Direct Testing For the Prevailing Cause of Changing Wavelength in Light

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Abstract: The introduction explains the motivations for this paper. Section 1 proposes direct tests for an expanding space theory of changes in lights wavelength. Section 2 proposes direct tests for lights wavelength changing due to the differently curved space it's in. The goal is to prove empirically which idea is better suited for generalization.

Introduction

When I stand in front of a mirror I do not see myself at this exact moment in time, I see myself as I was and where I was when the light of the reflection left the mirror. When I look at the moon I do not see it at this exact moment, I see it as it was and where it was 2 seconds ago. Looking at the sun I see it as it was and where it was 8 minutes ago. Looking at the stars at night I see them as they were and where they were several thousand years ago.

The HST Deep Field images were even more fascinating because I believed I was looking at galaxies as they were and where they were over 13 billion years ago. Then I found out that according to the theory of expanding space that notion does not apply to galaxies outside our local cluster. I learned that those Hubble images, according to expansion theory, are pictures of infant galaxies soon after the big bang. How could it be, I thought, that the furthest galaxies do not follow the simple rule that is true all the way from mirrors to stars in our galaxy? I learned that expansion theory explains it as thinking of those galaxies as being snails on a rubber band, and as the band expands the snail is pulled further along. That way, the image we see today was created over 13 billion years ago when the infant galaxy and all other galaxies were much closer together right after the big bang. And that image is just getting to us now, when the galaxy is over 13 billion light years away.

That idea was noteworthy because it allowed me to see the reasoning behind the theory of expanding space, and why so many people believe in it. But it did not make me just give up the cherished idea of looking at things in the past, as they were and where they were. Instead, I have several issues with the expansion interpretation of HST images of those furthest out galaxies. First, if we believe that the galaxy was, 13 billion years ago, somewhere else very far away then we have to believe that it is right now at the very spot where the image shows it to be. That means the theory of expansion somehow grants up to the minute information from a picture that is 13 billion years old. Furthermore, this could lead to taking pictures in every direction of every galaxy and saying that we know where all the galaxies in the Universe are, right now at this very moment. No one can say exactly where the Mars Rover is right now because of how long it takes the information to get to Earth from Mars, right next door. How then, can anyone claim to have accurate and up to the minute information on a galaxy 13 billion light years away?

Conversely, the theory claims that it knows where all those galaxies were 13 billion years ago, even though it is a place billions of light years away from the spot they believe it is in at this very moment. I think it is far more practical to believe the HST images are of galaxies as they were and where they were 13 billion years ago.

My second issue with the idea of an expanding universe is that it allows for celestial and terrestrial motion to be following two different sets of laws. Those furthest galaxies have recessional motion, according to the theory, that does not exist on Earth or even in our local cluster of galaxies. If the Newtonian Synthesis is to be undone, and the rules for lights change in wavelength are to be different in different parts of the Universe then I think there should be direct testing to support or invalidate the idea. This paper gives some ideas for ways to directly test those claims. Section 1 proposes two tests that concentrate squarely on whether or not galaxies are receding. Section 2 proposes tests that explain the changes in the wavelength of light as being caused by lights reaction to the curvature of the space it is traveling in, in other words that the curvature of space has a measurable and significant effect on the curvature of light.

Section 1

The first test to find out if the Universe is expanding is to simply count photons. In addition to the usual procedure of measuring many galaxy's once, testing should take place multiple times on individual galaxy's. If the wavelength of light is being expanded by expanding space, and the expansion continues constantly, then the number of photons that reach Earth should be less and less over time. Maybe it is decreased by 1 photon every minute or 1 photon a year, but it is testable with existing technology. It seems so simple that it surely must have already been done but I have seen no mention of it in my searches. While new testing could be started, there must be hundreds of facilities with state of the art equipment that have been measuring the wavelengths of light coming from distant galaxies, which would have data available from 5, 10 or 20 years ago. Those measurements could be compared with measurements taken today from the same equipment. To find proof that wavelength of light from the same source is indeed getting longer would prove the idea of expansion true, while finding no decrease whatsoever in the number of photons over 5-20 years would discredit the idea.

A second test to determine if the Universe is expanding involves angular separation. Any two objects that are receding along lines that are not parallel must be seen to grow further apart over time. If an image is taken today, for example, of a group of far off galaxies then the same image could be taken a year from now from the same equipment and place. Let's say that expansion theory predicts that in 1,000 years two galaxies in the image will appear to be 1 inch further apart. In 1 year, then, the two objects would have to be 1/1,000 of an inch apart, something that must be measurable with todays' technology. It was 100 years ago, after all, that Einstein's theory was proven using arc seconds of separation on equipment made before 1920. As with the test counting photons there must also be hundreds of facilities creating highly accurate maps of the Universe in recent years that could take an image today and compare it to one from 5-20 years ago and accurately test for angular separation. If there is found to be separation then the Universe really is expanding, and if not then an alternative explanation for lights wavelength is needed.

Section 2

The idea of studying lights differing wavelengths as it traveled through space began, and pretty much ended, with the Doppler-style tests in the late 1800's. Redshift became synonymous with recessional velocity after those tests, and became the hard and fast rule when Slipher and then Hubble began finding so many galaxies with redshifted light. At that time, however, no one could venture out into the differently curved space above Earth so they relied on the test done on Earth's surface, and done well inside Earths highly curved space. The redshift=recession rule was extrapolated out into the entire Universe where, incidentally, light spends nearly all its time traveling through space with very little curvature before it gets to Earth from far off galaxies. Today however the ability exists to test lights reaction to variations of curved space just above Earth's surface to see if redshift always equals recession.

The tests in the late 1800's involved 3 steps: light source and observer stationary with respect to each other, light source receding from observer, and light source approaching observer. The test where source and observer were stationary with respect to each other showed no change in lights wavelength, while the test where source and observer were receding showed an increase in lights wavelength. It seems sensible for the testers to believe at the time that redshift always equals recession, but what if those results are only true when the tests are done on the surface of a planet, inside highly curved space?

What if, for example, a test was done again on Earth's surface between an observer and light source that are stationary with respect to each other and 2,000 miles apart. The test would no doubt show no change in lights wavelength. But what if the same exact test was repeated with both source and observer 1,000 miles straight up off of Earth's surface? Would lights wavelength change slightly as it covered the 2,000 miles? The test could be done in increments even out past the orbit of the moon to see if the wavelength of light between 2 stationary observers always showed no change. It would also be interesting to test in increments that increase the distance between source and observer to see if length of time in space with little curvature effects lights wavelength. What would it mean if lights wavelength grew from a stationary source in space of low curvature?

The test on Earth between a light source and observer receding with respect to each other could also be done in a similar fashion. Certainly the test on Earth's surface would show the wavelength of light to increase, but what would happen to the lights wavelength as the tests were done higher and higher up and then at further and further distances apart? Would the redshifts increase as compared to the tests done on Earth's surface? What would it mean if the wavelengths did not increase in less curved space? The most interesting result, however, would be comparing the recessional tests to the stationary tests. What would it mean, for example, if the stationary tests gained more wavelength than the recessional tests compared to the test done on Earth's surface? When it came to the part of the tests where the distance between source and observer were increased, if the distance was repeatedly doubled and measurements of lights wavelength taken each time, would it be the stationary or recessional tests that more closely resemble Hubble's Law?

It would also be interesting to do these same tests perpendicular to Earth's surface rather than parallel. Let's say a light source and observer were 2,000 miles separated and stationary with respect to each other, with the observer on Earth's surface and the light source 2,000 miles up. In this stationary test the observer would see light blueshifting, as compared to no change in wavelength when observer and light source are both on the ground. If, on the other hand, the observer is 2,000 miles up and stationary to a light source on the ground wouldn't a redshift be measured? What would happen if source and observer were not stationary but receding while one is on the ground and the other is 2,000 miles up? Would recessional velocity make a difference in lights wavelength? If the observer was stationary 2,000 miles up and the light source receded down towards the Earth wouldn't a blueshift be measured because that's what light does as it enters Earths curved space? Conversely, if the observer was stationary 2,000 miles up and a light source approached wouldn't a redshift be measured? Both of these would contradict the tests done with both observer and source doing tests on Earth's surface. The point I am trying to make here is that the Doppler style tests done in the late 1800's were just the first chapter in a book that has yet be finished. Granted, if it is ever written, would look quite different from the book being used today but it would be empirically based and stay within the limits of our ability to know.

These tests are necessary but would be expensive and take quite a bit of time to complete. A faster and less expensive way to extend Doppler-style tests out into space of very low curvature would be to use the velocity of the Earth as measurements of lights wavelength are taken in varying situations. Granted, again, that expansion theory guards itself by saying that there is no velocity creating the redshifts that are attributed to expanding space, the theory was in fact born out of velocity being the cause of redshifts. Since there would be no expansion theory without having used those initial velocities, doing tests using velocity has a precedent it can follow.

One such test using Earth's velocity and changing positions to test changes in light's wavelength would require nothing new to be built and take only 9 months to complete. The 9 months is the time it takes Earth to complete ¾ of its orbit around the Sun. In this test consider the Sun to be at the center of a clock while the Earth travels around the perimeter. At the beginning of the test the Earth is at the 12 on the clock and a target galaxy is chosen, one that is far outside our Local Group and in a position so that the Earth is between it and the Sun. A measurement of its wavelength is taken from a facility on the ground. Three months go by and the Earth is now at the 9 position on the clock and receding from the target galaxy at 67,000 mph, at which point the facility takes a measurement of the galaxy's wavelength. Three more months go by and the Earth is at the 6 position on the clock, with the Sun now between it and the target galaxy. The timing for the tests, however, has been chosen in advance to coincide with a lunar eclipse that will allow the measurement of the wavelength of light from the target galaxy. The facility takes its measurement just as the light is being bent by the Sun curved space, similar to Eddingtons test for General Relativity. The last three months go by and the Earth is at the 3 position on the clock. It is now approaching the target galaxy at 67,000 mph, and a final measurement of its lights wavelength is taken.

Comparing the measurements taken at the 9, 6 and 3 positions to the initial baseline measurement would be interesting. Would the receding measurement be a slightly longer wavelength than the baseline, while the approaching measurement showed a slightly shorter one? If so, would that mean that expansion had sped up or slowed down during tests done in nonexpanding space? The eclipse test is probably the most interesting though. If the wavelength of the target galaxy is shorter when it is measured during the eclipse, as opposed to the baseline, then that must mean either the expansion slowed down in that area or that the galaxy got nearer to Earth for the test. Or, more likely it means that the measurements we take are highly dependent on the curved space the light is in, whether that is the curved space billions of light years away or in this solar system. If the tests do show a difference , it begs the question of how the effect on lights wavelength during billions of years of traveling through expanding space can be undone in just minutes inside this solar system.

The baseline test can also be used in another way, with more measurements taken from the same facility, and on the same day as the baseline measurement itself is taken. That baseline test would have been taken with the target galaxy essentially straight up in the sky in the middle of the night. It would be interesting to see if the wavelength of light is changed at all if measurements are taken just after dusk and just before dawn. Just after dusk the ground based facility would be 'approaching' the target galaxy because of the Earth's spin, plus the angle of the telescope would be nearly horizontal which is similar to the Doppler –style tests done on Earth's surface. The light from the target galaxy would not be coming straight down into Earth's gravity, but perpendicular to it. Conversely, if the test was done just before dawn the facility would be 'receding' from the target galaxy as the Earth rotated. Would there be differences in these measurements because of the angle of the telescope, or could there also be differences from the rotational velocity of Earth?

Another similar test could be done by the same facility, on its 9 month journey, but one that tests for the effect from the curved space of our galaxy on wavelength of light coming in from far away galaxies. Two target galaxies would be chosen that are the same distance from Earth, as measured by Cepheid variables rather than wavelength of light. One would need to be in a position so that its light must travel through the center of the Milky Way galaxy to get to Earth. The other would need to be in the opposite direction, so that its light comes through just the outskirts of the Milky Way to get to Earth. The light from the former would have to travel through 80,000 light years of curved space inside the Milky Way, while the latter would only travel 20,000 light years inside the Milky Way. The former would also travel through the more highly curved space that is at the center of the galaxy. Does the 80,000 year light have a shorter wavelength than the 20,000 year light, and if so is it 4x the effect?

This is a good test to see how long it takes for lights wavelength to adjust to the curvature of the space it is in. We know this adjustment time can't be instantaneous because we get different measurements for most objects seen from ground-based facilities. If light did instantly take on the curvature of the space it enters we would get all identical measurements. The 80,000 and 20,000 year times should be long enough to get an estimate of this adjustment time. The resulting proportion should correlate to changes in wavelength recorded in the Doppler-style tests at the beginning of Section 2. Since we know that light does not instantly gain curvature when it enters space more highly curved than that between galaxies, it stands to reason that it also does not instantly lose curvature when it leaves a galaxy and enters very low curved space. The proportions found in these tests should also correlate with lights increasing lack of curvature as it travels from increasingly far off galaxies.

Closing

The tests proposed in this paper are designed to find out if the theory of expanding space can stand on its own, barely including the effects of curved space, or if the curvature of space we call gravity needs to be considered the prevailing cause of lights changing curvature as it travels through the Universe. It seems unwise to ignore gravitational effects on light, and instead focusing on an expanding space that can never be proven, when we know that gravity and light are constant traveling companions from any source we measure in the Universe, and that the ability now exists to prove that there is only one type of space necessary to explain lights changes. Expanding space is an increasingly superfluous concept, and one that undoes the simplicity of the Newtonian Synthesis.

An example of how the belief in expanding space hinders progress lies in the balloon analogy, which is commonly used to explain the expansion of the Universe. Expansion theory leaves gravity out of the picture, but we know that gravity is pervasive throughout the Universe, and so the balloon analogy falls apart when gravity is allowed back into the picture as I hope the test begin to do. The tests should show that our measurements of any light source depend on the curvature of the space we are in when we take them. Since there is probably at least one civilization in every galaxy, there are probably 100 billion other civilizations out there on planets in different galaxy's that must have differing levels of gravity. Every ones measurement, then, of lights wavelength will be different. Since the Universe must expand at one rate, and not 100 billion different rates, the gravitational effects on light must be used to fix that problem. It begs the question of why believe in expanding space in the first place. Earths view of an expanding universe, then, is a special frame of reference not seen the same throughout the Universe. Some civilizations on planets with less gravity than Earth will see a more accelerated expansion, while civilizations on planets with more gravity than Earth will see a slower rate of expansion and possibly even a Universe contracting on them.

This 'contracting' version of the Universe could be happening much closer than expected. The light from our neighbor Andromeda is blueshifted, and interpreted to mean the galaxy is moving quickly towards ours. Has there been, however, multiple tests done over the years to confirm this or is it just being assumed? If it has not been confirmed by repeated testing then it is more practical to believe the Andromeda might have more highly curved space than us, which means the balloon analogy does not even extend to our next door neighbor.

My goal with these all the tests in this paper is to show that the original Doppler-style tests in the late 1800's might not be the end of the story, but rather a beginning. Right now those tests just mean an expanding Universe, end of story. There could however be much more waiting to be discovered, like the proportion of how light changes wavelength in differently curved space, for example. Eventually those original tests could be seen as ½ the proof that light also obeys an equivalence principle. Those tests showed how light responds in highly curved space, how it 'feels' gravity, but it has yet to be proven how light responds to acceleration of its source in space of little curvature.

Both ideas , expanding space and curvature of space, agree that light gets very, very flat out in the abyss between galaxies. It's just a matter of choosing the most practical way to explain it. The one that is the most empirical and that keeps the Newtonian Synthesis intact is the wisest choice.