Two Simple Proofs the Speed of Light is Variable

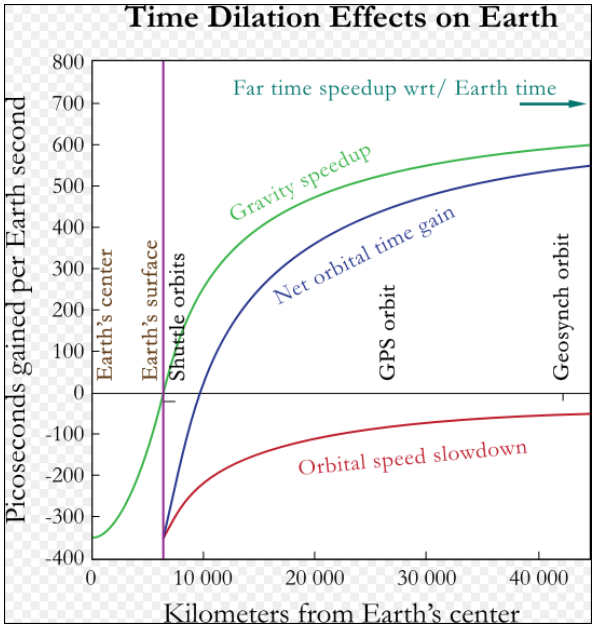
By Gene Preston March 1, 2015

It's well known that the speed of light in a vacuum is a constant. Well actually it's a measured constant. And furthermore it's only a measured constant if measured locally. By locally, I mean there is a clock to measure the time and a ruler of a known fixed length $\llcorner$ over which we will propagate an EM wave and measure the time of transit $\top$. Then the speed of light $c = \llcorner/\top$. c does not change as we relocate the experiment, so we conclude the speed of light must be a constant.

I will show this cannot be correct. Nature has fooled us. We have not carefully examined what would have happened in our experiment if c were variable. This examination will show that c <u>cannot</u> be constant if c is a measured constant.

Taking a closer look at an experiment measuring the speed of light:

We have an atomic clock with a local oscillator with frequency *Fo* down on the surface of the Earth. If this atomic clock is raised to a higher gravity potential the frequency will increase in accordance with the green line on the graph below:



Source: http://en.wikipedia.org/wiki/Gravitational_time_dilation#mediaviewer/File:Orbit_times.svg

The First Experiment:

As we rise above the Earth, the clock frequency is $F=F_o(1+p)$ where p a function of the height above Earth, i.e. the green line.

In our test equipment we will count the number of "ticks" N from the clock as the wave is propagating over a short path ⌣ (within the lab). Let N_o be the number of counts observed when doing this measurement on the surface of the Earth. As we move the experiment to a higher elevation let the count be N, although we know that $N=N_o$ (always) because that shows a constant speed of light. However, we just made an assumption mistake, which becomes apparent below.

Here is nature's trick on us. The only way $N = N_o$ always is if the speed of light is not constant. We know that a variable N would be inversely proportional to C and directly proportional to the clock frequency F as shown in this equation:

$$(N/N_o) = (F/F_o)(C_o/C)$$

However we always observe that $N = N_o$.

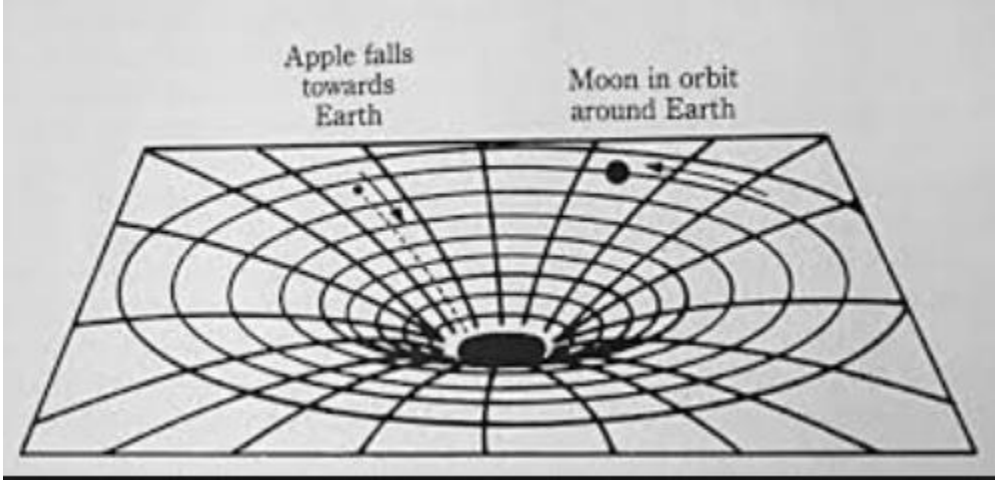
$$(N_o/N_o) = (F_o(1+p)/F_o)(C_o/C)$$

$$C = C_o(1+p)$$

The speed of light has to be variable to in order to get the experimental result that $N=N_o$. The clock frequency is increasing as the speed of light is increasing which causes the measured speed of light to appear as a constant on our N counter. It's ironic that a measured constant speed of light requires that the actual spatial speed of light must be treated as a variable in a vacuum.

What about the metric interpretation of gravity and the observation that the speed of light is a constant in the metric stretching of space model? Let's call the variable speed of light model a flat map space model in which the observer does not need to consider stretched space. This is best illustrated using the curved space interpretation we are used to looking at as shown on the next page.

Curved Space Interpretation:



What is important to note in this graph is that all the circular grid increments are equally spaced along the curved radial lines. The depression is the metric stretching of space necessary when the speed of light is interpreted as a constant by an observer moving along one of the radial lines. An observer of a light wave moving inward would see a constant speed of light. However to observe this performance the observer would need to travel along with the wave as it moves inward. This is idealized since it's not possible to move along with the light wave. Even though our clock frequency is dropping as we move toward the center, we would not be able to observe any frequency change. Likewise, we would not be able to observe any change in the metric stretching or shrinking of space (change in ruler lengths or grid spacings) while we are inside that affected space.

Flat Space Interpretation:

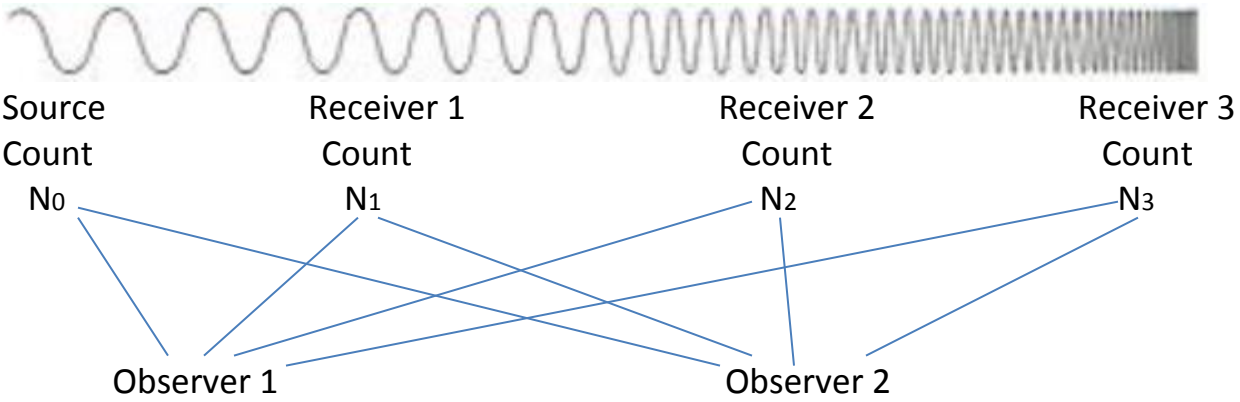
If we looked down on this graph so it appears flat, the circular grid lines would appear to become more closely spaced as we move toward the center. As a remote observer, we would see the metric space shrinking and the speed of light slowing down. To us at our remote location outside the affected space, we would see the frequency remain constant for waves traveling inward, although the clock frequency of a clock moving along one of the radial graph lines would change in frequency in accordance with $F=F_o(1+p)$ and variable speed of light $C = C_o(1+p)$.

The Second Experiment:

We have a second proof that the speed of light must be a variable utilizing the fact that EM wavefronts are conserved. The conservation of wavefronts is an even stronger law than the constancy of the speed of light. There is not a speck of evidence that wavefronts are created or destroyed over propagation times of billions of years through space. If individual wavefronts were created or destroyed, the spectrum information of very distant stars and galaxies would not be well preserved. Noise would be introduced, fuzzing the observed light, since losing an individual wavefront in flight is an integer process, not a linear one.

The Conservation of Wavefronts shows us a considerable amount of new info:

Consider the following test setup spread over a vast amount of space in which EM waves leave an area of high gravity potential and enter one with low potential. Along the route are receivers that just count the number of waves passing by that station and display their number on a digital display that remote observers at two locations can observe the displays on all the four sites stationed along the wave.



Note that the source and receivers do not have atomic clocks or any kind of clocks at their locations. There is just a simple oscillator of any frequency at the source and the receivers don't even have a frequency readout. They just have displays that show the number of waves passing by their points from a steady state carrier. None of the objects above are moving. Only the EM wave is moving. The entire system is in a vacuum of highly variable gravity potentials. The observers do not need accurate clocks. What these observers see is important after a continuous carrier in steady state for a long time so that the EM wave has arrived and is passing all the receivers.

What both observers see is that the counts N_0 N_1 N_2 *and* N_3 are all synchronized. The rates of counts at all locations is the same as far as each observer is concerned. However the two observers may not agree on the frequency of the counts per second, but they both will agree that all the *N* values are counting at the same rate for each individual observer. What can we now conclude from this experiment?

Conclusions from the Conservation of Wavefronts experiment:

1) Wavefronts are indeed conserved, none are created or destroyed.
2) Since each observer sees constant count rates at all four locations the frequency of the wave is constant along the path.
3) Because each observer sees a constant frequency we can conclude that all observers in the universe would arrive at the same constancy of frequency.
4) The frequency of a wave is not changed while in flight working against a changing gravity potential.
5) That the frequency does not change in flight means that an observer looking at the source knows for sure that the color of the wave or frequency of the wave that leaves the source remains the same, i.e. the observer is looking at an unmodified wave, and is actually seeing the source of the wave from its source.
6) When the experiment was initially turned on, there would be a difference in the total count at each receiver, thus the number of wavefronts between stations would be known and would be constant.
7) The observers might have a map of flat space or warped space showing the locations of the source and receivers. The warped space map might use the assumption that the speed of light is a constant and try to map evenly spaced wavefronts along the path to account for the differences in counts between the receivers. However, it would be simpler to use a flat map of the space between the receivers and then show the waves more compressed as gravity potential is lower, as is shown on the previous page. If this is the case, then we would have to say that the wave slows down as the wavefronts compress in the flat space.
8) So the observers viewing remotely a flat space between the receivers would observe that the frequency is constant so that F = speed/wavelength and the only way wavelength can compress is for the speed to slow down, thus the speed of light has to be treated like a variable and not a constant.

Note that in the 2nd experiment, frequency is constant, resulting in a variable speed of light. In the 1st experiment, frequency was variable, which also resulted in a variable speed of light. Certainly for a flat interpretation of space the speed of light will need to be considered as being variable.

Where Do We Go From Here?

1) Obtain the General Relativity formula for *p* in the previous discussions and recreate the green curve. (the discussion below was inserted 3/21/2015)

   The Pound-Rebka experiment web page gives the frequency shift formula as:
   http://en.wikipedia.org/wiki/Pound%E2%80%93Rebka_experiment

$$f_r = \sqrt{\frac{1 - \frac{2GM}{(R+h)c^2}}{1 - \frac{2GM}{Rc^2}}} f_e$$

   Letting $f_r = f_e(1+p)$ then we see *p* is the above root expression minus 1
   If we had originally defined $f_r = (p) f_e$ then *p* is the root expression which is probably more convenient a form to play with so let's use that definition.

2) Use the GR formula for the *p* green curve and verify that it produces the correct relativistic bending of light when passing near the Sun. (3/21/2015)

   Inserting into a computer program http://egpreston.com/rel.txt I see that the bending of light around the sun is calculated as

3) Use that formula to verify that there is a direct relationship between mass, the change in mass for different gravity potential, the force of gravity, and the change in the metric length, i.e. Einstein's curved space.
4) Recognize that gravity may have a non linear component at the size of galaxies, i.e. John Moffat's hypothesis. Use his modified gravity MOG to determine the G_1 term in this equation:
   $F_{gravity}=(Mm)(G_1/r + G_2/r^2 + G_3/r^3 + G_4/r^4 + ...)$ where
   G_1=~5E-27 G_2=~6.67E-11 G_3=~.0001 G_4=~.007 mks G_1 is significant at the size of galaxies and this coefficient will be updated using John Moffat's MOG.

G_2 is Netwon's gravity, G_3 may be the "5^{th} force", and G_4 is the nuclear force.

5) Look for a different formula for *p* similar to the GR formula that is the series expansion of the above equation for $F_{gravity}$ and when MOG and Newton terms are applied to that formula, the G_3 and G_4 terms are automatically predicted.
6) Verify the new MOD formula does agree with observed physics at all levels from the size of protons to the size of galaxies.
7) Show that dark matter and dark energy are explained using everything derived thus far. John Moffat solves the dark matter problem. I intend to show that dark energy is caused by a slower rate of time flow for the early universe because it was smaller and operated at a lower gravity potential, i.e. a negative *p* in the previous equation, and that coupled with the constancy of frequency when radiated from stars in that early universe cause the apparent red shifting to be larger than it actually is. I.e. there are two components to accelerated red shifting of the early universe, both recession velocity as well as gravity red shifting due to a lower *p* of the early universe. I.e. *p* is increasing all the time at the present time for the entire universe because of its expansion.

Previous posting on my web page:

Conservation of wavefronts starts a new path for linking Gravity to QED.

Apparent Speed of Light is a Constant

Everyone knows the measured speed of light is a constant. We also know that clocks slow down and dimensions shrink as we approach a mass. If this time slow down and dimension shrinkage is in proportion, then we would always observe the same speed of light even if it were not constant. What we are observing is that the apparent speed of light is a constant. Our experiments have not actually calculated the absolute speed of light. A variable speed of light would cause the gravity force, which we do observe. Therefore, it is most likely that the speed of light is variable and causes the gravity force.

Here is a nice reference about gravity bending light.
Derivations showing the effects of allowing a variable speed of light.
Restricting gravity to positive potentials can explain the Pioneer 10 anomaly.
Exotic explanation for pioneer anomaly ruled out.

Take a look at my derivation on the Pioneer 10 anomaly. I show that $2/7^{th}$ of the error is modified gravity and the rest must be the heat related force. This comes about by accepting the measurement results of Australians that the force of the gravity on the surface of the Earth is about 2% smaller than it should be. I correct G_1 to be ~4e-28.