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<u>Experimental proposal</u>

<u>(Examining the **"Balls Theory"** prediction that the speed of light isn't over time constant)</u>

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For the purpose of proving that the speed of light is not constant over a long time period, as raised out of the **"Balls Theory" -** a quantum gravity theory I wrote, let's, for the speed of light changes over time, assume a function of the form:

.1) $C_{(t)} = e^{kt} - 1$

when: C - the speed of light, t - time & k - a constant, depending on initial condition.

Hence, the distance (S) traveled by light leaving a far away star/quasar, is:

.2) $S = \int_{t1}^{t2} C(t)dt = \int_{t1}^{t2} (e^{kt} - 1)dt = \left[\left(e^{kt}/_k - t \right) \right]_{t1}^{t2}$

(Where t1 and t2 are: times when the light came out (t1) and measured by us (t2) - the variables are measured from the beginning of time/universe.

For the purpose of finding the value of the constant - k, let's assume that the age of the universe is, as is known today, about 14 billion years or: $1.4\ x\ 10^{10}$ years and that the known speed of light is about: 300,000 $^{km}/_{s}$ or 1 $^{light\ years}/_{year}$.

Received*:*

.3) $C_{(t)} = C_{(1.4\ x\ 10^{10})} =$ e^{kt} - 1 = 1 $^{light\ years}/_{year} \rightarrow e^{kt} = 2 \rightarrow \ln 2 = kt = 0.693147181$

Putting the universe known age, as mentioned, and get.
k = 0.69314718/(1.4x10^{10}) = 4.95105129E-11 in units of: $^{1}/_{light\ year}$

Hence the real distance (light years) of a star (quasar) that the light left it about $1.4\ x\ 10^{10}$ years ago (the beginning of the universe), after we set t1 = 0, in equation #2, is:

.4) $S_{(1.4x10^{10})} = \left[\left(e^{kt}/_k - t \right) \right]_{t1}^{t2} = \left[\left(e^{kt}/_k - t \right) \right]_{0}^{t2} = e^{kt(2)}/_k - t(2) - 1/k$

Setting: k = 4.95105129E-11 & t(2) =1.4 x 10^{10}, in equation #4, and get:

.5) $S_{(1.4x10^{10})} = 2/k - t(2) - 1/k = 1/k - t(2) = 6{,}197{,}730{,}572\ (light\ years)$

Unlike: 14 billion light years, as is known today (at a constant speed of light).
(Received that the star/quasar is about 2.25889 times closer than expected at constant speed of light or at a distance of about 0.442695041 than expected)

Now using the well-known fact that light intensity decreases within the square of the distance, it is obtained that the real light intensity of the examined quasar will be approximately: $5.1 \cong 2.25^2$ times lower than expected at a constant speed of light.

As an example, for a speed of light in the past, we calculate the speed of light in about 100,000 years ago.

$$.6)\ \ C_{(t)} = e^{kt} - 1 = e^{k(t2-100{,}000)} - 1 = e^{k(1.4*10^{10}-100{,}000)} - 1 = 0.99999009792193$$

We get that the speed of light in about 100,000 years ago, according the distribution assumed in formula #1, was about 2.97 $^{km}/_{s}$ lower than its today speed (300,000 $^{km}/_{s}$).

Return to the integral in its general form (formula #2)

$$.7)\ \ S = \int_{t1}^{t2} C(t)dt = \int_{t1}^{t2} (e^{kt} - 1)dt = \left[\left({e^{kt}}/_{k} - t\right)\right]_{t1}^{t2}$$

In order to measure the real distance of a body we use the facts that: (t2 – t1= t) and that t2, since the beginning of the universe until today, is equal to $1.4\ x\ 10^{10}$ years, so we get:

<u>As mentioned</u>
t1 is the time, since the beginning of the universe, when the light left the object on its way to us.
&
t2 is the time, since the beginning of the universe, in which light is measured by us $1.4\ x\ 10^{10}$.

Substitute in equation No. 7 and we get

$$.8)\ \ S = \left[\left({e^{kt}}/_{k} - t\right)\right]_{t1}^{t2} = \left[\left({e^{kt}}/_{k} - t\right)\right]_{(t2-t)}^{t2}$$

Then:

$$.9)\ \ S = \left[\left({e^{kt}}/_{k} - t\right)\right]_{(t2-t)}^{t2} = {e^{kt(2)}}/_{k} - t(2) - \{ {e^{k(t(2)-t)}}/_{k} - (t2 - t)\}$$

Arranging and offset the identical terms (t2) we get:

$$.10)\ \ S = {e^{kt(2)}}/_{k} - {e^{k(t(2)-t)}}/_{k} - t$$

In formula no 10, we place: the constant - k & the known age of the universe - t2 for objects at distances from us equal, at a constant speed of light, to - t (column #1). Than we get for their distance at the variable speed of light, according to the variation we assumed (formula #1), as follows.

column #7	column #6	column #5	column #4	column #3	column #2	column #1
The speed of light, as part of its speed today, before (in light years - according to column #1) - **formula #6**	How many times lower is the expected energy than expected **(the square of the distance)**	How many times closer is the object than measured today	Distance differences in percentages	Distance differences from constant speed of light - calculated in light years	Calculated distance - according to variable speed of light **(placement in formula #10)**	Distance in light years at constant speed of light = **t**
0.9999999999900980		1.00		0.00000	0.10000	0.10
0.9999999999009790	1.0000000	1.00	0.00000000%	0.00000	1.00000	1
0.9999999990097900	1.0000000	1.00	0.00000000%	0.00000	10.00000	10
0.9999999900978980	1.0000000	1.00	0.00000000%	0.00000	100.00000	100
0.9999999009789770	1.0000001	1.00	0.00000458%	0.00005	1000.000	1,000
0.9999990097899870	1.0000010	1.00	0.00004951%	0.00495	9999.995	10,000
0.9999900979219330	1.00001	1.000005	0.00049510%	0.495	99999.505	100,000
0.9999009814254560	1.00010	1.000050	0.00495097%	49.51	999,950	1,000,000
0.9998019677532510	1.00020	1.000099	0.00990178%	198.04	1,999,802	2,000,000
0.9990100348306960	1.00099	1.000495	0.04950234%	4,950.23	9,995,050	10,000,000
0.9901223699245800	1.00996	1.004967	0.49428904%	494,289.04	99,505,711	100,000,000
0.9033903060212390	1.10501	1.051197	4.87034303%	48,703,430.33	951,296,570	1,000,000,000
0.2190136542044750	2.99933	1.731856	42.25848207%	4,225,848,207	5,774,151,793	10,000,000,000
0.0000000000000000	5.10259	2.258891	55.73049591%	7,802,269,428	6,197,730,572	14,000,000,000

Conclusion:

When assumed (formula #1) an exponential distribution for the rate of the speed of light changing over time, we get that: visible objects are closer than expected at a constant speed of light - therefore they have a lower true brightness.
In this way we can explain, for example, the energy of quasars - objects that according to their Doppler effect (redshift, HR diagram) should be at a very large distance. A distance that requires enormous energy which cannot be explained by the known laws of physics. All this without the today prevailing assumption that their Doppler effect is caused by a relatively higher speed out of us (for example: a throwing from a black hole) while they are actually much closer
We get that the quasars, as a result of the changing over time speed of light are indeed closer than expected at a constant speed of light, as predicted by the **"balls theory"**, all without the need for another forced theory.
Final note: our assumption for the changing distribution over time of the speed of light is only an assumption - doesn't based on experimental observation. As we measure the: calculated distance (column #2)/true brightness expected (column #6) according to varying light speed compared to the brightness/distance (column #1) at a constant light speed for many more objects, at varying distances, we might obtain the exact mathematical distribution for the rate changes over time of the speed of light.