PAPER II
VELOCITY AND ROD LENGTHS

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ABSTRACT

The Michelson-Morley experiment, which was conducted deep in the earth's gravitational field, in addition to being an invalid test of the earth's drift through an ether, does not speak to rod length considerations. Likewise no experiment has confirmed that rod length contraction is associated with increased velocity. Einstein defined the passage of time as that which is indicated by the ticking of clocks. Ignored was the period or interval between ticks which change inversely as the ticking rate. Einstein's favorite thought experiment in which one travels with light suggests an alternative, in which a parallel relationship exists between clock ticking rate and the period or interval between ticks on the one hand and distance measurement and measuring rod length on the other.

THE ANALYSIS

I want to use some poetic license in the first portion of this paper for a couple of reasons: (1) I wish to clearly separate this paper stylistically from Paper I, so it is clear that the validity of each paper is not tied to the correctness of the other. (2) I want the numbers used to be easy to track as a little more complicated mathematical symbolism is used.

I will start the discussion with a parable, then progress to the section with the complicated symbolism, and end up with a more straightforward mathematical approach.

A PARABLE

King Henry is an absolute ruler whose castle is situated in a place far out in space which experiences no gravity. "How can this be?" one may ask. "What is to keep the king and all his subjects from flying off into space?" Well this was a magic kingdom.

King Henry recognizing the need for a system of measurement has modestly declared that the master unit of distance shall be one tenth of that run by his own royal self in ten seconds using one of his two favorite clocks which tick at the same rate in his kingdom. The King defined the interval between ticks as the standard second.

The king has also asked Prince Henry Junior to do likewise in the Land of Oz using the second clock. Both distances are to be run and marked off on royal carpets which are to be maintained as official standards of measurement.

The following events are testified to by Merlin, King Henry's royal counselor, and the Wizard of Oz, the Prince's advisor. They use magic whenever necessary to communicate and ascertain the Real Truth. So they can know how many ticks are occurring on the king's clock, even when they are in Oz. They decided to play a trick on the king and prince by making clocks in Oz tick only five times per each ten clicks of the clock in the Home Kingdom and stretching the carpet in Oz to double the length of that in the home kingdom.

The magicians made sure that both the king and the prince started their races at the same universal time and verified that their velocities were identical. The king quit at the end of ten clicks and Merlin marked off the Home Kingdom's carpet into 10 equal master units.

But the prince's clock had only clicked five times so he kept running for five more clicks, after which the Wizard marked off 10 master units on the carpet which became the official standard for the Land of Oz.

The king believing that by definition he was running 1 unit per tick was certain that he had run ten units. Viewing the prince's effort, he felt that Junior had run twice as far as he was instructed to do.

The Prince likewise regarded his own achievement as accurate and he could not understand why the king had quit when his job was only half done. He must be getting old.

Merlin and the Wizard, who were beside themselves with mischievousness, asked the prince to measure the standard reference rod in the home kingdom using the reference rod from Oz, which they froze in length. The prince found the rod in the home kingdom to have apparently contracted, which is what Merlin and the Wizard knew that special relativity predicted.

They told the king to measure the reference rod of the Land of Oz using the standard reference rod of the home kingdom, which they also froze in length. The result confirmed that the reference rod in the Land of OZ had expanded. The King called in the magicians to explain what was happening. Using their magic they were able to show king and prince that the clock in Oz was ticking at half the rate of the Home clock and that calculations based on said clock used with the longer rod produced the same velocity as would the king's Home clock and shorter rod. They noted that the moving seconds were twice as long as the reference seconds so that in ten seconds on Oz Junior had run twice as far.

The king asked the magicians why he should not lop off their heads. Their defense was that they wished to provide the king with an important insight regarding the way the universe functioned and a concept called timeliness. They explained that their trick was accomplished by having the Land of Oz fly through the universe with a much greater velocity (0.866c) than the Home Kingdom possessed (0).

THE THOUGHT EXPERIMENT

In paper I assert that the Lorentz formula, derived to account for the null results of the Michelson-Morley experiment, is an artifact in that instance, reflecting the difference between the expected results and those which occurred. That does not mean that I challenge the essence of special relativity. Nor do I believe that the Lorentz formula is not relevant. Indeed, I will use it below, but feel free to apply some critical analysis regarding the phenomena underlying its application.

Experiment supports SR's prediction that clocks in a moving frame tick less often than when they are in a rest frame and it seems reasonable that chemical processes and aging must follow suit.

But in addition, I assert that quantum mechanics requires that the Bohr radius be greater in frames than in rest frames and that objects and measuring rods (defined meters for example) are thus correspondingly longer in moving frames. In fact, I show later that both the *lengthened intervals between ticks, which produce the fewer ticks of moving clocks, and the lengthened rod lengths, which permit fewer meter rods to measure a standard distance, are tied to the same quantum mechanical phenomenon*, which can be viewed as due to the changed relationship exhibited between orbital and forward velocities of radiating particles within atoms.

Now, one can define time any way he or she wishes, so one can define time as the ticking of clocks. But there can be a price to pay in accuracy of understanding if the theory behind such accounting is not in conformance with objective reality.

As the guard in the movie *Hud* tells him, "*You need to get your mind right, Boy*"! Here is where we try to do that by applying the requested poetic license to a thought experiment.

Imagine a spaceship sent from the earth to the moon with astronauts, a clock and a meter long measuring rod aboard. The distance to the moon is known by both the astronauts and their controllers on the earth. *Presumably the distance to the moon does not change significantly because an itty bitty spaceship is on its way there*. <u>It is the measurement of this distance that changes</u>.

Factoring out the effects of acceleration and deceleration and applying only the effects of the constant spaceship velocity, the clock on the spaceship ticks fewer times than when it was on earth and, as is posited here, the measuring rod and other objects lengthen. So to measure any given distance the number of spaceship rod lengths is fewer than if the spaceship were stationary.

Let $\#_{TS}$ refer to the number of ticks by a clock on the spaceship, and $\#_{TE}$ to the number of ticks to by a clock on earth.

The number of ticks on the spaceship clock compared to one on earth is $\frac{\#_{TS}}{\#_{TE}} < 1$.

Let the length of the metering rod on the spaceship be L_S and one on earth be L_E. Then the length of the metering rod on the spaceship compared to one on earth is $\frac{L_{RS}}{L_{RE}} > 1$. Since meter rods and other objects lengthen proportionately, $\frac{L_S}{L_E} = \frac{O_S}{O_E}$. Thus an object measured on board will measure the same length as it did on earth.

Asking for big time forgiveness to make calculations simple, assume that the spaceship is traveling with the ridiculous velocity of 0.866c. Since $(0.866c)^2 = 0.75c^2$, applying the Lorentz transformation based on $\sqrt{1-\frac{v^2}{c^2}}$ gives $\sqrt{1-\frac{0.75c^2}{c^2}} = \sqrt{0.25} = \frac{1}{2}$, so $\frac{\#_{TS}}{\#_{TE}} = \frac{1}{2}$.

Since SR says # ticks equate with time passed, when the spaceship transverses the fixed distance from the earth to the moon, its clock will accordingly indicate that half the time has passed as the earth's clock indicates. From this it follows that if and when both clocks produce the same number of ticks, indicating according to SR that the same amount of time has passed, the space ship must traverse twice the distance as measured by earth. What's up?

When astronauts measured an object in the spaceship when it was on the ground using their own ruler, they got the same measurement as the controllers did using their own ruler. Assume 1 meter was measured by both groups. In flight the object will double in size per this model, but so will the ruler and the astronauts using their double sized meter stick will still measure the object as being 1 meter long.

But if astronauts in flight could measure the earth's meter using their own ruler, they find the earth meter measures half as long $\frac{L_{RE}}{L_{RS}} = \frac{1}{2}$.

If the controllers could measure the spaceship's meter using the earth ruler, they find that the rocket meter measures twice as long $\frac{L_{RS}}{L_{RE}} = 2$.

The astronaut's measurement of the distance between the earth and moon will contain half the number of spaceship meters, each of which is twice as long as a earth meter. So velocity remains the same, since both the time elapsed and the number of meters is halved and the halves cancel. $V = \frac{\#_{RS}}{\#_{TS}} = \frac{\frac{1}{2}\#_{RE}}{\frac{1}{2}\#_{RE}} = \frac{\#_{RE}}{\#_{TE}}$, so the calculated velocity remains the same.

This, not by accident, parallels the relationship leading to the calculation of the constant velocity for light.

$$c = \frac{\#_{RS}}{\#_{TS}} = \frac{\frac{1}{2}\#_{RE}}{\frac{1}{2}\#_{TE}} = \frac{\#_{RE}}{\#_{TE}} .$$

But another important association becomes apparent when one realizes that reducing the number of ticks is quantum mechanically due to the increases of the period between ticks, I, just as decreasing the number of rods required to measure the same objective distance is quantum mechanically due to the increase in rod lengths, L. Thus, $\#_T \times I = k$ is analogous to $\#_R \times L_R = k$. So the measurement of $\#_T$ time per SR and the measurement of length $\#_R$ are each inversely to quantum mechanical processes that are tied to each other within the atom. The reasoning behind quantum mechanical details will be discussed in more detail below.

In the meantime, a measuring rod length is proportional to physical object length experiencing the common motion of any given inertial frame. $\frac{R_{L1}}{O_{L1}} = \frac{R_{L2}}{O_{L2}} = k$.

LOOKING AT THREE FRAMES, ONE AT REST AND TWO IN MOTION

Let frames, A be at rest. Let B travel east at 0.866c and C travels west at.0.866c. Therefore in relation to A the clocks on both B and C tick at half rate and both of their rods double.

But using the Einstein's relative addition of velocities formula, B and C's relative velocities are approximately 0.99c. According to SR (and this model's view of rod lengths), each should experience clocks that tick at 0.14 the rate of the rest frame and rods that dilate by about 7 times:

$$\sqrt{1 - \frac{(0.9897c)^2}{c^2}} = \sqrt{1 - 0.9795} = \sqrt{0.205} = 0.14 ; \qquad \frac{1}{0.14} \approx 7$$

The result is that their internal measurements do not indicate a change in values and neither does their measurements of each other.

The same results are obviously obtained if they both travel east or both travel west as their relative difference in velocity is 0.

MORE RIGOROUS TECHNICAL ANALYSIS

The velocity and the slowing of clocks and the Bohr radius

Even though photons are absorbed and emitted from particles such as electrons, Bohr was, because of energy considerations, able to tie the frequency of emitted photons in a stationary atom to electron shell radii. Electrons in moving atoms still must orbit the nucleus, so here we consider the impact of velocity upon the wavelengths of a moving atom in terms of the Bohr radius[2,3] $a_0 = \frac{4\pi\varepsilon_0\hbar^2}{m_e e^2} = \frac{\varepsilon_0 h^2}{\pi m_e e^2}$, which will be used as a proxy for the behavior of all atoms. Emitted wavelengths are described by the formula $\lambda_e = \frac{8\varepsilon^2 h^3}{me^4}\left(\frac{n_1^2 n_2^2}{n_1^2 - n_2^2}\right)$ and is associated in a positive sense with the square of the Bohr radius[1], that is $\frac{\lambda_e(t_1)}{\lambda_e(t_2)} = \frac{a^2(t_1)}{a^2(t_2)}$

One finds that the complete story cannot be told if everything but mass is treated as constant. Thus, if the mass of the electron in the denominator of the these formulas is treated as the only non-constant and increases with velocity, as special relativity asserts the result is a decreased Bohr radius and emission wavelength in contradiction with experiment where increased motion is associated with a longer wavelength. So something else must play a role.

A likely candidate for contributing to the correct effect would appear to be the adjustable parameter the permittivity of the vacuum ϵ[7], which fortuitously is located in the numerator. Thus, its increase would be associated with an increased Bohr radius and vice versa.

To those who would object to having a constant like permittivity change, the author notes that the "foot has already be stuck in the door" at least twice

The first foot through the door is that permittivity has been shown to be dependent on spacetime geometry[4] in that The permittivity Є has been shown to be related to the Friedmann radius in the following manner. $\frac{E_1}{E_2} = \frac{\in_1}{\in_2} = \frac{a_1}{a_2}$ [4] which happily is consistent with this Paper I's assertion that the velocity of light varies with the state of expansion of the universe. E stands for energy and a for the Friedmann radius.

The second foot through the door is the fact that the value of the fine structure constant has been shown to be dependent on the energy of the probe that senses the charge. The value is 1/128[8] in high energy experiments as apposed to the conventional 1/137. The fine structure constant is so called because it is a composition of other constants. So, it is obvious that one or more constants change. This issue will be examined more thoroughly shortly.

At any rate, the change in the effective permittivity on the Bohr radius may be reflective of an effective weakening of the propagation of forces related to timeliness factors discussed below.

The permittivity ϵ is a form of resistance. Insight can be gained by considering the analogous situation in electricity where the current I = E/R. The same relationship exists between columns E and D in table A included at the end of this paper. The propagability of light in column E is the result of dividing column D into unity (or C_0). Column D can be thought of as doing double duty. (One column was used to save space.) It can be thought of in part as a measure of external response to the condensation process described in Paper I and in part as a measure of the internal resistance to photon propagation.

Thus, column D can be regarded as analogous to the permittivity of free space. If my intuition is accurate, the formula for the Bohr radius might be modified to $a = \frac{(1+\frac{v_g}{c})h^2}{\pi m_e e^2}$, which shall be justified further below.

The frequency of light emitted by the hydrogen atom in quantum transition between n_1 and n_2 is $\nu_e = \frac{m_e e^4}{8\varepsilon^2 h^3}(\frac{1}{n_2^2} - \frac{1}{n_1^2})$. Note that permittivity is squared while mass is not so it would trump the effect of mass on frequency. The emitted frequency has an inversely relationship with the square of the Bohr radius $\frac{\nu_e(t_1)}{\nu_e(t_2)} = \frac{a^2(t_2)}{a^2(t_1)}$

Timeliness and rod lengths

But how does increased velocity bring about this relationship? One way to understand this phenomenon is to do another thought experiment similar to those Einstein did.

It is apparent that the change in frequency can be explained in terms of timeliness and relative motions. *Increased forward velocity of an atom affects the relative orbital velocity* of an electron around the nucleus, since the nucleus has only to increase its forward velocity while the electron "maintains" an orbit in addition to increasing its forward velocity. Consider a fictional hydrogen atom traveling at the speed of light. It is obvious that since matter cannot exceed the speed of light, the electron could not orbit any longer. The best it could do would be to travel a parallel path with the proton. Odds are that it would have headed off into the sunset long before reaching the speed of light. In short as the velocity of the atom is increased, some of the orbital velocity of the electron is converted to forward velocity and the relative time for orbiting the nucleus is decreased.

Another way of viewing the same phenomenon is to think of the orbital velocity remaining constant while the forward velocity increases. If the values in column D are used as representative forward velocities, then the values in column E become representative of the relative orbital velocities.

This model posits that the velocity redshift and the gravitational redshift are tied to the same dynamics, namely the relative flow between atoms and the spatial medium, by whatever name it is called. In the case of the gravitational redshift and a stationary atom, the flow is that of the gravitational field. It seems reasonable that the parameters **ϵ** and **a** should be reflective of this dynamic. This relationship *also applies to rotational processes in the nucleus*.

Further support for the relationships derived above comes from an analysis of the Planck constant which can be written $h = \frac{q^2}{2\varepsilon v_0}$. An inverse relationship between permittivity and orbital velocity v_o occurs in the denominator if h is constant, consistent with foregoing thinking,

Once it is recognized that gravitational and electromagnetic forces operate at the speed of light, then the issue of the timeliness[6] and the delay of communication of and responses to forces with increasing velocity becomes important. One thing that occurs is a weakening of the gravitational field which is accounted for by the increase in the Bohr radius.

The inability of adjustment's to a particle's behavior to occur in a timely manner as its velocity approaches that of light is the cause of much non-intuitive phenomena, including the slowing of the aging process and of atomic clocks with increased velocity.

The Fine Structure Constant

The formula for the constant is: $\alpha_e = \frac{e^2}{2\varepsilon_0 hc}$

Current conventional wisdom holds it is the charge that varies in high energy experiments as the result of the energetic electron being able to shed hangers on virtual particles that mask its true charge. Whether this is the case or not, it helps with renormalization. It also seems likely that changes in the value of the fine structure constant in high energy experiments and that, if any, due to cosmic expansion result from different causes. Regardless, it is still a second foot through the door of variably measured constants.

It is interesting that permittivity is found in the denominator of the formula. Thus, an increase in permittivity due to cosmic expansion would result in a decrease in the fine structure constant which in turn would lengthen emission wavelengths.

But the speed of light c and Planck's constant h are also found in the denominator, as potential third and forth feet through the door. This model posits that the internal speed of light through the spatial medium varies with the density of the spatial medium, so although the units of measurement are significantly different, the affects of changes in permittivity and the speed of light tend to offset each other in the fine structure formula.

There is no compelling reason from the Planck formula referenced above to conclude that h is influenced by permittivity as the orbital velocity is present in just the right place to offset changes in permittivity. However there is also no compelling reason, except convenience, why any of the so called constants should not vary as space expands. That h should not vary as space expands seems a stretch. The author suspects that the third and forth feet are also stuck in the door.

What makes all of this relevant is that cosmological tests of the fine structure constant are being made to determine if constants, including the speed of light, have varied with the expansion of the universe. The fine structure constant may well be the poorest entity to measure such changes as any change in one component would likely be masked by cumulative changes in the others resulting in little or no overall net change. Obviously high energy experiments are a different matter, as may be the case for cosmic measurements if they could reach back close to the big bang.

One can analyze the above in terms of energy and mass considerations, but timeliness of expression of forces that propagate with finite velocity is insightful. Both gravitational and velocity dependent redshifts are posited to be a direct result of this timeliness factor no matter what the underlying causes are.

Timeliness causing the slowing of clocks and lengthening of rods is posited to be the basis for the constant speed of light in most cases as special relativity requires. It is hard to see how Einstein, given his velocity redshift, can do other than have rods in a frame with increased velocity lengthen.

DISCUSSION

The timeliness considerations provide a means of thinking about the relationships between velocity and the Bohr radius and emitted frequencies and wavelengths while side stepping internal issues within established formulas.

Regarding rod length considerations, since SR and the propositions here both result in holding c constant, they should have no impact on the results of the proposed test of the model in Paper I either way.

On a more speculative note Beckmann[9] argues that gravitational and inertial mass are equivalent only at rest and that gravitational charge like electric charge is constant and that it is only the inertial reaction that changes with increased velocity. Because of the analysis of the formulas for the Bohr radius, frequency, and wavelength above, *I would be interested in any experiment that measures whether a mass accelerated to higher velocity also increases its gravitational charge*

Some Decisions by Einstein

Experiment supports the idea that clocks slow with depth in gravitational fields and with increased motion. The shortening of rods has never been experimentally demonstrated. Indeed GR asserts that space is pulled into and stretched near black holes[10]. Thus the slowing of clocks and stretching of space can be expected to go together.

After Einstein had trouble with his transformations he decided to let the speed of light be constant under all circumstances and to let the rest of physics adjust as need be. He also decided to let clock rates stand for time. Einstein also defined a standard reference measuring rod. He did not define a standard second or means of determining a reference seconds, which he could have easily done. This would have avoided mistaking the measurement of time for the passage of time.

Since Einstein regarded the universe as a self contained, self referencing system, it is surprising that he did not use the universe as the basis for an ultimate reference frame. Since he reasoned that gravity and motion both affected the measurement of time, it seems reasonable that he could have used a theoretical stationary location deep in space where gravitation is absent or nil for this frame. Initially he wanted the universe to be static, but with his acceptance of an expanding universe he would have had to qualify the proposition to state that such a theoretical location was the standard reference frame for any given state of expansion or contraction of the universe.

Refer to Paper I for an explanation of Table A

Table A: Incremental behavior of light in gravitational fields.

		FALLING LIGHT				RISING LIGHT			
A	B	C	D	E	F	G	H	I	
Pt.	V_g	V_g/C_o	V_f=€	V_p	*Incremental*	C_f	V_r	C_r	
	% of c_o		$(Co+v_g)/c_o$	1 / Vf	*ratios:*	V_p x V_f	$(C_0-v_g)/c_o$	V_p x V_r	
1	0%	0	1	1	*D dn. or E up*	1c_o	1	1	
					1.1				
2	10%	0.1	1.1	0.9090909		1c_o	0.9	0.8181818	C_o
					1.09090909				
3	20%	0.2	1.2	0.8333333		1c_o	0.8	0.6666667	C_o
					1.08333333				
4	30%	0.3	1.3	0.7692308		1c_o	0.7	0.5384615	C_o
					1.07692308				
5	40%	0.4	1.4	0.7142857		1c_o	0.6	0.4285714	C_o
					1.07142857				
6	50%	0.5	1.5	0.6666667		1c_o	0.5	0.3333333	C_o
					1.06666667				
7	60%	0.6	1.6	0.625		1c_o	0.4	0.25	C_o
					1.0625				
8	70%	0.7	1.7	0.5882353		1c_o	0.3	0.1764706	C_o
					1.05882353				
9	80%	0.8	1.8	0.5555556		1c_o	0.2	0.1111111	C_o
					1.05555556				
10	90%	0.9	1.9	0.5263158		1c_o	0.1	0.0526316	C_o
					1.05263158				
11	100%	1	2	0.5		1c_o	0	0	C_o

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