Messenger Particles and Relativity

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Abstract. This article is an attempt to expose the role played by messenger particles in physics. The concept of the "messenger particle" has long been considered in physics. The latest research shows evidence that the four fundamental forces of nature ,Gravitation, Electromagnetic and the Weak and Strong Nuclear forces are all created by messenger particles. This hypotheses is leading to a new way of thinking about the fundamental sub-atomic wave/particles that are the building blocks of our universe. Some of the latest evidence actually shows that in order to understand what is happening with these messenger particles it is necessary to perceive them as information carriers. The four messenger particles that are thought to exist are the Graviton (not yet discovered) , Photon, Weak Guage Boson and the Gluon. This paper shall be concerned with the Photon as an information carrier.

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1. Messenger Particle Information

Information is a concept that has defied definition and indeed there are many who perceive it as an abstract invention that has no physical meaning. This paper shall show that information is encapsulated in its most basic form by the messenger particles and it may well be the very basis of everything that exists in this universe that we occupy.

2. Messenger Photons

The initial experiments on the Hydrogen atom showed that when hydrogen was exposed to a high energy source (potential difference) it was discovered that photons of a particular frequency were emitted. this was later explained as the energy that was emitted when an electron moved from one "allowed" orbit around the Proton to another "allowed orbit". Looking at this physical event from an informational perspective and it can be viewed as the electron transferring information about the event.

In this case the electron goes through the process of dropping down to a lower energy orbit and transfers Information of the event in the form of the messenger photon ejected from the hydrogen atom with a particular information/energy/wavelength equivalent to the event, in this case the energy difference between the different Photon "'allowed"' orbits.

3. Sub-atomic Information Transfers as a Creational Events

Accepting this argument for the time being, the question which needs answering is for what purpose is there an information transfer. Information has but one purpose, the purpose of creation. In this universe that we inhabit creation can be divided into just two different types: Physical Reality and Perceptive Reality.

Since we are using the example of a messenger photon ejected from a hydrogen atom (taking photons in the visible spectrum) this paper shall concern itself on how this ejected messenger photon information transfer is used for the creation of Perceptive Reality.

3.1. **Reality.** As stated there exists is this universe two different types of creation one of the creation of physical reality (Matter) and one of the creation of Perceptive Reality (what we perceive in our minds). How is Reality created. Reality is created in our minds by the most basic of sub-atomic wave/particles - electromagnetic radiation in the visible wavelength spectrum - the messenger photon. Photons enter the brain of an Observer and the information that they carry is transfered and using this information and also previously received information (experiences) the Observer's brain constructs it's own internal reality. The only information that is extracted from the messenger Photon is that of wavelength and two dimensional (x,y) position. Using this information the brain creates the infinite number of forms, shapes (positional information) and colors (wavelengths) that we perceive in our minds. Thus is the miracle of Creation of Reality, it really is "all in the mind".

4. Information and Relativity

Relativity as discovered by Einstein was essentially the study of the propagation of electromagnetic waves. Einstein also described electromagnetic waves as carriers

of information of past events and went on to describe how systems in relative motion have differing experiences of time due to the constancy of the speed of light (photons) and the propagation delay due to distances between differing systems. The famous transfer that mathematically defines the Special Theory of relativity is the Lorentz transfer that shows the relation between a system in space and time defined as (x,y,z,t)with uniform motion relative to another system in space-time with coordinates (x',y',z',t'). Einstein's work followed on from the work of Minkowski who developed the idea and theory of space-time. This theory showed that systems in nature were not only in motion through space but through time as well and that in order to understand the true nature of the universe it was necessary to understand the concept of 4 dimensional space-time with time as the fourth dimension which Einstein also proved to be variable. Without going through the entire Special theory of Relativity, this is currently our understanding of the macro world of Physics that has now superseded Newtonian Physics that lasted for hundreds of years. Newton's theories were found to be incomplete and Einstein's enabled a more profound and deeper understanding of the nature of the physical world.

4.1. **Information and Relativity.** If the definition concerning information that has been proposed in this paper about the nature of information is true then it should be possible to explain the experimental results and the conclusions of the Special Theory of Relativity from an informational aspect only. To do this we shall use a thought experiment to illustrate the previous assertions. If two Observers, Observer 1 and Observer 2 pass each other is space with uniform relative motion, with no other references except each other, relativity predicts what each observer shall experience.

4.1.1. *Observer 1 perspective.* Observer 1 sees Observer 2 approaching from a distances and sees Observer 2 pass by and recede into the distance. As Observer 1 looks at Observer 2 he notices that time for Observer 2 is running slow, he can see that his watch is running slow, not only that he can see that everything appears to run slow from the movements of Observer 2 including the beating of his heart. Indeed the theory states that time for Observer 2 is indeed running slowly from the point of view of Observer 1.

4.1.2. *Observer 2 perspective.* If we take the position from the point of view of Observer 2, he again sees, this time Observer 1, approaching and then passing him by to recede in the distance. Observer 2 also observes that everything about Observer 1 seems to run slow from his watch to the beat of his heart. This is the strange but true predictions of Special relativity. It has no meaning to say which point of view is correct, they are both correct depending on which point of view is taken, that of Observer 1 or Observer 2.

4.2. **Information Explanation of Special relativity.** The key to understanding Special Relativity using the previous assertions on the nature of information is to remember that we are currently concerned with information being used to create Reality and by Reality one means the Perceptive Reality created in our minds by the reception of messenger Photons as has already been explained.

4.2.1. *Observer 1 Information Theory Explanation of Special Relativity.* This is an explanation from the perspective of Observer 1 but it is equally valid for Observer 2. Why does Observer 1 Observe that time slows down for Observer 2. The reason is that as Observer 2 travels into the distance with a constant velocity, the distance that the messenger photons, containing the informational history of Observer 2, have to travel, increases.This means that they arrive at Observer 1 more separated in three dimensional space than would be the case if there was no relative motion. Since the information arrives more separated in space the brain of Observer 1 creates the perceived reality of Observer 2 at a slower rate than would be the case if the messenger photons were not separated in space i.e. if there was no relative velocity between the two Observers. Therefore the Perceived Reality of Observer 2 that Observer 1 is creating in his mind is created at a different rate or with a different time. This perceived time is a consequence of the increasing distance (motion) separating the two observers and the messenger photons arriving more separated in distance.

4.3. **Special Relativity and an accelerated Reference System.** Again taking Einsteins Theory, it also predicts what would happen if one of the systems (Observers) undergoes an accelerated reference. The theory predicts that if, for example, Observer 1 decides to catch up with Observer 2, he can only do that by undergoing an acceleration. The theory predicts that this will break the symmetry of the two observers perspectives and when they do rendezvous the Observer that has underwent an accelerated reference shall have experienced less time than the unaccelerated Observer. This would mean in our example that Observer 1 would have experienced less time going by than Observer 2 and at the rendezvous, Observer 1 would have traveled into Observer 2's future. Again strange but true. The question again is how can this be explained using the same Theory of Information and the Creation of Reality

4.3.1. *Observer 1 Information Theory Explanation of Special Relativity and Accelerated Reference.* Once again it can be explained by the rate of transfer of messenger photonic information and hence the rate of creation of Reality. As Observer 1 starts to accelerate, he starts to move closer and closer to the messenger photons already traveling from Observer 1. This means that the distance between receiving the messenger photons becomes less and the Reality of Observer 2 constructed by Observer 1 starts to proceed at a faster rate. This causes Observer 1 to perceive that the time for Observer 2 starts to pass quicker at a rate proportional to his acceleration. His own time proceeds to pass by normally for himself. As for Observer 2, this time, as he has not accelerated he continues to receive the messenger photonic information at the same rate as before and the reality created of Observer 1 in his mind is at a lower rate , (time). So the symmetry has been broken. The reality created in the mind of observer 1 of observer 2 is faster than the reality created in the mind of Observer 2 of Observer 1. So the result is as predicted. When they rendezvous, more time has passed for Observer 2 than Observer 1 and Observer 1 has moved into the future of Observer 2.

4.3.2. *General Explanation of Special Relativity and Accelerated Reference.* One can try out the above argument with any part or consequence of the special Theory of relativity and it can always be explained. Indeed the inescapable and immediate first impression when using this approach is the simplicity of it and also how it

de-mystifies the whole Special Theory of Relativity. When thought about this way the results and conclusions of Special Relativity seem natural and not in the least bizarre.

4.4. **Physical Reality.** This paper has concerned itself solely with Reality as created in the minds of the Observers. The logic of the arguments have been concerned just with this type of creation but as already stated there are two types of creation in this universe, the other being the creation of Physical Reality or the creation of matter. When Observer 1 finally meets Observer 2 he will observe that Observer 2 has aged much more than he has, an aging that will be proportional to the accelerated velocity of Observer 1. Again the same logic arguments hold. The creation of matter is about the transfer of information from one sub-atomic system to another. If in the above thought arguments the observers where changed to "'sub-atomic systems"' the results would be exactly the same. The time(s) generated due to the differing distances that information has to travel due to motion still are true and matter will be created at different rates (times).
The same argument applies to the transfer of all the fundamental "messenger particles", the Graviton ,the Weak Guage Bosons and the Gluon as it applies to the Photon. All these particles are carriers of information involved in creational events that follow the same relativistic laws as does the photon.

Therefore Internal generated Reality and External generated reality both experience the same passage of time if they are in the same frame of reference.

4.5. **mathematical Proof.** The preceding has been until now an argument using logic and thought. In order to proceed further the mathematics of the theory of Special Relativity shall have to be addressed in order to prove if the preceding arguments can indeed be interpretated using the same mathematics that proved the Special Theory of Relativity, namely, the Lorenz transforms.

The Special Theory of Relativity used the following Lorenz Transform for time which is the famous equation:

$$t' = \frac{(t - \frac{v}{c^2}).x}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{4.1}$$

From this equation can be derived $\Delta t'$

$$\Delta t' = \lambda \Delta t \, where \, \lambda \, = \, \sqrt{1 - \frac{v^2}{c^2}}$$

This means that the time difference of a clock running in a stationary frame of reference as opposed to a clock running in a uniformly moving frame of reference can be calculated by $\lambda = \sqrt{1 - \frac{v^2}{c^2}}(4.2)$ which is called the Lorenz factor.

There is, however, one other factor which influences the time dilation between two moving frames of reference. When light or photons are transmitted along the axis of motion (x-axis) in order to transfer information from one frame of reference to another, since the moving frame of reference is moving away along the x-axis the distance that the light has to travel becomes greater and the information, be what it may, the clock face information for example, arrives at a lower rate (slower) than would be the case if there was no relative motion.

This diagram shows the light signals in a frame of reference travelling in the x – axis. The light path is shown to travel perpendicular to the axis of motion and along the axis of motion. The effect of the time dilation due to these different light directions within the moving frame of reference is shown to be different. In order to understand this it is necessary to remember just what is causing the time dilation from the perspective of an Observer outside the moving frame of reference. It is simply the extra distance, from the Observers point of view , that the light has to travel. The extra distance that the light has to travel is different for tangential and axial, to the direction of motion , of the light.

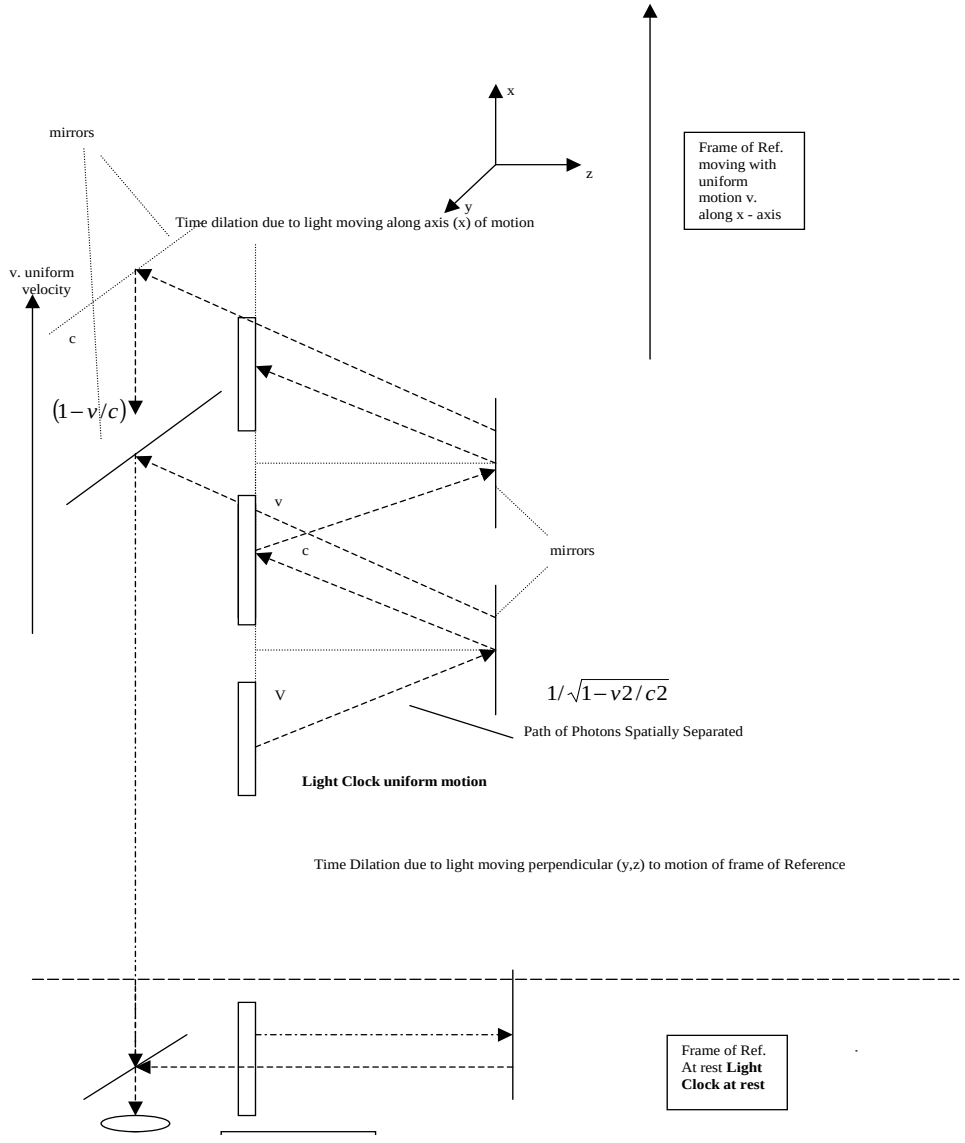

FIGURE 1. Axial Relative Motion

This slower rate is equal to the numerator in the equation that was given in Einstein's book (ref. 1 page 38) and it was for this reason that Einstein substituted x = ct to derive the equation. He was deriving time dilation in the special case when a light signal is send along the x-axis from the moving frame of reference to the stationary frame of reference. I quote:

"if referred to the system k' the propagation of light (along the x-axis) takes place according to this equation. "
"Albert Einstein"

Therefore after substituting x in the Lorenz transfer for time as x = ct we have the following equation:

$$t' = \frac{(1 - \frac{v}{c})t}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{4.3}$$

The numerator:-

$$(1 - \frac{v}{c})t \tag{4.4}$$

applies to light moving in the frame of reference along the relative axial direction (x dimension) .

The denominator :-

$$\sqrt{1 - \frac{v^2}{c^2}} \tag{4.5}$$

part of the equation applies light moving relative to motion from one frame of reference to another in the perpendicular (z,y) reference direction.

4.6. **Figure 1 Light in a Moving Frame of Reference.** Figure 1 shows a frame of reference moving with uniform velocity in the x direction. It shows a light clock and how from the stationary Observer's viewpoint the the up and down light beam of the light clock traces a diagonal path which is equivalent to the forward velocity v and the speed of the light c.
The light of the clock is then reflected by mirrors to travel back down the x-axis to be received by the stationary Observer. The light is shown to have to travel an ever increasing distance due to the x-axis uniform motion v. This causes the photons to be more separated out in space
Figure 1 therefore demonstrates the time dilation caused by light moving perpendicular in the moving frame of reference according to the denominator in the previous equation and also the time dilation caused by light traveling in the direction of motion in the frame of reference as caused by the numerator.

4.7. **The Information reducing factor.** The rate of reception of information is inversely proportional to the relative motion (v) of two frames of reference. Since, when there is no relative motion the information transfer is dependent on the speed of light (c), when there is a relative motion the information transfer is reduced by the term

$$\frac{v}{c} \tag{4.6}$$

4.8. **Relative time difference due to relative axial (x) uniform motion.** Therefore if the time dilation between two frames of reference was due entirely to light traveling along the axis of uniform motion the time transfer would be given by the numerator in the above equation:

$$t' = (1 - \frac{v}{c})t \tag{4.7}$$

The previous arguments have put forward the theory that it is the reception of information in the form of photons acting as messenger wave/particles, carrying the event information that is used to create a Reality of the events in the mind of an Observer. The argument then follows that if one frame of reference has a uniform velocity compared to another frame of reference then, because the messenger Photons traveling from one frame of reference to another, have an increased distance to travel then that will cause these messenger photons to be separated in space and the Reality being created in the mind of an Observer in one of the frames of references will create that Reality at a slower rate. This then leads to the conclusion that the time difference between the frames of reference is due to the different rates of creation of Reality.

Firstly, take the instance where two reference states, or Observers are at rest in relation to each other and there is no relative motion. This is shown in Fig 2. where the time difference is expressed as a ratio of

$$1 : 1 \tag{4.8}$$

$$t = t' \tag{4.9}$$

.

Secondly, Fig. 2 shows the instance where the two reference states are in relative motion (v) to each other only in the x dimension. In this case the relative times are shown to be proportional to the relation between the relative motion (v) and the speed of the information carrying photons (c) . As the two reference frames separate at the uniform velocity, the messenger photons become separated in space according to the reducing factor (reduced rate of information)which is the fraction of velocity v and the speed of the photons c . This reducing factor must then be subtracted from the original 1:1 ratio.

$$1 : 1 - \frac{v}{c} \tag{4.10}$$

$$t = (1 - \frac{v}{c})t' \tag{4.11}$$

The higher the velocity v, the greater the spatial separation becomes causing the Internal Reality of one Observer to another to be created slower. this then causes the relative perceived times to be slower.

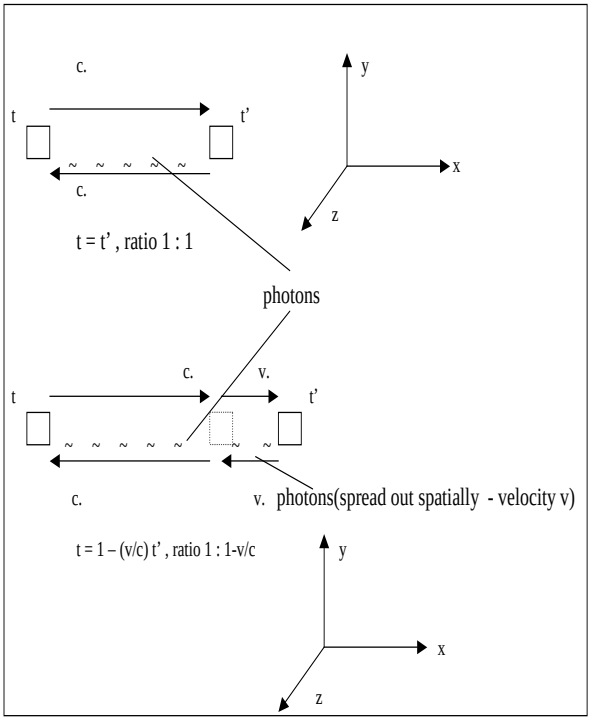

FIGURE 2. Axial Relative Motion

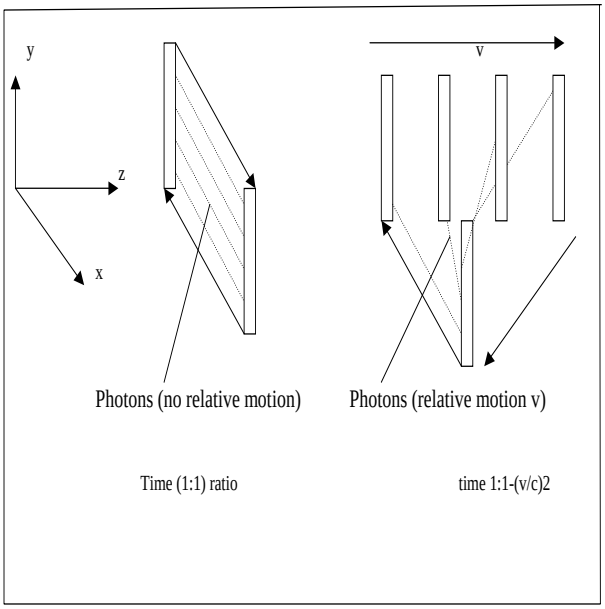

FIGURE 3. Perpendicular Relative Motion

4.9. **Relative time difference due to relative perpendicular (y,z) uniform motion.** Now taking two reference systems where there is perpendicular (y,z) relative motion between one frame of reference and another then the time transfer using the Lorenz equation shall be caused only by the denominator:

$$\sqrt{1-\frac{v^2}{c^2}} (4.12)$$

. Again using the same logic, with no relative motion the ratio of the times for the two references is 1:1. With the situation in figure 3 with a relative motion v. between the two reference frames, the information carrying photons are separated more than if there was no motion, in space. In this situation the separation is perpendicular i.e. in the two dimensions y and z. Again the amount of separation and consequently the reduced amount of photonic information being transfered between the two reference systems is proportional to the reducing factor which is, again, the fraction of v to c, the speed of the photons. This reducing factor is then taken away from the 1:1 ratio to obtain the new relative information being transfered

$$1 : 1 - \frac{v}{c} \tag{4.13}$$

In this case there is one major difference, the fact that the relative motion is in two dimensions, the z and y. This means that the information reducing factor must be calculated using a two dimensional ratio, a ratio of areas, therefore the terms v and c must be squared. Finally to achieve the final answer the square root must be taken.

$$\sqrt{1-\frac{v^2}{c^2}} (4.14)$$

This can of course be explained using the Pythagoras relation equation which is the explanation found in most text books. This approach, I find , comes closer to capturing the essence of the problem.
The problem being that the amount of photonic information being transfered between references can be described by the loss due to the fractional relationship between v and c in the x axis and between the fractional relation ship between the square of v and c when the motion is in the y and z axis. These relationships describe how the increased spatial distance due to the velocity v causes less information to be transfered.

This takes us back to the complete Lorenz transform for time when two reference states are in a state of uniform motion with respect to one and other.

$$t' = \frac{(1-\frac{v}{c})t}{\sqrt{1-\frac{v^2}{c^2}}} \tag{4.15}$$

Conclusion 1. *The aim of this article has been to look at messenger particles and their role in transferring information. Relativity was chosen as a test of the ideas presented and the results are surprisingly interesting. Using this approach one can look at relativity with a new and fresh perspective. Relativity looked at from an*

informational, creative point of view leads almost naturally to a slightly different view of time.

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References

[1] Albert Einstein *Relativity : The Special and the General Theory.* Threee Rivers Press New York

[2] Richard P. Feyman *Six Not So-Easy Pieces Einstein's Relativity, Symmetry and Space-Time.* Addison-Wesley 1997..

[3] Hans Frauenfelder, Ernest M. Henley *Subatomic Physics Second Edition* Prentic halll Upper sadddle River , New Jersey.

[4] J. E. House. *Fundamentals of Quantum Mechanics* Acedemic Press, Hardcourt Brace Company, publishers. New York.

[5] Steven Weinberg. *The Quantum theory of Fields* Press Syndicate of the University of Cambridge West 20th St. New York

[6] J. J. Sakurai. *Advanced Quantum Mechanics* Addison-Wesley 1967

[7] Roger Penrose *The Road to Reality*

[8] James H. Smith *Introduction to Special Relativity* Benjamin, New York, 1965.

[9] N. David Mermin *Space and Time in Special Relativity* McGraw-Hill, New York, 1968.

[10] Richard P. Feynman Robert, B. Leighton, and Matthew Sands *The Feynman Lectures on Physics* Addison-Wesley 1963.

[11] Robert Resnick, David Halliday, and Kenneth S. Krane *Physics* Wiley, New York, 1992.

[12] Richard Wolfson ,Jay M. Pasachoff *Physics with Modern Physics For Scientists and Engineers* AddisonWesley, Reading, MA, 1999

[13] Arthur Beiser *Concepts of Modern Physics* McGrawHill, New York, 2003.

[14] Randy Harris *Nonclassical Physics: Beyond Newtons View* Addison Wesley, Menlo Park, CA, 1999.

[15] Robert Resnick and David Halliday *Basic Concepts in Relativity and Early Quantum Theory* Macmillan, New York, 1992.

[16] Steve Adams *Relativity: An Introduction to Space-Time Physics* Taylor Francis, London, 1997.

[17] G. Barton *Introduction to the Relativity Principle* Wiley, New York, 1999.

[18] Wolfgand Rindler *Introduction to Special Relativity* Clarendon, Oxford, 1982.

[19] Leo Sartori *Understanding Relativity: A Simplified Approach to Einsteins Theories* University 0alifornia Press, Berkeley, 1996.

[20] W. S. C. Williams *Introducing Special Relativity* Taylor Francis, London, 2002.

[21] R. D. Sard *Relativistic Mechanics: Special Relativity and Classical Particle Dynamics* Benjamin, New York, 1970