

Wave-Theoretical Insight into the Relativistic Length-Contraction and Time-Dilation of Super-Nova Light-Curves

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Abstract

Einstein's Relativity-theories predict: length-contraction, time-dilation, transverse-Doppler-shift, gravitational-spectral-shifts, expansion-of-space, time-dilation-of-super-nova-light-curves...etc. First of all it is shown here that there is at least one problem with the current, Relativistic 'metric-expansion-of-space-based' explanation for the 'cosmological-red-shift'; leading to the theory of expansion-of-the-universe; therefore it is important to think of alternative possibilities. Then this letter makes an alternative-attempt, to gain wave-theory-based-insight into two of the predictions of Relativity: (i) length-contraction with speed and (ii) time-dilation of super-nova light-curves.

Keywords: Metric-expansion-of-space, Gate-function, Fourier-transform, Relativistic-length-contraction, Time-dilation-of-super-nova-light-curve

1. Introduction

Reconciliation of the Relativity-Theory with quantum-mechanics is one of the major goals of science; but first of all it is shown here that there is at least one problem with the current, Relativistic ‘metric-expansion-of-space-based’ explanation for the ‘cosmological-red-shift’; leading to the theory of expansion-of-the-universe. Therefore it is important to think of alternative possibilities. Then, as a rudimentary-attempt in this direction, we intend here to gain some wave-theoretical insight into the relativistic length-contraction and the observations of time-dilation of super-nova-light-curves.

2. How the current explanation for the Cosmological Red-Shift, based on ‘metric-expansion-of-space’, can not be correct

Currently, the cosmological red-shift is understood in terms of ‘metric-expansion-of-space’. It is believed that after the big-bang the space-time started expanding; so the distances between galaxies are increasing, even at the rates faster than the speed of light, near the edge of the universe. So, the wavelengths of extra-galactic-photons get stretched with the expansion-of-space, resulting in the observed ‘cosmological-red-shift’.

Now, I present here an argument that this explanation can not be correct, as follows. Accepting that the space between the galaxies is expanding; but the space within the galaxies is not expanding, because galaxies are gravitationally bound structures. So, there has to be a smooth transition, from the expanding-space out-side the galaxies, to the non-expanding-space within the galaxy. Now, when the extra-galactic-photons, after their long-long extra-galactic-journey, with their wavelength stretched due to ‘expansion-of-space’, enters the ‘transition-region’ from expanded-space to ‘non-expanded-space’, then their wavelength should start shrinking-back, like it shrinks while entering stronger and stronger gravitational-field; and when they enter the non-expanded-space of our milky-way-galaxy, their wavelength should shrink-back to original wavelength! Isn’t it? Therefore, the current explanation for the ‘cosmological-red-shift’, which is based on ‘metric-expansion-of-space’, can not be correct.

Every scientist has accepted my argument, that: “there has to be a smooth transition, from the expanding-space out-side the galaxies, to the non-expanding-space within the galaxy” when I attempted to explain galaxies’ rotation-curves based on this smooth-transition of expansion-of-space. This has encouraged me to think of

‘shrinking-back’ of stretched-wavelength of extra-galactic-photons while entering the non-expanding-space of our milky-way-galaxy.

3. How Alternative-interpretations of the Cosmological-red-shift are not incompatible to the Observations of ‘Time-dilation of Super-Nova-light-curves’

Alternative-interpretations of the ‘cosmological-red-shift’ have so far been rejected on the supposed-ground that they are not consistent with the observations of time-dilation of super-nova-light-curves; therefore it is important to see here how alternative-interpretations of the cosmological-red-shift are not incompatible with the observations of super-nova light-curves; as follows.

Any physical-process taking some ‘duration’ of ‘time’ can be mathematically described as a ‘gate-function’ in the ‘time-domain’; and then it can be Fourier-transformed [1] into the ‘frequency-domain’, as shown in fig.1. Fig.2 shows that compression in ‘time-domain’ means expansion in the ‘frequency-domain’, i.e. widening of the spectrum. And expansion in ‘time-domain’ means shrinking of spectrum in the frequency-domain. In addition to the ‘amplitudes’ of every spectral-component in the frequency-domain, there is a phase-spectrum also, not shown in the figures. Shifting of the ‘gate’ in time does not change the amplitude-spectrum, but it does change the ‘phase-spectrum’; i.e. a gate of one-second-duration at the origin of a graph, differs from another gate of one-second-duration between fifth-and-sixth seconds on the graph in terms of phase-difference of every corresponding-spectral-components.

Similarly, an object of one meter length at the origin can be mathematically-represented as a ‘gate-function’ in ‘space-domain’ and can be Fourier-transformed into ‘wave-number-domain’. And another object of one meter length at a distance x meters from the origin will have the same ‘amplitude-spectrum’ in the wave-number-domain, but a different ‘phase-spectrum’; i.e. each and every component of the spectrum, say thousand-waves-per-meter, has some phase-shift compared to its peer-component at the origin. With this back-ground let us now try to understand the relativistic length-contraction first; and then relativistic-time-dilation-of super-nova-light-curves, as discussed in the next sub-sections.

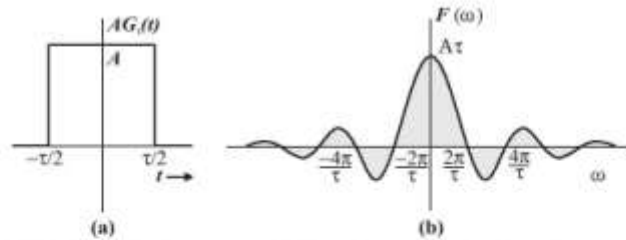


Fig.:1 (a) A gate function. (b) Transform of a gate function.

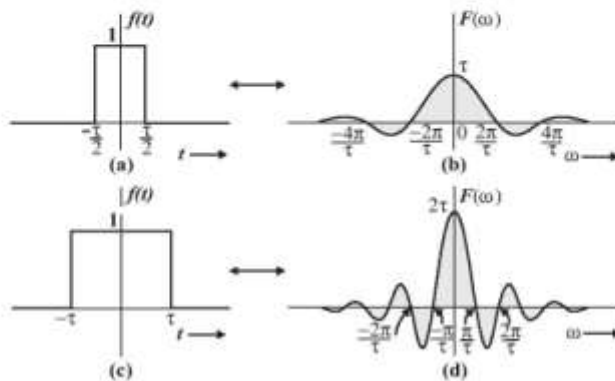


Fig.:2 Compression in the time domain is equivalent to expansion in the frequency domain.

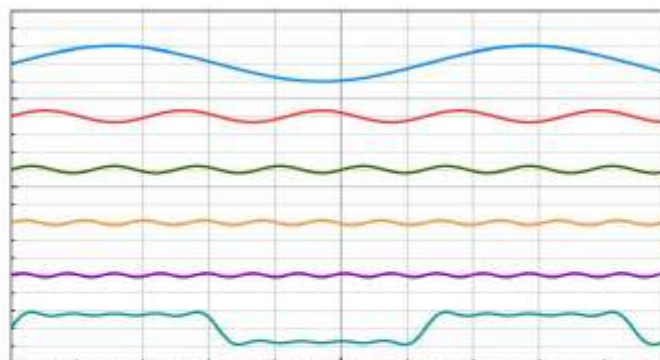


Fig.3: Graphs of spectral-components $\sin(x)$, $\sin(3x)/3$, $\sin(5x)/5$, $\sin(7x)/7$, $\sin(9x)/9$ and their superimposition: $\sin(x) + \sin(3x)/3 + \sin(5x)/5 + \sin(7x)/7 + \sin(9x)/9$ forming a 'gate-function'. All components are at the same phase 0° at the origin $x=0$, but they are at different phase-angles at different values of x .

3.1. Relativistic Length-Contraction with Speed:

As discussed in the presiding paragraph, an object-of-one-meter-length-at-a-distance x meters from the origin, differs from the object-of-one-meter-length-at-the-origin in terms of ‘phase-difference’ of each-and-every component of its ‘wave-number-spectrum’; though its ‘amplitude-spectrum’ is identical to the ‘amplitude-spectrum’ of the object at the origin. Now, when the object at the distance x moves with a velocity v , then the ‘phase-difference’ of each-and-every spectral-component will keep changing with time; i.e. there will be some ‘rate-of-change-of-phase’; and we know, that ‘rate-of-change-of-phase’ means ‘frequency’! That is, when an object moves with respect to the other object at the origin at some speed, then there is a shift in wave-number of each-and-every spectral-component, by some factor, say each spectral component gets multiplied by a factor 1.2. Therefore, if the spectrum corresponding to an object at rest, at the origin, is from one-wave-per-meter to ten-waves-per-meter then the spectrum of the object moving with a speed v will have 1.2 waves-per-meter to 12 waves-per-meter. So, the width of the spectrum, which was $10 - 1 = 9$ wave-numbers, changes to $12 - 1.2 = 10.8$ wave-numbers. And from the fig.2 we find that ‘expansion of spectrum in ‘wave-number-domain’ means ‘shrinking-of-length’ in ‘space-domain’.

3.2 Explanation for the Time-dilation of Super-Nova Light-Curves:

Super-nova-light-curves, described by Giacobbe, [2], can be viewed as a ‘gate-function’ in the ‘time-domain’; and it can be Fourier-transformed into frequency-domain; and it is this wide band of waves which travels in space and reaches us after millions of years. During its travel, when this wide-band of waves, being electromagnetic waves, gets red-shifted due to any mechanism then its band-width shrinks in the frequency-domain; so when it is transformed back into time-domain we find that the duration of the curve has got increased. Thus, time-dilation of super-nova-light-curves is not an independent observation from the observations of the ‘cosmological-red-shift’ due to any mechanism.

4. Conclusion

We arrive at two interesting conclusions: (i) ‘metric-expansion-of-space-based explanation for the ‘cosmological-red-shift’ leading to the theory of expansion of the universe, may not be correct; and (ii) time-dilation of super-nova-light-curves is not

an independent observation from the observations of the ‘cosmological-red-shift’ due to any mechanism. Alternative-interpretations of the ‘cosmological-red-shift’ have so far been rejected on the supposed-ground that they are not consistent with the observations of time-dilation of super-nova-light-curves; but now we understand that it is the ‘cosmological-red-shift’, due to any mechanism, which causes the time-dilation of super-nova-light-curves. This author has recently proposed four alternative-interpretations for the ‘cosmological-red-shift’ [3-5]. According to these new interpretations the red-shift depends only on distance traveled by the extra-galactic-photons, not on the relative-velocity of the source-of-light and observer. Therefore, as the photons travel a unit-distance, say one light-year, then there is certain amount of red-shift; say the frequency of photon which was f_0 , reduces to $f = f_0 / 1.1$. Then for the next unit-distance f becomes the new input frequency which gets red-shifted to $f / 1.1 = f_0 / (1.1)^2$. Then for the third unit-distance, new value of $f = f_0 / (1.1)^3$. Thus the red-shift-distance-curve becomes automatically non-linear, as observed, without invoking any ‘dark-energy’. Perlmutter and Riess based their interpretation of non-linearity of red-shift-distance-curve, on the current, ‘metric-expansion-of-space-based-explanation for the cosmological-red-shift, so they needed invocation of ‘dark-energy’[6,7], whereas here in section-2, we found that ‘metric-expansion-of-space’ can not explain the observation of the ‘cosmological-red-shift’. Thus there has been a need for considering alternative ways to understand ‘length-contraction’, ‘time-dilation’ and the observations of ‘cosmological-red-shift’.

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