GALILEAN ELECTRODYNAMICS

Experience, Reason, and Simplicity Above Authority
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EDITORIAL POLICY

Galilean Electrodynamics aims to publish high-quality scientific papers that discuss challenges to accepted orthodoxy in physics, especially in the realm of relativity theory, both special and general. In particular, the journal seeks papers arguing that Einstein's theories are unnecessarily complicated, have been confirmed only in a narrow sector of physics, lead to logical contradictions, and are unable to derive results that must be postulated, though they are derivable by classical methods.

The journal also publishes papers in areas of potential application for better relativistic underpinnings, from quantum mechanics to cosmology. We are interested, for example, in challenges to the accepted Copenhagen interpretation for the predictions of quantum mechanics, and to the accepted Big-Bang theory for the origin of the Universe.

On occasion, the journal will publish papers on other less relativity-related topics. But all papers are expected to be in the realms of physics, engineering or mathematics. Non-mathematical, philosophical papers will generally not be accepted unless they are fairly short or have something new and outstandingly interesting to say.

The journal seeks to publish any and all new and rational physical theories consistent with experimental fact. Where there is more than one new theory that meets the criteria of consistency with experiment, faultless logic and greater simplicity than orthodoxy offers, none will be favored over the others, except where Ockham's razor yields an overwhelming verdict.

Though the main purpose of the journal is to publish papers contesting orthodoxy in physics, it will also publish papers responding in defense of orthodoxy. We invite such responses because our ultimate purpose here is to find the truth. We ask only that such responses offer something more substantive than simple citation of doctrine.

The journal most values papers that cite experimental evidence, develop rational analyses, and achieve clear and simple presentation. Papers reporting experimental results are preferred over purely theoretical papers of equally high standard. No paper seen to contradict experiment will be accepted. But papers challenging the current interpretation for observed facts will be taken very seriously.

Short papers are preferred over long papers of comparable quality. Shortness often correlates with clarity; papers easily understandable to keen college seniors and graduate students are given emphatic preference over esoteric analyses accessible to only a limited number of specialists. For many reasons, short papers may pass review and be published much faster than long ones.

The journal also publishes correspondence, news notes, and book reviews challenging physics orthodoxy. Readers are encouraged to submit interesting and vivid items in any of these categories.

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From the Editor's file of Interesting Letters:

What is Time & What Causes Time?

There are many approaches toward understanding the phenomenon of time. We perceive time as past present and future. In Physics, time plays a major role in measurement of motion and forces. Einstein's relativity introduced the concept of slowing of time in motion and gravity.

What Are We Really Measuring?

One of the earliest devices to measure time was the sundial that used suns motion as a standard of measurement for time. The use of units like seconds and minutes which are radial angle measurements in geometry point toward the original connection of time measurements to radial motion of astronomical objects across the sky. Once we started using accurate time keeping watches, clocks and digital devices capable of measuring time independent of the celestial connection time developed a life of its own. When we measure the speed of a car, we are just comparing its motion to the motion of the hands of the clock and also indirectly to the fractional motion of sun across the sky. We seem to be measuring speed with something abstract called time; in reality we are just comparing a known motion (of the Sun) with an unknown motion of the car. Time is a way to compare or describe different kinds of motions like speed of light, how fast heart beats or how frequently earth spins around its axis. But these processes could be compared directly without making reference to time. Time may not actually exist; it may be just a common unit of motion making the world that is filled with motion easier to describe.

Time, Motion, and Forces

Time is a real phenomenon a continuous change through which we live. Time becomes evident through motion. The cycles of sunrise sunsets, night and day, changing seasons, the movements of the celestial bodies are all indicative of continuous change. The aging process is a reminder that molecular motion and interactions are also at work and are a part of time. Time also involves presence of motion of particles like photon and the motion at the atomic level.

An important aspect of time that is commonly ignored is that forces also act in time. Imagine two objects one moving in orbit around the other in space. Now suppose from our distant observation point of a fixed time we observe time to get slower in the area where these two objects are moving. We expect to see slower motion? We also should observe proportionally weaker (gravitational) force; otherwise the objects will get pulled together. If we observed faster time, we expect to see faster motion and stronger forces to keep the objects from flying apart. While with zero time motion will freeze and force will become zero. The increase or decrease in strength of forces is only in relation to our fixed time from where we are making the observation. From the point of view (time) of the orbiting objects neither motion nor force has changed. As this thought experiment also can be extended to particles held together by electromagnetic forces we can say that **time involves both motion and forces.**

Perception of Time: Past, Present, & Future

We perceive time as past, present, and future. We relate events to places as well as time; this gives us a feeling that time is more like a place and gives support to the block-universe view of time.

Concluded on p. 60

The Kinematics of an External Light-Clock: A Test for Einstein's Relativity, Part I

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This Paper introduces a new light clock to rearrange the details of our intuition of length and time and get rid of paradoxes that occur in Einstein's Special Relativity Theory (SRT). It shows that there are important philosophical defects in SRT, and they cannot be resolved unless we alter some Postulate of the theory. One Postulate is: *The invariability of physical laws in the reference frames with constant velocities relative to each other.* This Paper argues that absolute uniform motion *can* be detected, if the boundaries of observation are extended to the whole cosmos (galactic frame or the frame of the fixed stars, that is). New foundational statements about time and length play a decisive role in describing the *external light clock* as a replacement for Einstein's *internal light clock.* Involving the physical behavior of the large-scale cosmos leads to the practical relations and formulas in small scales of a single particle, the (arithmetic) mean value theorem for integrals is used. This produces many results that are against those of SRT, but compatible with experiments in general, such as the incompatibility between the Doppler Effect predicted by this theory and that predicted by SRT, the possibility of exceeding the speed of light, and the *time-shrinkage* as well as the time dilation from some observers' viewpoint. This theory is much more consistent with Mach's philosophy of relativity than Einstein's SRT is.

Keywords: Special Relativity Theory; Light-clock, Time dilation; Time shrinkage; Length contraction; Length expansion; Twin paradox; Ladder paradox; Exceeding the speed of light; Universal lines; Imaginary universe; Doppler effect. PACS number: 03.30.+p.

1. Introduction

Articles [1-3] are typical of many offered to show the coherence of SRT or resolve Paradoxes in SRT. Two important Paradoxes are the Ladder Paradox and the Twin Paradox, and this paper shows both may be due to falsity of the First Postulate of SRT; namely, the Galilean Postulate that the laws of physics are the same for all inertial observers. It demonstrates a vivid difference between two reference frames with constant relative velocities, in which one has already undergone acceleration, whereas the other has remained an inertial reference frame. This leads to a definition of absolute motion, which could revive Newton's concept of an absolute cosmological reference frame. New philosophical Postulates are then stated, and next, the deficiencies of Einstein's light clock are demonstrated. To get rid of these deficiencies and to show the effect of the new occurrences on measurements of time and length, an *external light clock* is defined and replaces Einstein's *internal light clock* (as a *gedanken experiment*)

As the philosophical postulates about time and length are explained, all physical phenomena are categorized as symmetric or asymmetric. In this context, *amended SRT* is the limit of a more generalized perspective. The theory is thus independent of Einstein's SRT, and of his general theory, GRT. That is, the theory has its own postulates and results, and will not be concerned with non-inertial frames or gravitation, mathematically, or otherwise. The deduction based on the principle of the constancy of light speed in all inertial frames, which is propounded in this article, is the only presupposition nearly similar to that of SRT. Next, the vague duality in the definition of time based on the Doppler Effect, which is one of SRT's deficits, is resolved. A thorough analysis of the principles of relativity is made, and shows that, besides the two famous Postulates in SRT, there are some other hidden assumptions that have been ignored, not only by Einstein himself, but also by many scientists today.

The ultimate aim of the theory is to revise fundamental ideas about our expectations of time and length, issues according to which, intrinsically, the paradoxical situations ought not appear. Nonetheless, the theory completely agrees with the outlines discussed in several articles and reports that assert the existence of paradoxical anomalies in SRT experimentally (the theory is compatible with the results of experiments like: GPS, Hafele-Keating, Particle Accelerators, Muon Decay in the Atmosphere) [4]. The introduced external light clock is a kind of clock consisting of all cosmic masses, *i.e.*, every single particle that has been spread through the cosmos affects the measurements of time and length from the viewpoint of a specific observer. Thus, it will soon be demonstrated that an average value of all cosmic effects is useful as an approximate solution in terms of the many of cosmic masses. Although there are several methods of calculating intermediate values for functions - arithmetic, geometric, p^{th} power mean, *etc*. - this paper uses only the first mean-value theorem for integrals (the arithmetic mean).

Here some important statements declared in this article are compared with statements from relativity theory:

SRT: - There *is no* preferred frame.

New Theory: - There *is always* a preferred frame if an asymmetric system of motions is considered.

SRT: - The speed of light remains invariant from the viewpoints of the observers in all inertial reference frames, and light speed *is* the upper bound for the speed of any object in the Universe.

New Theory: - The speed of light remains invariant from the viewpoints of the observers in all inertial reference frames, and there *is not* an upper bound for velocity in the Universe.

SRT: - In two reference frames ($\mathrm{A} \,\&\, \mathrm{B}$) with constant velocity relative to each other, the velocity of A measured in B and the velocity of B measured in A, are of opposite sign but equal magnitude.

New Theory: - In two reference frames (named $\mathrm{A} \& \mathrm{B}$) with constant velocity relative to each other, the velocity of A measured in B and the velocity of B measured in A, *are not exactly* equal in magnitude, but are opposite in sign.

SRT: - From the viewpoints of the observers in two inertial reference frames, the clocks *always* run either with the same rate (relative velocity zero) or run slower (relative velocity not zero).

New Theory: - From the viewpoints of the observers in two inertial reference frames, clocks always run with the same rate (relative velocity is zero *or a symmetric system of motions is considered*). However, the clocks should run slower (relative velocity is not zero) from the viewpoint of the observer in the *permanent* inertial reference frame and, *vice versa*, *run faster* from the viewpoint of the observer who experiences acceleration to a specific value of velocity and then continues in inertial reference frame with constant velocity (*asymmetric system of motions is considered*). Nevertheless, the magnitude of such acceleration is not involved in our calculations!

2. Absolute Motion

This Section shows that absolute motion can be detected when we consider that an observer is surrounded by many other objects: Imagine a man, as the first observer, and his cat, as the second, are both at rest in a room occupied with several things like a desk, bags, some books, *etc*. The man suddenly moves toward his cat; what does each of the cat and the man observe? From the standpoint of the cat only the man is approaching, whereas from man's viewpoint not only his cat but also many objects in front of him like the wall, books and everything are located in back of the cat (also between the cat and him) are approaching. Reciprocally, many other objects like the desk and everything behind the man are moving away from him. This difference in observations is the cornerstone that revives the concept of *absolute motion*.

If we extend this phenomenon from a room to the whole cosmos we can easily realize that the observer who accelerates to a value of velocity *always* divides the set of universe, consisting of all objects (the cosmos), into two parts: **1)**- objects, from a single electron to a great galaxy, that approach; and **2)** objects that recede. First of all, we realized that there are examples galore can show a difference in observation between two reference frames in terms of the existence of the other objects surrounded them, but how should such examples be considered to put such a preferred frame in a mathematical use? Answering the question is hard. However, with a little imagination we can find a good solution. Note that we must choose a way in which all physical measurements are to be dealt with the whole universe, *e.g.*, we must assert a definition of time or length so that they lose their meanings if we ignore the distribution of the objects through the cosmos. We incline to do so because we previously found that the only thing, confidently capable of distinguishing an asymmetric system of motions from that of a symmetric, is the distribution of objects through the space. Therefore, the effect of such a distribution, as such, should appear throughout our calculations.

Assume the whole cosmos consists of objects all with *constant* velocities relative to each other. For each single particle (observer) of this system, measuring the average values for all velocities, masses, lengths, *etc*., (of the other objects) are probably meaningful. (Physical possibility of making such measurements and the variety of the mathematical methods that each leads to a sort of intermediate values are not important) With regard to the fact that for each observer the averages can be of either equal values or different ones, one occurrence is incontrovertible:

If an object (observer) accelerates and changes its velocity, he measures different average values relative to his rest (or relative to the other objects in inertial frames) because, from his viewpoint, all cosmic motions are being affected because of his motion (remember the example of the man and the cat). However, the observer(s) in the *permanent* inertial frame measures no change in the average measurements of time, length, *etc*., because the motion of *only one* object (the accelerated one) does not affect the mean value produced by several objects. Now, for the second case, imagine that another object accelerates to the same velocity of the previous object (in the same direction) reciprocally. From both points of view, all cosmic motions are being affected symmetrically and thus, average measurements must be of equal values from each viewpoint. Now we can deduce that when only one frame, between two considered frames in a collection of objects (such as the universe) with a variety of relative velocities, accelerates to a specific value of velocity, the measurements must result in different values with regard to the *asymmetric philosophical expectations*. On the other hand, when both frames between two considered frames analogously accelerate to a specific velocity (toward or, probably, away from each other), the measurements must result in the same values with regard to the *symmetric philosophical expectations*.

3. Philosophical Expectations

Imagine there are two similar clocks (as observers) in your hands a short distance apart from each other. If you move one away from the other and after a while return it to the first clock you have made the circumstances asymmetric. In this case, to avoid facing any paradoxes, you *must* deduce that if the clock in your right hand runs slower from the viewpoint of the other clock (observer), the clock in your left hand *must* run faster from the standpoint of the other clock (observer) unless paradoxes like the twin one will occur. Naming the clocks as A and B, we can say that t_{AB} is the time of A's clock from A's own viewpoint, and the same for t_{BB}. In the asymmetric case, we *must* have

$$t_{\mathrm{AB}}/t_{\mathrm{BB}} = t_{\mathrm{AA}}/t_{\mathrm{BA}} \quad . \tag{1}$$

This equation shows that if the time dilates as α from one viewpoint, it *shrinks* as $1/\alpha'$ from the other viewpoint; *i.e.*, when the clocks, after one's travel, are reunited; there is no age difference. As long as one observer gets older from the viewpoint of the other, the second one remains younger from that of the first observer.

Let us return to our example of clocks: Assume that you move both of the clocks, instead of just one, and after a little travel you bring them back together at rest. In this case, because of the symmetry of motions, no change in time *must* be detected from each observer's viewpoint or we *must* have:

$$t_{AB}/t_{BB} = t_{BA}/t_{AA} = 1 \quad . \tag{2}$$

In symmetric circumstances, there is no reason for each observer to decide whether a clock runs slower or faster, otherwise one reference frame would be preferred to the other. In Einstein's SRT the above ratios are not obtained equal to unity, and thus a variety of paradoxes occur. The same symmetric and asymmetric relations can be found for the space dimensions (height, length, width) of the object. Suppose the length L with proper subscripts, similar to that of the time, being defined between the two considered objects. Then Eqs. (1,2) can be reformed into:

$$\text{Eq.(1), asymmetric case} \Rightarrow L_{AB}/L_{BB} = L_{AA}/L_{BA} \quad , \tag{3}$$

$$\text{Eq.(2), symmetric case} \Rightarrow L_{AB}/L_{BB} = L_{BA}/L_{AA} = 1 \quad . \tag{4}$$

(Recall that there are similar equations for height and width.) We realized that the discussed philosophical expectations, as such, are conceptions that *can* be formulated, and so it would be logical to expect them as postulates, rather than consequences of a theory. It seems that an unfortunate ignorance, over the years, has made most of physicists ignore and underestimate the importance of such formulas based on philosophical intuition. But the reason of this points out not only the ignorance of relativists but also a misfortune in applying such formulas in regard to the only-advanced-time-measurer, *Einstein's internal light clock*.

The equations obtained above cannot be used straightforwardly in our calculations unless we change the structure of our light clocks so that the whole Universe being involved with measurements of time and length. That is, applying Einstein's internal light clock, unsolvable paradoxes will alternatively appear by the time we put the obtained equations in use. In the next two sections, we consider deficiencies of Einstein's light clock as an internal time measuring apparatus and we introduce a replacement for that.

4. Einstein's Internal Light Clock: Deficits

In this Section, we discuss the limited structure of Einstein's light clock to show that it is vital the clock to be replaced with another one. In our view, Einstein's light clock, categorized as an internal one, suffers from three important deficiencies: 1- Uncertainty; 2- Relativistic neutralization; 3- Vague duality in the definition of time.

4.1 Uncertainty

We are familiar with the thought experiment of setting off a flashbulb on the floor of the train, a distance h apart from the roof, in which the light travels vertically toward a mirror that has been set on the ceiling and reflects back to the starting point that exactly explains the time dilatation and length contraction. Avoid verbosity, we do not explain this thought experiment in details and we tend to argue that this special light clock introduced by Einstein, can culminate in different results when it is considered in new aspects. In Einstein's thought experiment it is assumed that the variation of time interval, in observer's viewpoint, can be measured only when the vertical direction of light travel is considered and it is assumed that there is no change of height perpendicular to the velocity vector, simultaneously, as the light clock moves. On the other hand, the obtained result for time alteration is used to justify the change in the length parallel to the velocity vector of the moving train (light clock). What will happen if we consider the problem inversely: Assume we set the mirror on the train's wall in front or back of the observer; we also assume that the length of the train L never changes during the travel of light. By keeping Einstein's second postulate of the constancy of the speed of light, for both situations of rest and motion in Fig. 1, we calculate:

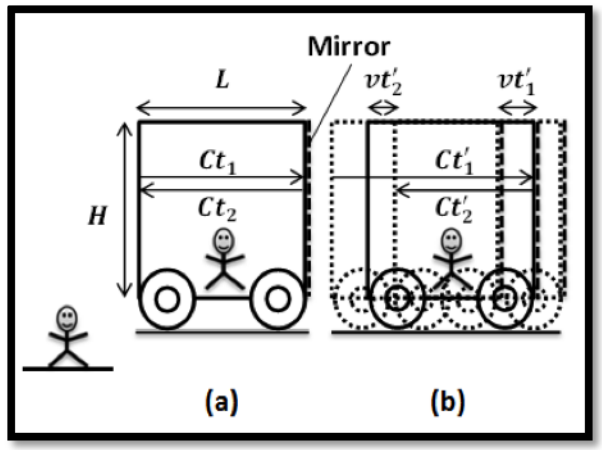

Figure 1. The train and the mirror set on the wall in front of the observer; the length of the train never changes during the travel of light. In (a) the observer is at rest, and in (b) he is moving from the viewpoint of the observer standing outside

(a):
$$L = Ct_1 = Ct_2 \quad . \tag{5}$$

For the total time t we have:

$$t = t_1 + t_2 = 2L/C \quad . \tag{6}$$

(b):
$$L + vt'_1 = Ct'_1 \Rightarrow t'_1 = L/(C - v) \quad ; \tag{7}$$

$$L - vt'_2 = Ct'_2 \Rightarrow t'_2 = L/(C + v) \quad . \tag{8}$$

For the total time t' we have:

$$t' = t'_1 + t'_2 = 2LC/(C^2 - v^2) \quad . \tag{9}$$

By substituting L from Eq. (6) into Eq. (9), we obtain:

$$t' = t/(1 - v^2/C^2) \quad . \tag{10}$$

This result includes a factor with an exponent twice that of SRT, i.e., according to our assumptions, the time dilates by different factor than that appears in Einstein's SRT, given traditionally its own symbol, $\gamma = 1/\sqrt{1 - v^2/C^2}$. Now it is plausible to calculate the changes in the height of the compartment (Fig. 2) in terms of the change of time we obtained:

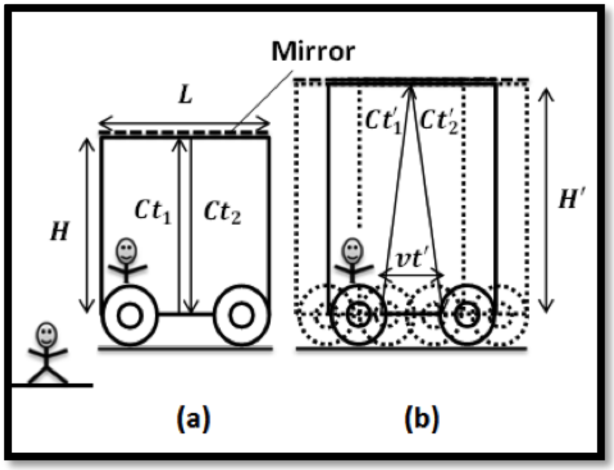

Figure 2. The change in height is demonstrated. In (a) the observer is at rest and in (b) he is moving from the viewpoint of the observer stood outside.

a) $$H = Ct_1 = Ct_2 \quad . \qquad (11)$$

For the total time t we have:

$$t = t_1 + t_2 = 2H / C \Rightarrow H = Ct / 2 \quad . \qquad (12)$$

b) $$H'^2 + (t'v / 2)^2 = (Ct' / 2)^2 \Rightarrow H' = (t' / 2)\sqrt{C^2 - v^2} \quad . \qquad (13)$$

Using Eqs. (12,13) we write:

$$H' / H = t'\sqrt{C^2 - v^2} \Big/ tC \quad . \qquad (14)$$

By substituting t' from Eq. (10) into Eq. (14), we get:

$$H' = H \Big/ \sqrt{1 - v^2 / C^2} \quad . \qquad (15)$$

This equation shows that the height of the compartment neither contracts nor remains unchanged; it expands by the factor $1\Big/\sqrt{1 - v^2 / C^2}$ according to which an important disagreement with relativity is detected. Not only the light path can be assumed parallel to the velocity vector of the moving light clock for calculating changes in time but also with any arbitrary values of angle that culminate in too many results of length and time measurements that differ from those of SRT [5] Now we ask a question: Which method of interfacing the constancy of the speed of light with the possible definitions of time is acceptable? One can answer that Einstein's light clock sounds to be correct because it is the only one that may result in the Lorentz transformation. [6] The other one can answer that Einstein's method is correct because if we accept with length changes perpendicular to the direction of the motion a kind of paradox may occur: [7,8]

If we set two pointed objects on the top and bottom of both moving compartment A and a nearby one B at rest, at the time they are being scratched on the walls grazing each other touchingly, each of the observers can claim that he is at rest and the other is moving indeed. Therefore, from the viewpoint of A the height of's compartment expands and only the pointed objects fixed on 's compartment makes traces on the other, whereas B's pointed objects do not reach A's compartment to scratch and this statement can mutually be reclaimed by A (Paradox). (Recall that because of the expansion of the height, the distance between the two pointed objects of each compartment is enlarged from the viewpoint of the other observer).

For these reasons, preferring Einstein's method is not justifiable. For the first one, we can say that according to our claim in Sect. 2, the invariability of the laws of physics is not always defendable from one reference frame to another, thus it is possible to consider other transformations in which physical laws are variant. However, Einstein's internal light clock is not capable of showing the real time, *i.e.*, such a light clock causes our whole trial to be laid under the wrapper of confusion and thus we cannot deduce a plausible definition for time and length. For the second one, it can easily be said that the deduction is no more valid if a reference frame is preferred.

It is recognized that Einstein's light clock is a bad device for measuring time intervals because it is not capable of restricting conditions so that all several methods for time measurements culminate in similar results or a method be preferred, logically, to the other; we name this deficiency the *uncertainty*. Nonetheless, one may suggest that we must find a proper condition of Einstein's internal light clock that satisfies the philosophical expectations were formulated in the previous section. This is a logical offer but unfortunately if we try to eliminate the clock paradox by using Eq. (1,2) a permanent length- paradox will appear that will make us unable to use Eqs. (3,4), or it will culminate in illogical results and, reciprocally, such anomalies will occur for Eqs. (1,2), if we intend to maintain the very essence of Eqs. (3,4). Each, indeed, definition of light clock must be capable of utilizing the philosophical expectations without facing paradoxical statements. That is, a good theory of relativity is one that assumes the mentioned philosophical expectations as postulates without seeking whether they are qualified to be predicted, as results, by the theory itself.

4.2. Relativistic Neutralization

One of the unmentioned peculiarities of relativity is that Einstein's light clock is founded on the *relativistic motions* that can easily be neutralized while the observers, moving with relativistic velocities, keep their eyes on each other just by turning their heads with negligible angular velocities in the direction of the motion of the other compartment. (Imagine each observer views the other one through a spyglass) Therefore, from each observer's viewpoint, the light path does not differ from its path in the compartment at rest, *i.e.*, there occurs neither time dilation nor length contraction nor other probable changes in time and length that argued in previous subsection (paradox). Justifying such changes in time and length, one can assume a kind of dense matter (Ether) fills up within the compartment as observers make relativistic motions neutral by turning their heads so that the velocity of light may reduce with a proper classical index of refraction. [9] In such a way, the index of refraction takes values with which the changes in time and length are justified according to S.R or any other kind of light clocks introduced in the previous subsection. This might be a good way for getting rid of such a paradox but, it cannot help us to find a convincing answer to this question: Which observer allows to imagine such a dense medium within the other compartment?! Therefore, this solution is not capable of eliminating the second philosophical paradox that we call it the *relativistic neutralization*.

4.3. Vague Duality in the Definition of Time

We know that each single photon has its own frequency that can be conceived as a time measurer per se. In Einstein's internal light-clock there are two sorts of clocks: **1)** A clock that is introduced by a to- and-fro journey of photon between two mirrors; **2)** The frequency of the light wave. From the standpoint of philosophy, it would be illogical if an observer calculates different results for time changes using each of these ways. That is, if there are several sorts of clocks, a specific choice between such clocks, with different results, will be problematic to be attributed to the changes of *real-time*, which has caused an important paradox in Einstein's relativity. According to SRT, it is calculated that the time dilates by the factor $1\Big/\sqrt{1-v^2/C^2}$, whereas the changes of time based on the frequency of light depends on the angle of the light's propagation that can be either dilated or *shrunk* by the factor $\left[1+(v/C)\cos\theta\right]\Big/\sqrt{1-v^2/C^2}$ from the viewpoint of a specific observer. The discrepancy between the mentioned fomulae causes the observer to attribute a certain change to the real time with priority that, *e.g.*, causes biological aging.

5. Advantages of the External Light-Clock:

We realized that Einstein's internal light clock culminates in at least two important ambiguities except the twin paradox; we also realized that the whole cosmos can help us to find a preferred frame between two reference frames moving uniformly relative to each other. Let us introduce our light clock and then we evaluate its results both physically and philosophically. It was demonstrated that all objects spread through the universe would be effectual in our effort to find the absolute motion, thus it would be plausible if we consider the whole Universe as a great structure of a novel light clock that can be used by any observer! But how can it be defined? Assume that each observer holds a flashbulb and a clock of a sort. The observer turns on an electric current so that the flashbulb produces a signal and sends it through the space. The signal is reflected back from every object it reaches as a single light wave. Each reflection takes its own amount of time, proportional to the distance it travels, to be back in the compartment. Thus the observer measures the time interval of each reflected light wave. After the observer receives the reflected light waves, he calculates the mean value of all measured time intervals by summing them up and dividing the result by the number of objects that reflected the waves. This is his *real time* based on cosmic objects.

If the observer makes the measurements, he indeed measures the time that was denoted by t_{AA}, as mentioned in Sect. 3. If observer A judges B's time from his (A's) viewpoint, he indeed measures the time that was denoted by t_{BA}; these measurements would occur in the same way, from B's viewpoint, which result in time measurements denoted by t_{BB} and t_{AB} reciprocally. Nevertheless, in such a light clock there are some ambiguities that must be clarified: If there is an infinite number of objects in the cosmos, the number of reflected light waves would become infinite too, and also it would take an infinite amount of time that reflections, from objects located at distances of infinite values or objects of infinite numbers, reach the first place in the compartment.

Nonetheless, the present theory is flexible enough that by stating a few logical assumptions we can reach a proper solution to these problems of infiniteness:

1) The universe is isotropic and homogeneous *only* from the viewpoint of the observer at rest relative to his local galaxies or to the fixed stars.

2) For such an observer all local galaxies are assumed to be distributed on an imaginary sphere (or circle in two-dimensional space) with a large radius R. This assumption is stated to simplify our calculations; however, we can suppose that there are either several concentric spheres or other sorts of graphs determined by experiment to include all cosmic objects.

3) For simplicity, we consider the problem in two-dimensional space. Now we can begin our calculations for both symmetric and asymmetric conditions that we previously pointed out.

5.1. The Asymmetric System of Motions:

Imagine two observers $A \& B$, are at rest relative to each other and to their local galaxies shown below in Fig. 3.

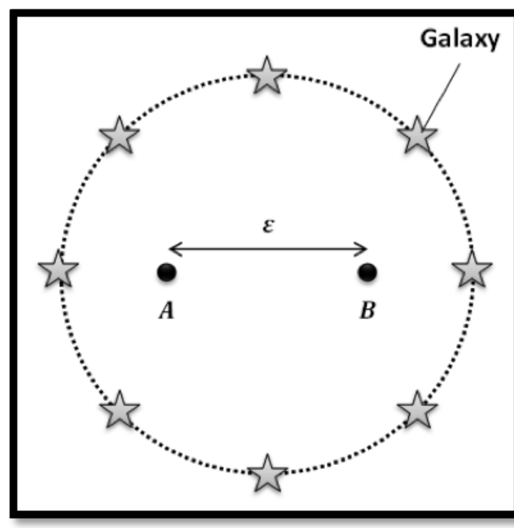

Figure 3. Observers A & B are at rest relative to each other and their local galaxies.

After a while, A accelerates until it reaches the velocity v_{AB} toward B and continues his motion in/as an inertial frame. We denote by v_{AB} the velocity of A as measured by B.

It has been realized that what A observes differs from what B doess, *i.e.*, from A's viewpoint not only is B approaching him, but also all the local galaxies located in front of him (A); but, from B's viewpoint, it is only A that approaches.

We first measure time in A's view when he uses his own external light clock, as described, among the local galaxies distributed on an imaginary circle around the observers homogeneously. From A's viewpoint, all the galaxies are approaching with a relativistic velocity v_{BA} (the letter B in the index denotes by the observer B itself or each galaxy). When the flash is being emitted by A, it travels within a time interval t_{AA1} and reflects back in the compartment after a time t_{AA2}.

We can write:

$$\Delta_{\mathrm{AB'B''}} \overset{\widehat{B'}=\theta}{\Rightarrow} v_{\mathrm{BA}}^2 t_{\mathrm{AA1}}^2 + D_{\mathrm{AA}}^2 - 2D_{\mathrm{AA}} v_{\mathrm{BA}} t_{\mathrm{AA1}} \cos\theta = C^2 t_{\mathrm{AA1}}^2$$
$$t_{\mathrm{AA1}} = \frac{D_{\mathrm{AA}}}{C^2 - v_{\mathrm{BA}}^2}\left(-v_{\mathrm{BA}}\cos\theta + \sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2\theta}\right) \quad . \tag{16}$$

where D_{AA} is the distance between A (The first A as subscript) and a celestial body from A's (The second subscript) viewpoint.

As shown in Fig. 4, and by using Eq. (16), we have:

$$Ct_{AA1} = Ct_{AA2} \xrightarrow{t_{AA}=t_{AA1}+t_{AA2}} t_{AA} = 2t_{AA1}$$
$$t_{AA} = \frac{2D_{AA}}{C^2 - v_{BA}^2}\left(-v_{BA}\cos\theta + \sqrt{C^2 - v_{BA}^2 \sin^2\theta}\right) = \tag{17}$$

Important Annotation 1: The other solution to Eq. (17) is

$$t_{\mathrm{AA1}} = \left[D_{\mathrm{AA}} \middle/ \left(C^2 - v_{\mathrm{BA}}^2\right)\right]\left(-v_{\mathrm{BA}}\cos\theta - \sqrt{C^2 - v_{\mathrm{BA}}^2 (\sin\theta)^2}\right) \ ,$$

which is unacceptable for the speeds with values less than that of light, *i.e.*, according to such a solution, negative values are assigned to the time for the interval $-C \le v_{\mathrm{BA}} \le C$, so we ignore it at this time. Nonetheless, as it is shown further, this solution becomes important in our calculations when the speeds exceed that of light: $v_{\mathrm{BA}} < -C$ or $v_{\mathrm{BA}} > C$. Therefore, remember that this solution can be considered by changing the term $\sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2\theta}$ into $-\sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2\theta}$ anywhere in the relevant results that are obtained.

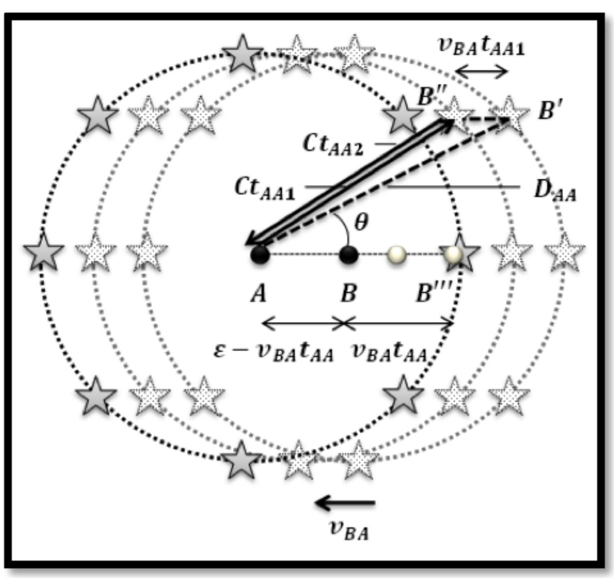

Figure 4. A flash is emitted by A and travels for time t_{AA1} and reflects back into the compartment after t_{AA2}.

According to Fig. 5, we can calculate t_{BA} as the time of B measured by A:

$$\Delta\mathrm{BB''B'''} \overset{\widehat{\mathrm{B''B'''B}}=\beta}{\Longrightarrow} v_{\mathrm{BA}}^2 t_{\mathrm{BA1}}^2 + D_{\mathrm{BA}}^2 - 2D_{\mathrm{BA}} v_{\mathrm{BA}} t_{\mathrm{BA1}} \cos\beta = C^2 t_{\mathrm{BA1}}^2$$
$$t_{BA1} = \frac{D_{\mathrm{BA}}}{C^2 - v_{\mathrm{BA}}^2}\left(-v_{\mathrm{BA}}\cos\theta + \sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2\theta}\right) \quad . \tag{18}$$

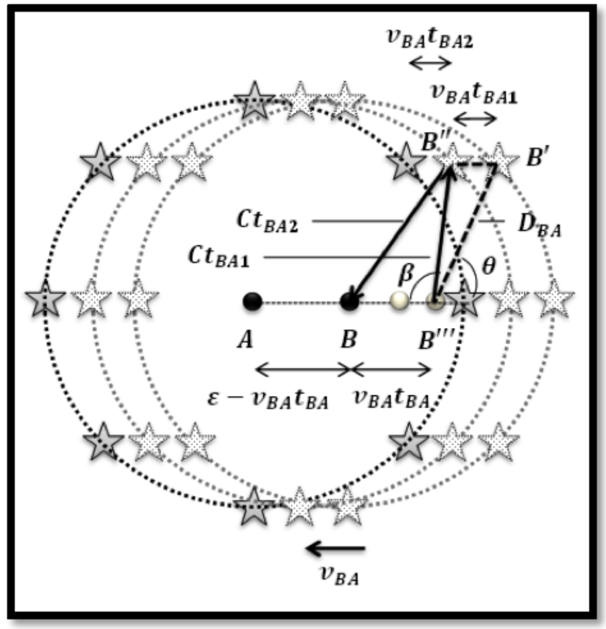

Figure 5. The Universe as viewed by A for measuring t_{BA}

$$\Delta\mathrm{BB''B'''} \overset{\widehat{\mathrm{B''B'''B}}=\beta}{\Longrightarrow} C^2 t_{\mathrm{BA1}}^2 + v_{\mathrm{BA}}^2 t_{\mathrm{BA}}^2 + 2Cv_{\mathrm{BA}} t_{\mathrm{BA1}} t_{\mathrm{BA}} \cos\beta = C^2 t_{\mathrm{BA2}}^2$$
$$\cos\beta = \frac{C^2 t_{\mathrm{BA2}}^2 - C^2 t_{\mathrm{BA1}}^2 - v_{\mathrm{BA}}^2 t_{\mathrm{BA}}^2}{2Cv_{\mathrm{BA}} t_{\mathrm{BA1}} t_{\mathrm{BA}}} \quad . \tag{19}$$

$$\Delta B'B''B''' \overset{\widehat{\mathrm{B'B''B'''}}=\beta}{\Longrightarrow}$$
$$C^2 t_{\mathrm{BA1}}^2 + v_{\mathrm{BA}}^2 t_{\mathrm{BA1}}^2 + 2Cv_{\mathrm{BA}} t_{\mathrm{BA1}}^2 \cos\beta = D_{\mathrm{BA}}^2 \quad . \tag{20}$$

Substituting Eq. (19) into Eq. (20), we have:

$$C^2 t_{\mathrm{BA1}}^2 + v_{\mathrm{BA}}^2 t_{\mathrm{BA1}}^2$$
$$+2Cv_{\mathrm{BA}} t_{\mathrm{BA1}}^2 \frac{C^2 t_{\mathrm{BA2}}^2 - C^2 t_{\mathrm{BA1}}^2 - v_{\mathrm{BA}}^2 t_{\mathrm{BA}}^2}{2Cv_{\mathrm{BA}} t_{\mathrm{BA1}} t_{\mathrm{BA}}} = D_{\mathrm{BA}}^2 \quad . \tag{21}$$

where $t_{\mathrm{BA}} = t_{\mathrm{BA1}} + t_{\mathrm{BA2}}$. By substituting Eq. (18) into Eq. (21), t_{BA2} can be calculated as:

$$t_{\mathrm{BA2}} = \frac{D_{\mathrm{BA}}^2}{t_{\mathrm{BA1}}(C^2 - v_{\mathrm{BA}}^2)} = \frac{D_{\mathrm{BA}}}{-v_{\mathrm{BA}}\cos\theta + \sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2\theta}} \tag{22}$$

Then for the total t_{BA}, we have:

$$t_{\mathrm{BA}} = t_{\mathrm{BA1}} + t_{\mathrm{BA2}} = \frac{D_{\mathrm{BA}}}{C^2 - v_{\mathrm{BA}}^2}\left(-v_{\mathrm{BA}}\cos\theta + \sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2\theta}\right) + \tag{23}$$

$$\frac{D_{\mathrm{BA}}}{-v_{\mathrm{BA}}\cos\theta + \sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2\theta}} \Rightarrow t_{\mathrm{BA}} = \frac{2D_{BA}}{C^2 - v_{\mathrm{BA}}^2}\sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2\theta} \ .$$

D_{BA} is the distance between B and a celestial body as seen from A 's viewpoint. See Fig. 6.

Next consider the problem from B 's viewpoint and his measurements of t_{BB} and t_{AB}. It is essential to change the previous Figures into different ones with regard to B 's viewpoint, *i.e.*, from his viewpoint it is only A that approaches him (B) and that the whole universe remains stationary.

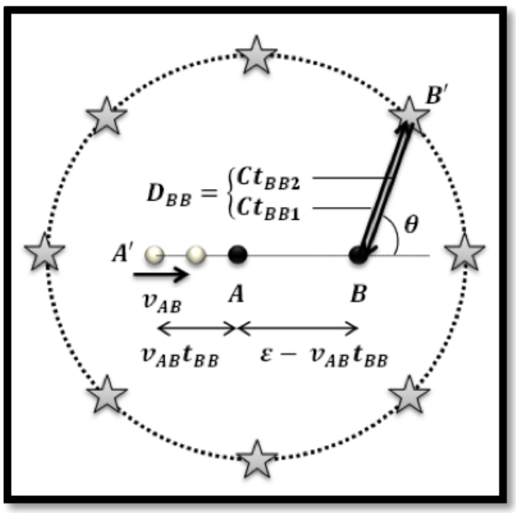

Figure 6. The time of B rom his own viewpoint.

D_{BB} is the distance between B (The first B as subscript) and a celestial body from B 's (The second subscript B) viewpoint. See Fig. 7. We can calculate t_{AB} as the time of A measured by B, for t_{BB}, we have:

$$Ct_{\mathrm{BB1}} = Ct_{\mathrm{BB2}} = D_{\mathrm{BB}} \xRightarrow{t_{\mathrm{BB}} = t_{\mathrm{BB1}} + t_{\mathrm{BB2}}} t_{\mathrm{BB}} = 2D_{\mathrm{BB}} / C \tag{24}$$

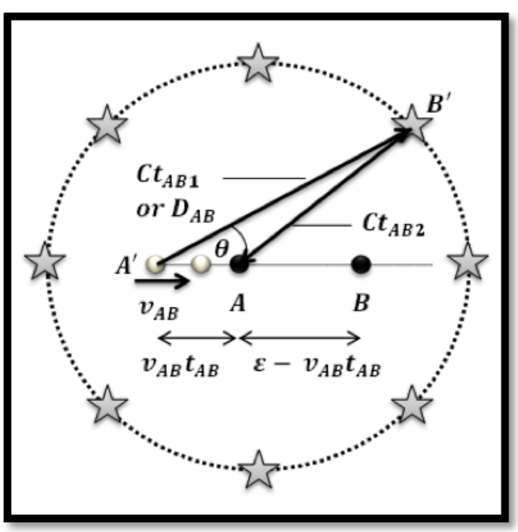

Figure 7. The time of A from B 's viewpoint.

According to Fig. 7, we can calculate t_{AB} as the time of A measured by B, we can write: for t_{BB}, we have:

$$\Delta AA'B' \Rightarrow v_{\mathrm{AB}}^2 t_{\mathrm{AB}}^2 + D_{\mathrm{AB}}^2 - 2D_{\mathrm{AB}} v_{\mathrm{AB}} t_{\mathrm{AB}} \cos\theta = C^2 t_{\mathrm{AB2}}^2$$

$$v_{\mathrm{AB}}^2 (t_{\mathrm{AB1}} + t_{\mathrm{AB2}})^2 - 2D_{\mathrm{AB}} v_{\mathrm{AB}} (t_{\mathrm{AB1}} + t_{\mathrm{AB2}}) \cos\theta = C^2 t_{\mathrm{AB2}}^2 \tag{25}$$

$$\xRightarrow{t_{\mathrm{AB1}} = D_{\mathrm{AB}}/C} t_{\mathrm{AB2}} = \frac{D_{\mathrm{AB}}}{C(C^2 - v_{\mathrm{AB}}^2)}\left(v_{\mathrm{AB}}^2 + C^2 - 2Cv_{\mathrm{AB}}\cos\theta\right) \ .$$

$$t_{AB} = t_{AB1} + t_{AB2} = \frac{2D_{AB}}{C^2 - v_{AB}^2}\left(C - v_{AB}\cos\theta\right) \tag{26}$$

All of the measurements of the time during which the light travels a distance to an arbitrarily chosen cosmic object (B′) and reflects back to both A and B, from each one's viewpoint, have been obtained in an asymmetric physical system of motion.

If we assume that the distance ε between observers is short compared with the distance between observers and celestial bodies D and that the distribution of objects is assumed to be on a circle, we can write:

$$D_{\mathrm{BB}} = D_{\mathrm{AB}} = R \tag{27}$$

Nevertheless, it is *not* plausible to deduce that $D_{\mathrm{BA}} = D_{\mathrm{AA}} = R$; *i.e.*, we cannot claim that the Universe in its general shape, from the viewpoint of the moving observer, remains unchanged and saves its spherical (circular) shape because if we do so, as we will show soon, illogical results will occur where we tend to calculate the mean value of time. Therefore, we set forth a presumption according to which the graph of the Universe obeys an arbitrary function of θ:

$$D_{\mathrm{BA}} = D_{\mathrm{AA}} = D(\theta) \tag{28}$$

Now we are determined to calculate the mean value of time for each of the four cases obtained above. If it is assumed that the distribution of cosmic objects around the observers is nearly continuous so that we can suppose such a distribution obeys a continuous function of θ, calculations of great simplicity, compared to those of discreet analysis, can be produced as follows. The first mean value theorem for integrals in polar coordinates, can be rewritten, as well as that in Cartesian coordinates:

$$\bar{f} = \frac{1}{\theta_1 - \theta_0}\int_{\theta_0}^{\theta_1} f(\theta)\, d\theta \tag{29}$$

Where the number $\bar{f}$ is the mean value of $f(\theta)$ for the interval $\theta_0 \le \theta \le \theta_1$. For a complete rotation, we get:

$$\bar{f} = \frac{1}{2\pi}\int_0^{2\pi} f(\theta)\, d\theta \tag{30}$$

Using Eq. (17,28) The mean value of the time t_{AA}, $\overline{t_{AA}}$, can be calculated as follows:

$$\overline{t_{\rm AA}} = \frac{1}{\pi(C^2 - v_{\rm BA}^2)} \int_0^{2\pi} D(\theta)\left[-v_{\rm BA}\cos\theta + \sqrt{C^2 - v_{\rm BA}^2 \sin^2\theta}\right] d\theta = (I+J)\Big/\pi(C^2 - v_{\rm BA}^2) \quad . \tag{31}$$

where:

$$I = \int_0^{2\pi} -D(\theta)\, v_{BA}\cos\theta\ d\theta\ ,\ J = \int_0^{2\pi} D(\theta)\sqrt{C^2 - v_{BA}^2\sin^2\theta}\ d\theta\ .$$

We denote by $\overline{t_{\rm AA}}$ the mean time measured by observer A due to the cosmic objects located in all directions around him. One of the important virtues of this clock is that no specific light path is preferred to others (all directions play role for the time measurement effectually, that is), whereas in Einstein's internal light clock one direction is preferred to others that was introduced as an anomaly in subsection (4.1). The other advantage of this clock is that no observer can neutral the paths of light by any negligible motion, such as turning the head or using a spyglass, to attain any odd anomaly, whereas this point leads to the second deficiency of Einstein's light clock that was discussed in subsection (4.2). Using Eqs. (27,28) in the same way, we can calculate average values for $t_{\rm BA}$, $t_{\rm BB}$ and $t_{\rm AB}$ ::

$$\overline{t_{\rm BA}} = \frac{1}{\pi(C^2 - v_{\rm BA}^2)} \int_0^{2\pi} D(\theta)\sqrt{C^2 - v_{\rm BA}^2\sin^2\theta}\ d\theta \tag{32}$$

$$\overline{t_{\rm BB}} = 2R/C \tag{33}$$

$$\overline{t_{\rm AB}} = 2CR\Big/(C^2 - v_{\rm AB}^2) \tag{34}$$

It is worthy to calculate the ratio of $\overline{t_{\rm AB}}\Big/\overline{t_{\rm BB}}$ in order to perceive whether A's clock runs slower or faster from the viewpoint of B:

$$\overline{t_{\rm AB}}\Big/\overline{t_{\rm BB}} = 1\Big/(1 - v_{\rm AB}^2\big/C^2) \tag{35}$$

This equation shows that the clock of the observer, who accelerates for a while and then continues in an inertial frame, runs slower from the viewpoint of the observer at rest (relative to the local galaxies). Nonetheless, the clock of the observer at rest runs faster (See Eq. (1)) from the standpoint of the observer who has experienced acceleration for a while:

$$\overline{t_{\rm BA}}\Big/\overline{t_{\rm AA}} = 1 - v_{\rm AB}^2\big/C^2 \tag{36}$$

The result obeys the inverse function of the previous one. This shows a great discordant state with invariant physical laws from one inertial frame to the second one moving with constant velocity relatively to each other that introduced by Einstein. Moreover, a second discordance notes that although the moving clock runs slower from the viewpoint of the observer at rest, it obeys different function than that of Einstein's relativity. Indeed, Eq. (35) is the same as Eq. (20) obtained in subsection (4.1), however, this must not be conceived as a final result because the methods of evaluating a mean value for a function are galore. According to Eq. (1), as one of our philosophical expectations, we can also write:

$$\overline{t_{\rm AB}}\Big/\overline{t_{\rm BB}} = \overline{t_{\rm AA}}\Big/\overline{t_{\rm BA}} \Rightarrow 1\Big/\left(1 - v_{\rm AB}^2\big/C^2\right) = \frac{1/\pi(C^2 - v_{\rm BA}^2)\int_0^{2\pi} D(\theta)\left(-v_{\rm BA}\cos\theta + \sqrt{C^2 - v_{\rm BA}^2\sin^2\theta}\right)d\theta}{1/\pi(C^2 - v_{\rm BA}^2)\int_0^{2\pi} D(\theta)\sqrt{C^2 - v_{\rm BA}^2\sin^2\theta}\, d\theta}$$
$$(1 - v_{\rm AB}^2\big/C^2)^{-1} = (I+J)/J \quad . \tag{37}$$

where:

$$I = \int_0^{2\pi} -D(\theta)\, v_{\rm BA}\cos\theta\ d\theta\ ,\ J = \int_0^{2\pi} D(\theta)\sqrt{C^2 - v_{\rm BA}^2\sin^2\theta}\ d\theta\ .$$

It is worthwhile to note that $v_{\rm AB}$ is not essentially equal to $v_{\rm BA}$ that can be revealed as the third disagreement of apparent theory with Einstein's presupposition. According to Einstein's first postulate, it is realized that in two inertial frames not only length and time but also the absolute value of relative velocities must be measured equally from each of the points of view. Nonetheless, in our theory we cannot claim the validity of such a presupposition because the theory tends to show that the laws of physics are *variant* from one reference frame to the other unless we take account of the symmetric system of motions in which the laws of physics are considered to be unchanged. That is to say, in a symmetric system, there happens neither time dilation (shrinkage) nor length contraction (expansion) nor any other change that distinguishes one frame from another. Recall that, as we have pointed out earlier, if we assume the general shape of the universe, from A's viewpoint, remains unchanged $D_{\rm BA} = D_{\rm AA} = R$, thus we must insert R instead of $D(\theta)$ into Eq. (37) that results in $I = 0$ and thus $1\big/(1 - v_{\rm AB}^2/C^2) = 1 \to v_{AB}/C = 0$, which is not correct. This, urges us to assume that the graph of the universe should change from A's viewpoint.

5.2. The Symmetric System of Motions

In the previous example, if we accelerate observer B to the same velocity of A, we made the situation symmetric indeed. In this case, whatever B measures must physically be equal to the measurements made by A but this does not mean that if from A's viewpoint B's clock runs slower, then from B's viewpoint A's clock runs slower either! Because if we accede to any changes in length or time measured by any of the observers, the twin and ladder paradoxes will be revived; unless we realize that not only the ratio of $\overline{t_{\rm BA}}$ to $\overline{t_{\rm AA}}$ is to be equal to the ratio of $\overline{t_{\rm AB}}$ to $\overline{t_{\rm BB}}$ but also the ratios must be equal to unity. [See Eq. (2).] That is, such observers cannot reveal any time-length change compares with their stationary condition. Now we consider the problem from A's viewpoint as shown in Fig. 8. In a symmetric system of motion, it is confirmed by daily experience that from each of the observers' viewpoint the relative velocity of the other observer is nearly measured twice that of the local galaxies:

$$u_{\rm AB} = u_{\rm BA} \cong 2v_{\rm AB}\ (\text{or} \cong 2v_{\rm BA}) \tag{38}$$

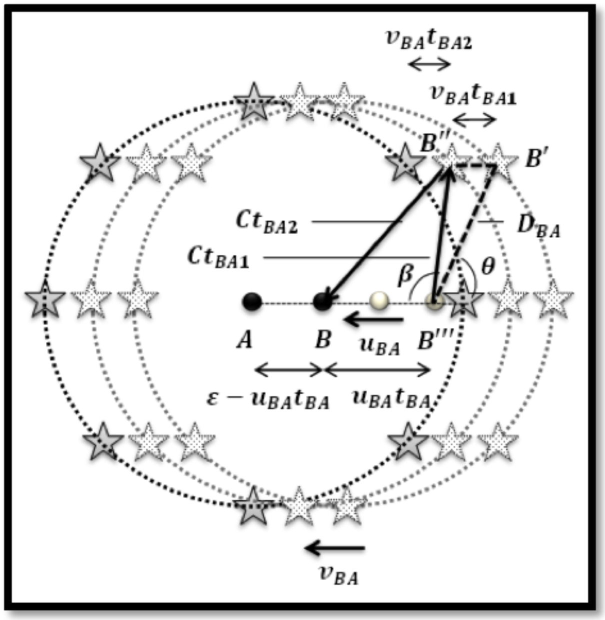

Figure 8. The time of t_{BA} from A's viewpoint in the symmetric system of motions

According to Galilean transformation, it is calculated that u_{AB} must be exactly equal to $2v_{\mathrm{AB}}$ (or $2v_{\mathrm{BA}}$) and that $v_{\mathrm{AB}} = v_{\mathrm{BA}}$. Nonetheless, in the apparent theory we cannot deduce that velocity vectors essentially obey the rule of the common addition of vectors neither in asymmetric nor in symmetric systems and the equality between v_{AB} and v_{BA} can only be deduced, compatible with experiments, when the symmetric system of motions is argued. In this case, t_{AA} obeys the function obtained in Eq. (17) but for t_{BA} we must arrange new calculations with regard to Fig. 8:

$$\Delta B'B''B''' \overset{B''B'''B=\beta}{\Longrightarrow} v_{\mathrm{BA}}^2 t_{\mathrm{BA1}}^2 + D_{\mathrm{BA}}^2 - 2D_{\mathrm{BA}} v_{\mathrm{BA}} t_{\mathrm{BA1}} \cos\theta = C^2 t_{\mathrm{BA1}}^2$$
$$t_{\mathrm{BA1}} = \frac{D_{\mathrm{BA}}}{C^2 - v_{\mathrm{BA}}^2}\left[-v_{\mathrm{BA}}\cos\theta + \sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2\theta}\right] . \quad (39)$$

$$\Delta BB''B''' \overset{\widehat{B''B'''B}=\beta}{\Rightarrow} C^2 t_{\mathrm{BA1}}^2 + u_{\mathrm{BA}}^2 t_{\mathrm{BA}}^2 + 2C u_{\mathrm{BA}} t_{\mathrm{BA1}} t_{\mathrm{BA}} \cos\beta = C^2 t_{\mathrm{BA2}}^2 \quad (40)$$
$$\cos\beta = \left(C^2 t_{\mathrm{BA2}}^2 - C^2 t_{\mathrm{BA1}}^2 - u_{\mathrm{BA}}^2 t_{\mathrm{BA}}^2\right) \Big/ \left(2C u_{\mathrm{BA}} t_{\mathrm{BA1}} t_{\mathrm{BA}}\right) .$$

$$\Delta B'B''B''' \overset{B'B''B'''=\beta}{\Longrightarrow} C^2 t_{\mathrm{BA1}}^2 + v_{\mathrm{BA}}^2 t_{\mathrm{BA1}}^2 + 2C v_{\mathrm{BA}} t_{\mathrm{BA1}}^2 \cos\beta = D_{\mathrm{BA}}^2 \quad (41)$$

Substituting Eq. (40) into Eq. (41), we have:

$$C^2 t_{\mathrm{BA1}}^2 + v_{\mathrm{BA}}^2 t_{\mathrm{BA1}}^2 + 2C v_{\mathrm{BA}} t_{\mathrm{BA1}}^2 \frac{C^2 t_{\mathrm{BA2}}^2 - C^2 t_{\mathrm{BA1}}^2 - u_{\mathrm{BA}}^2 t_{\mathrm{BA}}^2}{2C u_{\mathrm{BA}} t_{\mathrm{BA1}} t_{\mathrm{BA}}} = D_{\mathrm{BA}}^2 \quad (42)$$

where $t_{\mathrm{BA}} = t_{\mathrm{BA1}} + t_{\mathrm{BA2}}$. By substituting Eq. (39) into Eq. (42), t_{BA2} can be calculated and then t_{BA} is obtained as follows:

$$t_{\mathrm{BA}} = \left[2D(\theta) \Big/ (C^2 - u_{\mathrm{BA}}^2)(C^2 - v_{\mathrm{BA}}^2)\right] \times \left[\begin{array}{r} \dfrac{-\sin^2\theta\, v_{\mathrm{BA}}^3 - (v_{\mathrm{BA}}^2 + C^2) X \cos\theta + (1 + \cos^2\theta) C^2 v_{\mathrm{BA}}}{(v_{\mathrm{BA}}\cos\theta - X)} \times u_{\mathrm{BA}} \\ -C^2 (v_{\mathrm{BA}}\cos\theta - X) \end{array}\right] . \quad (43)$$

where $X = \sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2\theta}$. Using Eq. (30), we can calculate the average value for t_{BA} as before:

$$\overline{t_{BA}} = (u_{BA} K + L) \Big/ \left[\pi (C^2 - u_{\mathrm{BA}}^2)(C^2 - v_{\mathrm{BA}}^2)\right] \quad (44)$$

where

$$K = \int_0^{2\pi} \left[\frac{-\sin^2\theta v_{\mathrm{BA}}^3 - (v_{\mathrm{BA}}^2 + C^2) X \cos\theta + (1 + \cos^2\theta)\, C^2 v_{\mathrm{BA}}}{(v_{\mathrm{BA}}\cos\theta - X)}\right] D(\theta)\, d\theta .$$

and $$L = \int_0^{2\pi} C^2 (-v_{\mathrm{BA}}\cos\theta + X) D(\theta)\, d\theta$$

If just a little thinking is applied, in comparison with Eq. (37), we realize that:

$$L = C^2 (J + I) \quad (45)$$

$$K = \frac{-1}{v_{\mathrm{BA}} C^2}\left[v_{\mathrm{BA}}^2 L + I C^2 (C^2 - v_{\mathrm{BA}}^2)\right] = \frac{-1}{v_{\mathrm{BA}}}(v_{\mathrm{BA}}^2 J + C^2 I) \quad (46)$$

(To prove the equations above, computations must be done patiently by hand.)

According to Eq. (2), in a symmetric system, we can deduce that $\overline{t_{BA}} = \overline{t_{AA}}$ and by using Eq. (31,44) simultaneously:

$$\overline{t_{\mathrm{BA}}} - \overline{t_{\mathrm{AA}}} = 0 \Rightarrow \frac{u_{\mathrm{BA}} K + L}{\pi (C^2 - u_{\mathrm{BA}}^2)(C^2 - v_{\mathrm{BA}}^2)} - \frac{(I + J)}{\pi (C^2 - v_{\mathrm{BA}}^2)} = 0 \quad (47)$$

Then we obtain:

$$u_{\mathrm{BA}} = \frac{-1}{2(I + J)}\left(K \pm \sqrt{K^2 + 8IJC^2 - 4IL + 4C^2 I^2 + 4C^2 J^2 - 4JL}\right) \quad (48)$$

By substituting Eq. (45,46) into Eq. (48), the acceptable solution for u_{BA} is calculated:

$$u_{\mathrm{BA}} = (v_{\mathrm{BA}}^2 J + C^2 I) \Big/ v_{\mathrm{BA}} (J + I) \quad (49)$$

By using Eq. (37) for u_{BA} as a function of v_{BA} and v_{AB}, we finally obtain:

$$u_{\mathrm{BA}} = (v_{\mathrm{BA}}^2 C^2 + v_{\mathrm{AB}}^2 C^2 - v_{\mathrm{BA}}^2 v_{\mathrm{AB}}^2) \Big/ v_{\mathrm{BA}} C^2 \quad (50)$$

This result must nearly be equal to that of our daily experiences as described before, *i.e.*, if we assume the velocity of light approaches an infinite value (velocities are negligible compared with that of light, that is), the equation above must approaches $2v_{\mathrm{BA}}$ (or $2v_{\mathrm{AB}}$):

$$\lim_{C\to\infty} \left(v_{\mathrm{BA}}^2 C^2 + v_{\mathrm{AB}}^2 C^2 - v_{\mathrm{BA}}^2 v_{\mathrm{AB}}^2\right) \Big/ v_{BA} C^2 = v_{\mathrm{AB}} + v_{\mathrm{BA}} \cong 2v_{\mathrm{BA}} \text{ or } 2v_{\mathrm{AB}} \quad . \tag{51}$$

This accordance shows that the theory, based on philosophical expectations, culminated in a plausible result so far.

Before continuing the calculations, let us note that in an asymmetric system of motions there were four fundamental cases as was shown in Fig. (4-7) However, in a symmetric system we considered only one case as shown in Fig. (8), because one of the situations (AA) is analogous to that of asymmetric discussed before and the two others (AB & BB), would culminate in the same results as obtained above just because of the symmetry of the system. There is a bridge of relation between an asymmetric and symmetric systems that helped us to eliminate some of the undetermined values like that we used to reach Eq. (50). We know that finite changes, when a system including an infinite number of objects is considered, have no effect on the mean value of the function involved with that infinite amount of objects. Therefore, *e.g.*, we neglected the straight effect of A 's motion on B 's measurements of time; *i.e.*, the light emitted from B to A , as one of the infinite number of light paths, was not considered. Through the next Section we discuss the graph of universe as is viewed by A or B using Eqs. (27,28).

Additionally, we must point out that an infinite number of shapes (curves) can be attributed to $D(\theta)$ in terms of our choice of the spherical (circular) distribution of objects, with a radius R , from the point of view of the observer at rest, which must satisfy conditions discussed in the next Section.

6. Limacon-Like Universe

From each observer's viewpoint, the general shape of the universe cannot exactly be derived from our time equations obtained through the previous section. Therefore, we must *guess* an appropriate function for $D(\theta)$ that satisfies the conditions:

$$v_{BA} = 0 \Rightarrow D(\theta) = R \tag{52}$$

and

$$D(\theta) \geq 0 \tag{53}$$

A good guess is that $D(\theta)$ can be derived from Eq. (17) [or Eq. (23)] as follows:

$$D(\theta) = CR\left(-v_{\mathrm{BA}} \cos\theta \pm \sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2\theta}\right) \Big/ \left(C^2 - v_{\mathrm{BA}}^2\right) \tag{54}$$

The plus sign is considered for $-C \leq v_{\mathrm{BA}} \leq C$ and the minus one for $v_{\mathrm{BA}} < -C$ or $v_{\mathrm{BA}} > C$. This equation and that of limacon are very alike in graphs. If observer A moves at a considerable fraction of the light velocity, he observes that the distance between him and the objects in front of him just contracts and the behind distances expand. See Fig. 9.

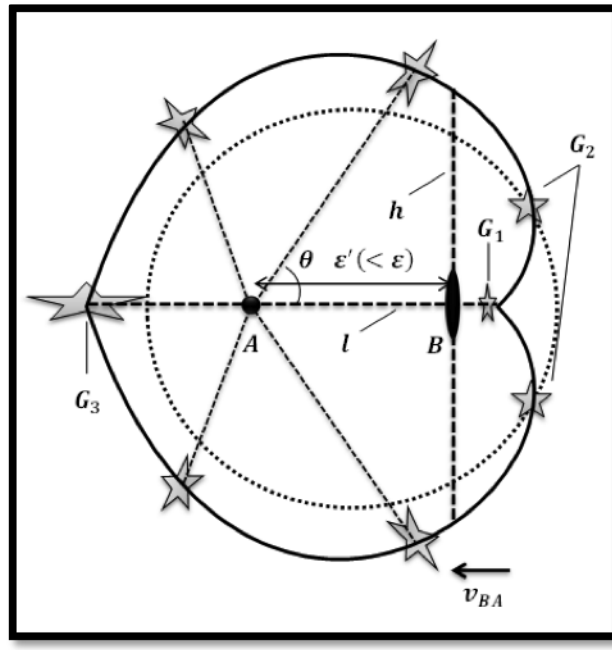

Figure 9. Universal lines l and h are shown from A 's viewpoint. G_1 represents a galaxy that contracts in front of A . G_2 represents two Galaxy that remain unchanged because they are located on the intersection point of the two graphs, $D(\theta) / R = 1$. G_3 represents a galaxy that expands just behind A .

When the observer stops moving $v_{\mathrm{BA}} = 0$, according to Eq. (52), the heart-like universe changes into a sphere (circle) with a radius R . Now it is time for detecting the effect of such universal-length-scale changes on the spatial distribution of a single object like the observer B as is being observed by the moving observer A . According to Eq. (54), for each spatial direction determined by θ , there will be an imaginary straight line between A & B that changes (obeys the heart shape in polar coordinates) with respect to the time that A is at rest (obeys the graph of circle with a radius R).

Important Annotation 2: As we mentioned, there are several functions that can replace Eq. (54) so that each can satisfy the conditions introduced by Eqs. (52,53), *e.g.*, $D(\theta) = R + R(v_{\mathrm{BA}} / C)^n \cos(m\theta + l)$ for $n > 0$ can be revealed as another proper function for $D(\theta)$. In Einstein's SRT, despite the deficiensies discussed earlier, it is possible to compute the changes (contraction) in the other spatial dimension while it is assumed that the time is changed in the direction perpendicular to the previous one (the height is assumed unchanged). However, in the present theory, conditions are not restricted enough to result in an specific function for $D(\theta)$ explicitly but it is possible to verify the plausibility of an arbitrary function for $D(\theta)$. That is, the theory cannot show how exactly the universe changes from the viewpoint of the moving observer and must be determined by experiment indeed, however, as an aproximation, we defined it by the Eq. (54). We assumed that $D_{\mathrm{BA}} = D_{\mathrm{AA}} = D(\theta)$ that means the universe from A 's viewpoint with either A or B as the pole

of a polar coordinate system, obeys the same function $D(\theta)$ because the distance $\in$ is supposed to be very short and the points $A \& B$ are approximately superposed on each other.

Therefore, the ratio $D(\theta)/R$ can help us to determine the contraction or expansion of length in any angular directions. It is plausible to say that the spatial dimension of object B, corresponding to the imaginary line mentioned, absolutely obeys the ratio. That is to say, in the case of approaching, if A views that the universal lengths (l) contracts in front of him with respect to his rest, he will deduce that the spatial dimension of object B contracts too in the direction of the motion. Fig. 9. Conversely, in the case of recession, if A views that the universal lengths (l) expands behind him with respect to his rest, he will deduce that B is also expanded parallel to the direction of motion. Fig. 10. The change in the spatial dimension of B perpendicular to the motion obeys the change in cosmic line (h) passes through the point B perpendicular to the motion as is observed by A. Fig. 9 From A's viewpoint, the rest of the cosmic objects are effected in spatial dimensions as shown in Fig. 10.

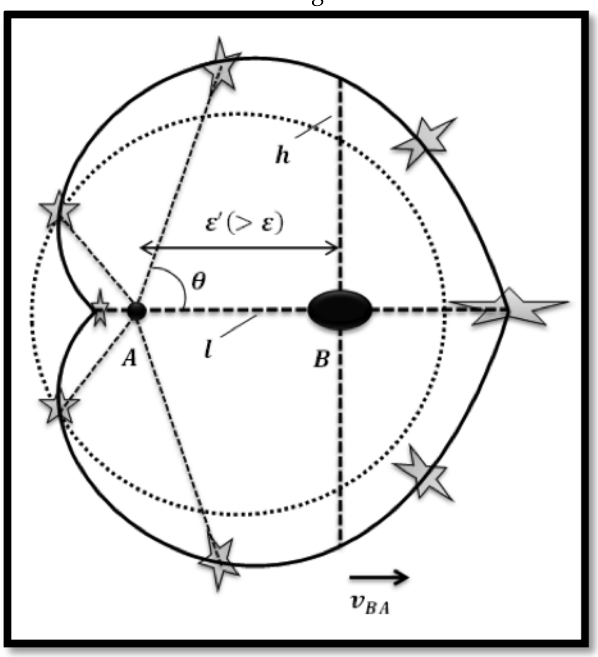

Figure 10. In case of recession, from A's viewpoint, B expands in all spatial dimensions in terms of the changes in universal lines.

It is worthwhile to mention that the heart-like universe remains unchanged from A's viewpoint even if B accelerates to the same value of A's speed in a symmetric system. Nonetheless, in this case, B's spatial dimensions change into their normal magnitudes (when both $A \& B$ were at rest) as is being observed by A. Therefore, each of $A \& B$ detects no change in spatial dimensions, height, length and width, of the other one with respect to the time that they are both at rest. The symmetric system of motions is shown in Fig. 11. Remember that there is no need for us to get rid of any paradox. That is, the theory has been founded stably in order not to face any anomaly, at least about time and length.

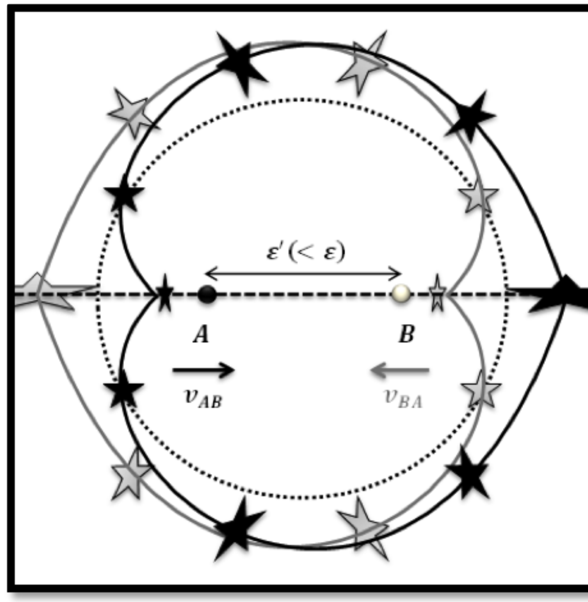

Figure 11. Symmetrical system of motions from each observer's viewpoint for the case of approach. The Universe as is viewed by A is shown in grey, and from B's viewpoint it is in black

As a numerical example, let us consider one of the most discussed peculiarities of Einstein's relativity, the twin paradox,:

Example 1

Josh and Jade are fraternal twins. Josh travels with a velocity $v = 0.6c$ to a planet and returns while Jade remains at home. **a)** When they are together again, which twin is younger? **b)** What is Jade's speed measured by Josh? **c)** Argue about their changes in spatial dimensions from each one's viewpoint.

First, we should be convinced that the problem is an asymmetric case. Therefore, Josh plays the role of the observer A and Jade plays that of B as were shown in Fig. (4-7). According to Eq. (35) we have:

$$\overline{t_{AB}} \Big/ \overline{t_{BB}} = 1 \Big/ \left(1 - v_{AB}^2 \Big/ C^2\right) = 1/(1 - 0.6^2) \cong 1.56 > 1$$

If the travel takes 3 years measured by Jade on Earth, she nearly measures that Josh got two years older ($3/1.56$), *i.e.*, he is younger than she is at the time they are together again. From Josh's viewpoint [Eq. (36)], he measures:

$$\overline{t_{BA}} \Big/ \overline{t_{AA}} = 1 - v_{AB}^2 \Big/ C^2 = 1 - 0.6^2 = 0.64 < 1$$

The travel takes nearly two years (3×0.64) from his viewpoint whereas he views that it takes three years for his sister with respect to the clock is held by her, *i.e.*, from Jade's viewpoint, her brother's clock runs slower, whereas from Josh's viewpoint, his sister's clock runs faster and the asymmetry between these motions of twins justifies the time discrepancy. For the second part, according to Eq. (37) we have:

$$\frac{1}{1 - v_{AB}^2 \Big/ C^2} = \frac{I + J}{J} \Rightarrow \frac{1}{1 - 0.6^2} = \frac{\int_0^{2\pi} -D(\theta) v_{BA} \cos\theta \, d\theta}{\int_0^{2\pi} D(\theta) \sqrt{C^2 - v_{BA}^2 \sin^2\theta} \; d\theta} + 1$$

By substituting $D(\theta)$ from Eq. (54), we calculate:

$$v_{\mathrm{BA}} \cong \pm 0.85\ C\ \mathrm{m/sec}$$

That is, from Josh's viewpoint, Earth and her sister move with a speed exceeds that of Jade. By using numerical methods (or a scientific calculator), we can perceive that, from Jade's viewpoint, if Josh's speed approaches C, & A & B ,; from Josh's viewpoint, Jade's speed will grow beyond all bounds that is completely discussed through the next section. For the third part of the example, we should consider the ratio of $D(\theta)/R$ according to Eq. (54) in order to calculate the changes in Jade's length, parallel to the direction of motion ($\theta = 0°$), as is viewed by Josh:

$$\frac{L_{\mathrm{BA}}}{L_{\mathrm{AA}}} = \frac{D(0)}{R} = \frac{C}{C^2 - v_{\mathrm{BA}}^2}\left[-v_{\mathrm{BA}}\cos 0 + \sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2 0}\right]$$
$$= 1/(1+0.85) \approx 0.54 < 1 \quad .$$

This equation shows that the universal length parallel to the motion contracts in front of Josh thus, the length of his sister obeys the factor and contracts too. Nevertheless, this result is correct when Josh returns home and observes her sister approaching. While he is moving away from Jade and travels to the planet, he leaves her sister behind ($v_{\mathrm{BA}} = -0.85C$) and we have:

$$L_{\mathrm{BA}}\big/L_{\mathrm{AA}} = D(0)\big/R = C\big/(C + v_{\mathrm{BA}}) = 1/(1-0.85) = 6.66 > 1$$

In this case, he observes that his sister expands in length parallel to the motion. Fig. 10 For the height of the earth (Jade), from Josh's viewpoint, we must consider the changes in the universal line (h) passes through B (Jade) perpendicular to the motion. See Fig. 9. However, if the distance ε between Jade and Josh is short compared with cosmic distances $D(\theta)$, we can consider the magnitude of D for $\theta = \pi/2$ thus, we have:

$$\frac{h_{\mathrm{BA}}}{h_{\mathrm{AA}}} = \frac{\pi}{2}\frac{D}{R} = \frac{C}{C^2 - v_{\mathrm{BA}}^2}\left[-v_{BA}\cos(\pi/2) + \sqrt{C^2 - v_{\mathrm{BA}}^2 \sin^2(\pi/2)}\right]$$
$$= C\Big/\sqrt{C^2 - v_{\mathrm{BA}}^2} = 1\Big/\sqrt{1-0.85^2} = 1.89 > 1$$

For Josh, in both cases of approaching and receding Jade, the height of the earth (Jade) expands by the factor obtained above. Now we tend to discuss the spatial dimensions of Josh as is viewed by her sister on earth. According to Eq. (3), we can write:

$$\frac{L_{\mathrm{AB}}}{L_{\mathrm{BB}}} = \frac{L_{\mathrm{AA}}}{L_{\mathrm{BA}}} \Rightarrow \frac{L_{\mathrm{AB}}}{L_{\mathrm{BB}}} = \begin{cases} 1/0.54 = 1.85 \text{ (approaching)} \\ 1/6.66 = 0.15 \text{ (receding)} \end{cases}$$

For the height, we have:

$$\frac{h_{\mathrm{AB}}}{h_{\mathrm{BB}}} = \frac{h_{\mathrm{AA}}}{h_{\mathrm{BA}}} \Rightarrow \frac{h_{\mathrm{AB}}}{h_{\mathrm{BB}}} = \frac{1}{1.89} = 0.53 \begin{cases} \text{approaching} \\ \text{\& receding} \end{cases}$$

It is worth mentioning that in finding changes in spatial dimensions of a moving object from the viewpoint of the observer at rest, there is not any strict physical rules but philosophical ones like those we easily stated in section three. That is, the theory is flexible enough for the philosophy to be involved, a characteristic in opposition to that of Einstein's Special Relativity Theory discussed in Sect. 4.

7. The Doppler Effect

One of the most important physical facts must be interpreted by the theory is the frequency of light and its alteration in the motion systems introduced previously. As mentioned in Subsect. 4.3, light has its own *clock*, *i.e.*, in the wave theory of light, there is a physical factor that can be understood as a time measurer: *The frequency*.

The frequency is a clock that can be used with no need of introducing a to-and-fro journey of light in a straight line. That is, in this Article we (and Einstein himself in his internal light clock) *made* a light-clock by the use of periodical motion of light in a straight line, as if, we were completely ignorant of the fact that a single photon *includes* a property that can be used as a time measurer per se. By this interpretation, it is realized that if there are several clocks being introduced in different ways such as a to-and-fro journey or the frequency of light itself, all must result in the same measurements of time from the viewpoint of a specific observer and must obey our philosophical expectation of time. That is to say, the observer *should* calculate the same results for time taking the mean values in each way or he will encounter another paradox of time discussed previously. Therefore, according to our theory, we *must* have:

$$\overline{T_{\mathrm{AB}}}\big/\overline{T_{\mathrm{BB}}} = \overline{t_{\mathrm{AB}}}\big/\overline{t_{\mathrm{BB}}} \quad , \quad \overline{T_{\mathrm{BA}}}\big/\overline{T_{\mathrm{AA}}} = \overline{t_{\mathrm{BA}}}\big/\overline{t_{\mathrm{AA}}} \tag{55,56}$$
(in both cases of symmetric and asymmetric motion)

where $T_{ij} = 1/\nu_{ij}$ and ν_{ij} is the frequency of i's light from j's viewpoint.

Starting with $\overline{T_{\mathrm{AB}}}\big/\overline{t_{\mathrm{BB}}} = \overline{t_{\mathrm{AA}}}\big/\overline{T_{\mathrm{BA}}}$,

substituting Eq. (56), $\overline{T_{\mathrm{AA}}}\big/\overline{T_{\mathrm{BA}}} = \overline{t_{\mathrm{AB}}}\big/\overline{t_{\mathrm{BB}}}$

Substituting Eq. (35), $$\overline{T_{\mathrm{AA}}}\big/\overline{T_{\mathrm{BA}}} = 1\Big/\left(1 - v_{\mathrm{AB}}^2\big/C^2\right) \tag{57}$$

Unfortunately, we cannot determine T_{ij} as a function of θ but the ratio of their mean values $\bar{T}_{ij}$ to each other. Nonetheless, any arbitrarily chosen function for T_{ij} that satisfies Eq. (57) can be approved as an approximation to the real function. A good function can be evoked from the main functions of t_{ij}. That is, we can assume $T_{ij} = kt_{ij}$, where k is a proper constant. Thus, we have:

$$T_{\mathrm{AA}}/T_{\mathrm{BA}} = \overline{t_{\mathrm{AB}}}\big/\overline{t_{\mathrm{BB}}} \quad ..$$

By Eqs. (24, 26, 27)

$$T_{AA}/T_{BA} = C\left(C - v_{AB}\cos\theta\right)/\left(C^2 - v_{AB}^2\right) \quad . \tag{58}$$

With $\theta = 0$,

$$\frac{\nu_{BA}}{\nu_{AA}} = \begin{cases} C/\left(C + v_{AB}\right) < 1 \text{ (approaching)} \\ C/\left(C - v_{AB}\right) > 1 \text{ (receding)} \end{cases} \quad . \tag{59}$$

The equations include an important contradiction with those of Einstein. According to Eqs. (58, 59), if A approaches B ($v_{AB} > 0$), A views that the frequency of light emitted by B ($\theta = 0$) is less in comparison with the time they were both at rest. Mutually, in the case of receding ($v_{AB} < 0$, $\theta = 0$), B′s frequency increases from A′s viewpoint, whereas Einstein predicted that, conversely, the frequency of B must be measured greater than that produced by A in the case of approaching and must be measured less in the case of receding from A′s (and also B′s) viewpoint. However, the present theory, approximately, agrees with SRT from B′s viewpoint:

$$\frac{\nu_{AB}}{\nu_{BB}} = \frac{C^2 - v_{AB}^2}{C^2 - Cv_{AB}\cos\theta} = \begin{cases} (C + v_{AB})/C > 1 \text{ (approaching)} & (60) \\ (C - v_{AB})/C < 1 \text{ (receding)} & (61) \end{cases}$$

According to Einstein's theory, relevant equations are introduced as follows:

$$\frac{\nu_{AB}}{\nu_{BB}} = \frac{\sqrt{C^2 - v_{AB}^2}}{C - v_{AB}\cos\theta} = \begin{cases} \sqrt{(C + v_{AB})/(C - v_{AB})} > 1 \text{ (approach)} & (62) \\ \sqrt{(C - v_{AB})/(C + v_{AB})} < 1 \text{ (receding)} & (63) \end{cases}$$

In a symmetric motional system, there occurs another contradiction with SRT, *i.e.*, in this case no change in frequency must be determined by each of the observers, while we tend to save the principle of *similarity between all sorts of clocks*, whereas SRT insists on the frequency alteration in conformity with Eq. (62, 63). In this case, it would be hard checking which of the results holds more accuracy experimentally because the experiments must be carried out from the viewpoint of the moving observer, otherwise, experiments, from the viewpoint of the observer at rest relative to cosmic objects yield results nearly compatible with those of SRT We can see that the theory is capable of eliminating the shortcoming discussed in Subsect. 4.3. That is, there is a great agreement between different ways of measuring time based on the apparent theory whereas Einstein's SRT lacks the advantage.

8. Conclusion

We see that the absolute motion can be detected if we consider the whole cosmos. Therefore, the invariability of physical laws in the reference frames with constant velocities relative to each other is not correct when we consider an asymmetric system of motions, hence, Einstein's claim, which is asserted in his theory as the first Postulate, is not defendable any further.

Arguing about the asymmetric and symmetric systems of motions, it culminated in logical results far apart from any paradoxes and made it clear that it is not plausible to use any oscillating apparatus as *real time* measurers. Einstein's internal light clock was also found improper for time and length measurements because it results in some ambiguities and it does not allow the philosophical expectations to be involved with the physical speculations, whereas the new theory is flexible enough to do so. All noted SRT deficiencies were resolved by the theory. The philosophy, unfortunately, has been put away by physicists in recent times and we think that the happening of this affair is due to the overvaluing the role of mathematics in physics, namely, the physicists of nowadays tend to play with the mathematical formulas as an entertaining activity and as a pastime. Nevertheless, if we cogitate about the important theories that have been stated through the history we will find undeniable traces of philosophy as sparks that have kindled the arid woods of physics. In this theory, the philosophy was revived so that we could apply it to our physical problems and, further, we deduced some important formulas that obviously helped us to form a firm theory with satisfactory solutions to many of renowned and less-known problems in Einstein's SRT.

Acknowledgment

I must thank God for the inspiration that caused me to reach a clear deduction for the main difference of the symmetric and asymmetric systems of motions, and for igniting the sparks of intellection in my mind to attain a plausible definition for the absolute motion.

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Comments From the Editor: On the Use of Postulates in Mathematical Physics

As students, we were all introduced to the use of Postulates in Mathematics through a course in Euclidean Geometry. Postulates allow different people to embark on a shared mathematical development with a common basis of belief. Postulates make clear to all the students all of the Assumptions being used in the development.

The main rules for us to follow are:

1) List all Assumptions as fully and clearly as possible at the beginning of the development;

2) Delete any Assumptions that can be derived from other Assumptions listed earlier, and

3) Once the list is complete enough to support further derivations of theorems and lemmas, **leave the list alone**.

If you are ever tempted to add another Postulate to a working mathematical system, then be *sure* to delete some earlier Postulate in order to make mental space for the new one. We must *never* introduce *more* Postulates into a situation that does not *need* them. Too many Postulates can lead to Contradictions, otherwise known as *Paradoxes*. From the days of ancient Greece, the spirit of Euclid has been with us, warning us to refrain from wantonly making up new Postulates.

The use of Postulates in the foundation for Special Relativity Theory (SRT) doesn't quite follow Euclid's advice. The first Postulate says the laws of Physics are the same for all inertial observers. That means the differential equations involved are the same for all inertial observers. That much is OK. The Second Postulate says the speed of light is the same number c for all inertial observers. That statement doesn't quite answer all possible questions. Does the statement mean that c is c relative to the observer for an entire propagation path, all the way back from the observer to the source? The natural language does not say for sure, but the math expressions that follow the statement do support that interpretation.

Only one alternative to Einstein's proposal seems to have been considered in the years immediately following. That was the Ritz proposal; namely, that c should be c relative to the *source*. And evidently Ritz, like Einstein, meant his proposal to apply for the whole propagation path, all the way from the source forward to the observer. The Ritz proposal did not comport with various astronomical observations involving Earth and/or star motion. So having no other choice, the world settled on the Einstein proposal.

But *both* the Einstain and the Ritz proposals were really overly bold. Consider that by the early 20th century, there was a pretty reliable protocol available for handling situations characterized by **differential equations**, families of **solution functions**, and problem **boundary conditions**.

Light propagation is *not* unlike that standard math situation:

1) For differential equations, we have Maxwell's four coupled field equations, or the wave equations that they imply.

2) For solution families, we have all sinusoids, and all functions that can be synthesized by combining sinusoids.

3) For boundary conditions, try: **a)** no energy backflow behind the source, and **b)** no energy overflow beyond the receiver.

About the differential equations, Maxwell's equations, or the wave equations derived from them, are all fine to use.

About a solution family, there is an interesting story to ponder. Consider the situation in 1905: the thing that was called 'Signal' on one day might, on another day, have been called 'Photon'. A Signal/Photon is a little bundle of electromagnetic energy that starts in one place and ends another place, and thereby conveys Information. But we cannot know how bundled up a photon/signal really is during its trip.

Now in 1905, the concept of 'Information' was not yet developed mathematically; that work came in the mid 20th century, from Claude Shannon and his collaborators. But the concept of 'Entropy' was at hand, and that is practically the same, but for a minus sign. Einstein knew all about Entropy from his days in the Patent Office, where he would have had to filter out proposals for perpetual motion machines and the like. So he could have invented Information Theory in his spare time. But he didn't.

Sinusoids really cannot convey 'information' because the only thing that varies on a sinusoid is the absolute phase, and nobody can measure absolute phase. Even if we could measure absolute phase, we would still not have a way to identify *when* the signal arrived. That is, the conveying of information requires *pulses* of *finite energy*. Infinite EM plane waves cannot do the job. You have to think about finite pulses of EM energy. Alas, for SRT Einstein thought more about infinite waves than finite pulses.

To form a pulse, we would need an infinite sum of sinusoids. To model a light signal, it seems better to *begin* with something pulse-like. So the Gaussian function, along with its Hermite polynomials generated by differentiation, seems a more appropriate model.

For the boundary conditions, there is another interesting story to think about. The zero energy flows can mean zero energy flow *through* each boundary, or it can mean *equal* energy flows fore and aft *from* each boundary. Only for the latter interpretation can there be a non-zero speed to talk about.

For specifying the *speed* of light, we should specify *only* for the boundaries, and *not* for the whole path. Specifying for the whole path was Einstein's big miss-step. His statement was ***not*** a ***boundary* condition**; it was instead a ***whole-path* commandment**. A mathematician would call this new problem statement **over-constrained**. It is bound to lead to Paradoxes.

So what then should we say about 'the speed of light' *at* the boundaries? Without doubt, we should say c locally at *each* boundary, and that means c relative to each boundary, but each statement 'relative to' is ***only local***, and does ***not*** apply over the whole path.

And what should we way about 'the speed of light' *between* the boundaries? Whatever we say, we cannot verify it, since verifying it requires the injecting some measuring equipment, and that in turn entails injecting another boundary surface into the problem description. But we can make a good guess: remember Fermat: use a straight-line change from source to receiver as reference.

CKW

Angle is a Dimension

The late Robert S. Neiswander
communicated by Laurel Neiswander
7733 Texhoma Ave., Northridge, CA 91325

Inclusion of **Angle** as a fundamental dimension in Dimensional Analysis expands its application to rotating and oscillating systems. Failure to recognize angle as a dimension can lead to misleading concepts and false conclusions. Although *angle* is recognized as a dimension in spatial coordinates, in other applications it is ignored.. We will show, as an example, that ignoring angle creates a false concept of the very core of quantum theory, the quantum itself.

Introduction

A physical condition or event can be described by the component parameters involved, by the component measurement units, or it can be decomposed into basic, linearly independent dimensions. While any of the three descriptions may be used to check the statement for consistency, analysis of its linearly independent, basic dimensions is the most rigorous and is taken to be the fundamental analysis.

As proposed by Bridgeman [1] in 1922, this decomposition, called *dimensional analysis,* recognizes three dimensions: **M = Mass**, **L = Length** and **T = Time**. For example, an acceleration has dimensions $\mathbf{LT^{-2}}$**, and** an angle is dimensionless. But despite its widespread acceptance, Bridgeman's dimensional analysis has its shortcomings. For instance, it does not acknowledge that space is 3-D.

Concern with the over simplification of dimensional analysis is not new. Huntley [2] (1967) noted that **L** has three components $\mathbf{L_x}$, $\mathbf{L_y}$ and $\mathbf{L_z}$ and Siano [3] (1985) introduced unit direction vectors to accommodate angles. The most direct approach, however, is to be mindful of space and add **Angle** as a real dimension. While this approach is mathematically inelegant, it is simple, easy to visualize and conceptually rigorous.

Definition of Angle

First, we note that coordinate systems include angles.

Coordinate Systems

	Coordinates	Dimensions
Two dimensions		
Cartesian	x, y	$\mathbf{L^2}$
Polar	r, θ	**LA**
Three dimensions		
Cartesian	x, y, z	$\mathbf{L^3}$
Cylindrical	r, z, θ	$\mathbf{L^2A}$
Spherical	r,θ,ϕ	$\mathbf{LA^2}$

In the polar, cylindrical, and spherical coordinate systems, **Angle** is an independent and basic dimension. Nevertheless **Angle** is different in that it can be defined from two lengths. First we select a center point that is the apex for all angles, and then introduce the following dimensions:

$\mathbf{L}_{\text{rad}}$ is the radius of a sphere concentric with the center point.

$\mathbf{L}_{\text{tan}}$ is the length measured along a great circle of the sphere.

$\mathbf{L}_{\text{tan}}^2$ is an area on the sphere.

With these lengths, the angular dimension are:

Parameter: angle	Dimension: $\mathbf{A} = \mathbf{L_{tan}}/\mathbf{L_{rad}}$
Parameter: solid angle	Dimension: $\mathbf{A^2} = \left(\mathbf{L_{tan}}/\mathbf{L_{rad}}\right)^2$

Since $\mathbf{L}_{\text{rad}}$ is linearly independent of $\mathbf{L}_{\text{tan}}$, the ratio and the angle are not dimensionless. Also note that $\mathbf{M}$, $\mathbf{L}_{\text{tan}}$, $\mathbf{L}_{\text{rad}}$ and $\mathbf{T}$ have arbitrary units, but $\mathbf{A}$ and $\mathbf{A}^2$ naturally carry units *radians* and *steradians* respectively.

Angles easily extend to oscillations, *angle* is *phase angle* and *angular velocity* is *angular frequency*. Multiplying the natural angle by 2π creates a *cycle* and multiplying the angular frequency by 2π gives us temporal frequency in *Hertz*.

To illustrate the usefulness of **Angle**, here is a simple dimensional analysis::

<u>Statement</u> (torque) = (moment of inertia)×(angular acceleration)

$$\text{torque} = (\text{force})\acute{}(\text{radius}) = (\mathbf{M\,L_{tan}}/\mathbf{T^2})\mathbf{L_{rad}}$$
$$\text{moment of inetia} = \mathbf{ML_{rad}^2}$$
$$\text{angular acceleration} = \mathbf{A} / \mathbf{T^2}$$
$$(\mathbf{ML_{tan}} / \mathbf{T^2})\mathbf{L_{rad}} = (\mathbf{ML_{rad}^2})(\mathbf{A} / \mathbf{T^2})$$
$$(\mathbf{ML_{tan}L_{rad}} / \mathbf{T^2})\Big/(\mathbf{ML_{rad}^2} / \mathbf{T^2}) = \mathbf{L_{tan}} / \mathbf{L_{rad}} = \mathbf{A}$$

Validation of a formula, though, is just a minor role for dimensional analysis. Physical concepts arise from the dimensions assumed for them.

Planck's Constant

In modern quantum theory, Planck's constant h identifies a quantum of action, so h has units *joule seconds*. [4] It is dimensioned as *action* under the assumption that *cycle* is dimensionless. But accepting *cycle* as a real dimension leads to a much different concept of Planck's constant and of the quantum, and a different statement of Heisenberg's Uncertainty Principle.

And the disregard of angle creates other problems. For instance, to describe an oscillation the phase angle is usually expressed in *radians*; so quantum theorists have introduced an alternative constant, $\hbar = h/2\pi$. While $\hbar$ has no physical significance, it simplifies the equations; but, without angles, $\hbar$ and h have the same units, although they differ in magnitde by 2π.

Acknowledging that **Angle** is a real dimension gives us a much different picture. Planck's constant h is defined by Planck's Equation in which the dimensionless exponent is the ratio $h\nu / kT$; where k is Boltzmann's constant, T is the absolute temperature of the black body and kT is the average energy of Planck's oscillators in thermal equilibrium. With kT as energy, $h\nu$ must be energy. We know that ν is the photon's wave frequency *cycles/second*, so

$$h = \frac{kT}{\nu} \rightarrow \frac{\text{joules}}{\text{cycles/second}} = \frac{\text{joule-seconds}}{\text{cycle}} = \frac{\text{action}}{\text{cycle}}$$

Planck's constant h is *action per cycle:* it converts action into the phase of an oscillation. The oscillation is, of course, the photon's disturbance wave. Planck's constant links the properties of the photon as a particle with its properties as a wave.

The Photon as a Particle

Consider a stream of photons in a collimated beam pointed in the *X*-direction. We can locate a photon in the beam by $x = ct + x_0$. As a particle this photon has an inertial mass m_{photon}, a kinetic energy $E_{\text{photon}} = m_{\text{photon}} c^2$ and a kinetic momentum $p_{\text{photon}} = m_{\text{photon}}\, c$. By definition, its energy action is its energy accrued over time is:

$$\text{Energy action } S_E = E_{\text{photon}}\, t$$

and its momentum action is its momentum accrued over distance,

$$\text{Momentum action } S_{\text{p}} = p_{\text{photon}}\, x$$

Ignoring fixed phase angles, we take $x = ct$, and we know $E_{\text{photon}} = p_{\text{photon}} c$. Therefore,

$$S_E = E_{\text{photon}} t = p_{\text{photon}} ct = p_{\text{photon}} x = S_p \, ; \quad S_E - S_p = 0 \quad . \qquad (1)$$

Zero action ($S_E - S_p$) is a fundamental principle of physics; zero kinetic action establishes the dynamics of a moving particle (or body); a change in action must be zero, $\Delta S_E - \Delta S_p = 0$, or

$$\Delta E\, \Delta t = \Delta p\, \Delta x \quad , \quad \Delta E / \Delta x = \text{Force} = \Delta p / \Delta t$$

Zero action enforces Newton's second law of motion for both photons and planets.

The Photon as a Wave

The properties of a photon as a wave can be described by its wave equation,

$$\psi = a \exp 2\pi\, i(\nu t - \eta x) \quad , \qquad (2)$$

where amplitude ψ is an oscillating property of the photon's disturbance wave. It might represent, for example, the amplitude of the photon's electric field. The wave frequency in time is $\nu = 1/\tau$ cycles/second, and the wave frequency in space is $\eta = 1/\lambda$ cycles/meter, where τ is the wave period and λ the wave length.

The Particle-Wave Equation

Energy action is converted to phase by Planck's constant:

$$S_E / h = (E_{\text{photon}} / h) \times t \text{ cycles}$$

or $$(2\pi / h) S_E = (2\pi / h) E_{\text{photon}} t \text{ radians}$$

Comparing this with the equivalent phase term in the wave equation, we see that

$$E_{\text{photon}} / h = \nu \text{ cycles/second or } E_{\text{photon}} = h\nu \qquad (3a)$$

Similarly,

$$S_{\text{photon}} / h = p_{\text{photon}} x / h \text{ cycles}$$

or $$(2\pi / h) S_{\text{photon}} = (2\pi / h) p_{\text{photon}} x \text{ radians}$$

$$p_{\text{photon}} / h = \eta \text{ cycles/meter, or } p_{\text{photon}} = \eta h \qquad (3b)$$

The photon wave equation can be written in terms of either wave parameters or particle parameters:

$$\begin{aligned}\psi &= a \exp 2\pi\, i(\kappa t - \eta x) \\ &= a \exp \frac{2\pi i}{h}\left(E_{\text{photon}} t - p_{\text{photon}} x\right) = a \exp \frac{2\pi i}{h}(S_{\text{E}} - S_{\text{p}}) \quad .\end{aligned} \qquad (4)$$

This evokes a question: If the role of h is to transform the photon particle equation to the photon wave equation, what is a quantum?

The Quantum

As a wave, the repeatable element, is one sinusoidal cycle. Representing this kernel or quantum by $Q = 1$ *cycle*, we can write wave period in time: and wavelength in space:

$$t_\lambda = Q\tau \quad (1\,\text{cycle})(\text{seconds/cycle}) = \text{seconds} \quad ;$$

$$x_\lambda = Q\lambda \ (1\,\text{cycle})(\text{meters/cycle}) = \text{meters} \quad .$$

This quantum not divisible; the best resolution, $t_{\min}$, the minimum uncertainty in measuring the photon's location in time is one cycle, the time of its period. And the best resolution in measuring the photon's location in space, $x_{\min}$, is one cycle, the length of its wavelength. But the wave period and wavelength may be very small. To be more useful the limits in time can be expanded: $\Delta t = n t_{\min}$ and $\Delta\tau = n\tau$, where n is an arbitrary integer.

$$\Delta t / \Delta\tau = nt_{\min} / n\tau = t_{\min} / \tau \geq Q \quad , \qquad (5a)$$

and the limits in space become $\Delta x = nx_{\min}$ and $\Delta\lambda = n\lambda$, giving,

$$\Delta x / \Delta\lambda = nx_{\min} / n\lambda = x_{\min} / \lambda \geq Q \qquad (5b)$$

These quantum statements can be expressed as frequencies:

$$1 / \Delta\tau = 1 / n\tau = \nu / n = \Delta\nu \quad , \quad \Delta t \ \Delta\nu \geq Q \qquad (6a)$$

$$1 / \Delta\lambda = 1 / n\lambda = \eta / n = \Delta\eta \quad , \quad \Delta x \, \Delta\eta \geq \boldsymbol{Q} \qquad (6b)$$

There are various ways to interpret these quantum statements. For instance, suppose you are designing a radiotelegraph system having a high data transmission rate. This requires a short pulse, but, as stated in Eq. (6) the shorter the pulse width Δt, the larger the frequency bandwidth $\Delta\nu$. It is a design tradeoff.

In another situation, you are designing a radar system having the best target resolution practicable. The uncertainty of target location in time is the radar pulse width Δt; and again improving performance is at the expense of increased frequency bandwidth. The frequency bandwidth can also be viewed as the uncertainty in frequency of the reflected wave.

Heisenberg's Uncertainties

We convert the photon quantum $\boldsymbol{Q}$ as a wave, to the photon quantum $h\boldsymbol{Q}$ as a particle, by Planck's constant, where $h\boldsymbol{Q}$ is a quantum of action; *i.e* $(\text{action / cycle}) \times (1\,\text{cycle}) = \text{action}$. But this is a special kind of action,

$$\text{energy action gained in one cycle: } E_{\text{photon}} t_\lambda = h\nu t_\lambda = h\boldsymbol{Q}$$
$$\text{momentum action gained in one cycle: } p_{\text{photon}} x_\lambda = h\eta x_\lambda = h\boldsymbol{Q}$$

All of the photon's energy action and its energy, all of the photon's momentum action and its momentum, are stowed in a quantum cycle. And this quantum is indivisible; it defines the best possible resolution of the photon's action, energy and momentum. Defining $\Delta E = h \ \Delta\nu$ and $\Delta p = h \, \Delta\eta$, we can rewrite Eqs. (6a) and (6b) as actions:

$$\Delta t \ (h\Delta\nu) = \Delta t \, \Delta E \geq hQ \quad , \quad \Delta x \ (h \, \Delta\eta) = \Delta x \, \Delta p \geq h \, Q \quad , \qquad (7a,b)$$

which look like Heisenberg's equations but have one important difference. The quantum of action $h\boldsymbol{Q}$ is specifically the action accrued during a quantum cycle, whereas Heisenberg's equations, ignoring the factor $\boldsymbol{Q}$, put no restriction on quantized action (and quantized energy). Before we discuss the implications, though, we should establish one more point.

Although we have focussed on the photon, the concepts and the conclusions apply equally well to material particles. Energy action of a photon is kinetic energy, action, momentum action of a photon is kinetic momentum action. The only change needed in our analyses is to generalize energy and momentum, photon energy becomes kinetic energy and photon momentum becomes kinetic momentum.

And this is where acceptance of *angle* as a dimension has led us. For a perspective of what the inclusion of angle accomplishes, let's compare our concepts and conclusions with their counterparts in modern quantum theory.

<u>The quantum with complete dimensions</u>: The foundations for our analyses are Planck's blackbody equation defining his constant, and the disturbance wave equations defining properties of a particle and of a wave. These equations have been extensively confirmed by experiment.

Planck's h converts the kinetic action of moving particle into the properties of the particle's disturbance wave. Kinetic energy is converted to frequency in time and kinetic momentum is converted into frequency in space.

One cycle of the disturbance wave is an indivisible quantum. This resolution limit, though, applies only to location in space or in time within the wave. Other methods of determining a particle's position in time and its energy, or its position in space and its momentum, are not bound by the quantum. For instance, we can position a particle by micro-tweezers with nanometer precision and simultaneously immobilize (zero momentum) the particle.

<u>The incomplete quantum</u>: The structure of modern quantum theory rests on decisions made during its formative era. Disregard of angle created Planck's constant as a quantum of action rather than the action in a quantum cycle. Without the quantum cycle, there was no solid foundation for Heisenberg's uncertainties. But we must realize that physics was undergoing a transformation from a deductive to an inductive science. Ushered in by Schrodinger, Heisenberg and other theorists, the new physics presumed reality was a cosmic abstraction describable only in the language of mathematics. Inspirations such as Heisenberg's uncertainties appeared as spontaneous revelations that were not only applicable to the physical world but often had deeper metaphysical meanings "*. . . indeterminism* (uncertainty) *is inherent in the very structure of matter* ."[5]

In this environment in which truths were often revealed by epiphanies, the suggestion that Heisenberg's principle and the communication engineers' pulsewidth-bandwidth rule stem from the same roots was viewed as a desecration. If we were to rewrite history, acceptance of the dimension **Angle** during quantum theory's formative years would have produced a different role for Planck's constant, a different concept of the quantum, and a different expression of Heisenberg Principle and its derivative metaphysics.

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What is Time? Continued from p. 42

Present is the most real perception of time however almost all of what we perceive as the present is already past. The present is a fleeting moment; whatever is happening now (present) is confined to an infinitesimally narrow point on the time line which is being encroached upon by what we think of as the past and the future.

Present resembles the sharp point of a recording laser or needle; it may be the mental awareness of recording of memory as it is being inscribed into our brain. A person who goes to an event but falls asleep would have no recollection of it as if the event did not exist in his past. Unless we are consciously aware of an event it does not seem to enter our past memory. Unlike the present the past and future are measurable durations of time. Past historical events, a meeting, or a wedding reception, are all measurable durations or extensions in time, just like a recorded material on tape. **This similarity suggests that past is just a recorded memory, while future can be compared to an unrecorded tape.**

Historical events have in them the same time characteristic as stories that are just creations of human imagination. Both contain in them the time concepts of earlier, the later, the past the present and the future; **this again suggests that past really is similar to memory of events.** Future appears to be a projection created by our past experiences stored in our memory. **The fact that the present which gives us the most real feel of time cannot be measured while the inaccessible past and future can be measured as durations may suggests that the way we perceive time is an illusion.**

Time as a Block Universe

> "People like us who believe in physics know that the distinction between the past, the present and the future is only a stubbornly persistent illusion" Albert Einstein

Every event in time has a place like feeling to it, giving support to the block universe view of time in which time is fixed and laid out like a time-scape. In the block universe past, present and future exist together superimposed in different dimensions. This view of time suggests that dinosaurs are still alive and roaming the earth in other time dimensions; so are multiple copies of us and the whole universe. This view is reinforced by Einstein's General Relativity (GR) in which time extends as the fourth dimension from the past to the future. Lack of simultaneity in Einstein's SR and an interpretation of the Lorentz transformation equation also promote this view to explain the Andromeda paradox as an alternative reality existing in a different time dimension.

Time in the block universe is laid out as time-scape similar to landscape; future and past already exists and there is difficulty with the concept of free will. Even in the smallest duration of time in the block universe there should be infinite number of copies of everything including the whole universe. Block universe concept leads to some problems and paradoxes. It raises more questions and provides few answers. How do we explain the origin of universe as all parts of the block universe exist all the time? If there is a big bang in block universe then even now it exists. If time-scape is already laid out then what causes our consciousness to move through it and why we cannot willfully move it anywhere anytime?

If concept of block universe is correct then there should exist in time future civilizations millions or billions of years more technologically advanced then us. At least some of them should be capable of time travel. We should have seen some evidence for that, unless there is some law of the universe which prohibits time travel. Inherent to time travel are the time travel paradoxes including the grandfather paradox in which a person travels to the past and kills his grandfather thereby changing the future so that the time traveler would not exist and thus not travel to the past to kill his grandfather.

Theory of Relativity predicts slowing of time with motion and gravity. These predictions have been confirmed in particle accelerators as well as gravity experiments. Twin paradox discussions may have served as a distraction from obvious question that arises; if there is a block universe why particles and masses with slower time do not disappear into the past? In gravitational fields space is clearly continuous between areas of slower and faster time. Black holes with their intense gravity that bring time to a screeching halt do not disappear from our present into the past. Slowing of time without sliding into the past or the future suggests that time is a process and not a dimension. This may be a significant point against the block universe view of time when taken together with other aspects of time described above.

Motion, Forces, and the Arrow of Time

The Arrow of Time requires two points in time that can exist only in the block universe. Arrow assumes that the two points' between past present or future exist, it also assumes that time only involves motion. Presence of forces as a part of time changes this equation as it provides the necessary gradient for the direction in time. There is also a statistical touch to this argument; smashing a glass with a hammer means application of force at one point while to assemble it back in reverse would require coordinated application of multiple tiny forces in a reverse and continuous manner which is statistically unlikely. Similarly throwing a stone into a pond creates ripples which then travel to the edge of the pond. To reverse this would require simultaneous application of multiple tiny forces at the edge of the pond to produce multiple synchronized waves moving backward to the area of splash where the stone pushed up by the ground at the bottom of the pond will be waiting to be thrown out into the hand of the thrower; a statistical impossibility.

Time presents to us in numerous ways, which possibly creates difficulty in understanding this phenomenon. We are immersed in time yet we do not fully understand it. We know that time is closely linked to motion as well as forces. Theory of relativity introduced the concept of slowing of time with motion and gravity. This breakthrough could have led to further progress in understanding of time and possibly the cause of time. However, almost 100 years have passed without substantial progress. ISST could possibly taking a lead in solving the riddle of time by encouraging ideas that are not necessarily mainstream.

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