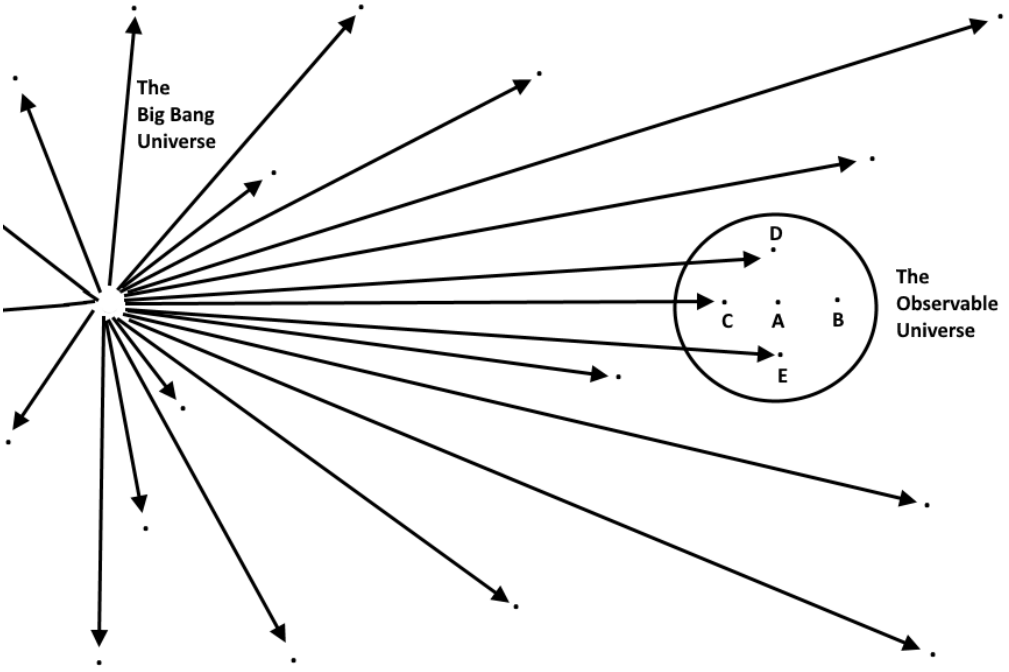

Figure 3

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 about the same 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. Quantum Mechanics.

Unfortunately, that simple and straight-forward explanation of how our universe works is incompatible with Quantum Mechanics. Quantum Mechanics is defined as:

> a theory of matter that is based on the concept of the possession of wave properties by elementary particles, that affords a mathematical interpretation of the structure and interactions of matter on the basis of these properties, and that incorporates within it quantum theory and the uncertainty principle[3]

In other words, Quantum Mechanics is about how elementary particles work, and it really has virtually nothing to do with how the universe works. It is like comparing how a passenger jet airplane works to how the buckles on the passenger seats work. They are not comparable. Yet, for over a hundred years Quantum Mechanics mathematicians have been working to change our understanding of the universe in order to make it fully compatible with Quantum Mechanics. It is all being done under the pretext of unifying Quantum Mechanics with Einstein's theories of Relativity.

Why do they need to unify Quantum Mechanics with Relativity? Because they want "a Theory of Everything." And why do they want "a Theory of Everything"? Because QM mathematicians ***believe*** that everything can be explained with mathematics. And since mathematical rules are fixed, QM mathematicians ***believe*** the universe must fit those rules. In short, they are trying to make the universe fit their beliefs.

III. The Problems.

The first problem is that Quantum Mechanics cannot cope with an infinite universe because empty space cannot be quantified. There can be no quantum of empty space. That means that QM mathematicians, including most physicists and many astronomers, view "the everything universe" as consisting only of two 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 something of unknown size 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, QM mathematicians have created what should probably be called "The Quantum Mechanical Universe," but I'll call it "The Mathematical Universe."

IV. **The Mathematical Universe**.

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

It seems that QM mathematicians can only compute distances between ***objects***. There can be no "Infinite Universe" because such a universe contains no object which marks where the universe ends. To such a mathematician, "empty space" is only found ***between*** objects. That empty space increases as the two objects move farther and farther apart. What are the objects moving ***into***? That is simply not a valid question. If you ask it, you are told that you simply do not understand Quantum Mechanics. Quantum Mechanics may not represent reality as others see it, but it is the only reality QM 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.**[4]**

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.[5]

According to one popular source:

"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*." [6]

According to *Scientific Americ*an 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."[7]

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."**[8]

That same idea appears in many college textbooks. It appears to be the QM 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.

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.

V. Dark Energy

It appears that QM 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.[9]

No one knew what was causing those distant supernovae to appear to be moving at a different speed than newer and closer supernovae. So mathematicians simply 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 what they call "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.

VI. 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."[10]

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 *does not add to* 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.

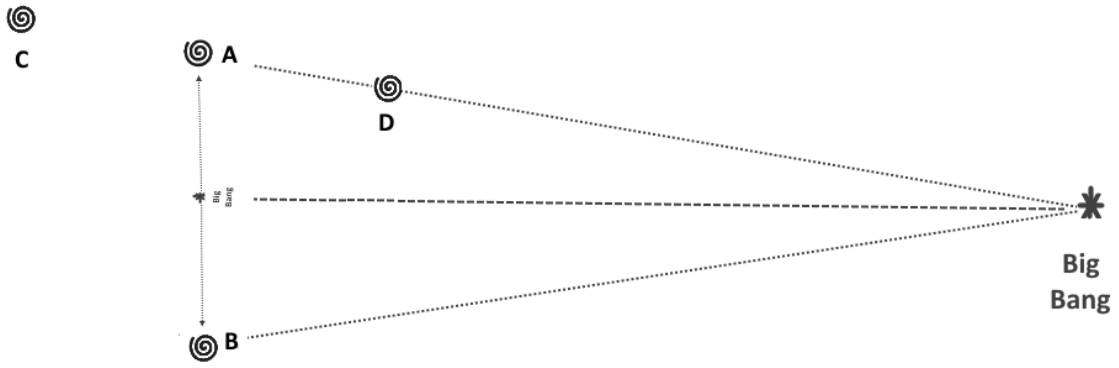

Figure 4

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" as we both move away from the point of the Big Bang. 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 "Big Bang" line midway between "A" and "B." "A" and "B" are moving away from each other at *twice* the speed that each moves away from the center line. And it is only the speed away from that center-line that affects the red-shift, because, as Einstein's Second Postulate implies, "B's" motion away from "A" does not change the light seen by "A," because motion of the emitter does not add to the speed of the light that is emitted. But motion of the observer *does* 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 line which traces back to the point where both "A" and "B" were once together at the time of the Big Bang.

The same holds true, of course, for light from Galaxies "C" and "D." How much the light from "C" is red-shifted as observed by "A" depends upon how much faster Galaxy "C" is moving away from the point of the Big Bang than Galaxy "A". And Galaxy "D's" red-shift depends upon how much slower "D" is moving than "A."

Of course, that suggests a very interesting question: If the universe is expanding, how can there be blue-shifted galaxies?

VII. 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."[11]

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*[12], 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,[13][14] 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 most or all of 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.

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 emitted. 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 emitter*</u> at *v*. Thus the Earth will encounter photons from Andromeda <u>as if</u> those photons were traveling at $c+v$, where *v* is the speed of the Earth relative to the emitter. The light will be blue-shifted due to the Compton Effect (similar to the "Doppler Shift"). The speed of the light will be *c*, but the <u>energy</u> the photons carry will be increased when they are received by atoms moving at *v*.

And, since Quantum Mechanics only deals with motion between objects, and since the speed of light is <u>not an object</u>, Quantum Mechanics cannot cope with anything moving relative to

the speed of light, which is essential to understanding Einstein's Theory of Special Relativity. Thus we have another way that the two theories are irreconcilable.

VIII. 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 because those galaxies were moving away from the Big Bang significantly faster than we are, while the blue-shifted galaxies are actually moving toward us.

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.[15] Light traveling at 299,792,458 meters *per one second*, as one second is measured at the fast moving 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 does light on Earth, even if that light arrives at *c*, we will perceive it as being red-shifted because of the Compton Effect.

This, of course, once again conflicts with Quantum Mechanics and QM mathematicians who cannot cope with variable time or a variable speed of light. A "quantum" cannot be variable, since a "quantum" must have a *constant* value in order to be used in mathematics. As a result, in spite of what many experiments have clearly demonstrated, [16] QM mathematicians simply 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. Interestingly, 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. They have created a universe that they believe works mathematically, but it certainly does not work logically.

Logically, at the point of the Big Bang, time passes at its fastest rate. All motion in the Big Bang universe is relative to that stationary point, which means the speed of an object at that point can be considered to be zero. When measuring velocity time dilation, time can be considered to pass fastest at that point, and time passes at a slower rate at any point that is *not* stationary relative to the point of the Big Bang. Unfortunately, because we do not know exactly where the point of the Big Bang is located, we know of nothing that is stationary relative to the point of the Big Bang. We on Earth move at hundreds of miles per hour (mph) as the Earth spins on its axis, we also move at about 67,000 mph as the Earth moves in its orbit around the sun, and we move at about 486,000 mph as the sun orbits the center of the Milky Way Galaxy, and we move at approximately 1,342,161 mph as the Milky Way Galaxy moves in the direction of the constellation Hydra. If we could somehow negate all those movements, one second for us would be considerably shorter.

In addition, at the point of the Big Bang all matter in The Big Bang Universe can be presumed to be 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*.

IX. Conclusion

Albert Einstein helped invent Quantum Mechanics, but he fought until his death against the QM idea that the universe was governed by mathematical probabilities instead of by deterministic laws based upon cause and effect. Einstein viewed the universe logically and he primarily used mathematics to define thought experiments which would confirm the logic.[17] He considered Quantum Mechanics to be an *incomplete* theory. In a paper,[18] he wrote:

> In a complete theory there is an element corresponding to each element of reality. A sufficient condition for the reality of a physical quantity is the possibility of predicting it with certainty, without disturbing the system. In quantum mechanics in the case of two physical quantities described by non-commuting operators, the knowledge of one precludes the knowledge of the other.

Logically, the Observable Universe is a small portion of the Big Bang Universe, and the Big Bang Universe is an immeasurably tiny portion of the Infinite Universe. The fictional Mathematical Universe described by QM mathematicians who cannot quantify empty space, gravity, variable time or the variable speed of light, merely creates illogical absurdities.

Quantum Mechanics and QM mathematicians cannot cope with the apparent reality of an infinite universe, nor with variable time and the variable speed of light, nor with measuring motion relative to the speed of light. So, instead of dealing with the reality of how our logical universe works, they work to create a universe that fits their mathematics and their beliefs.

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