The Relationship B/W Time and Energy

The Relationship Between Time, Acceleration, and Velocity and its Affect on Energy

Shiv Raj Aryan

Abstract

Presented is a theory in fundamental theoretical physics that establishes the relationship between time and energy. This theory abandons the concept that mass is directly affected by relativistic motion and shows instead, that the energy related to an object undergoing such motion is a direct result of the effect time expansion has on velocity. In support of this concept, new equations are introduced for both kinetic and total energy that replace those of special relativity. Subsequent equations for momentum, distance, and acceleration are then derived that establish a direct link between time and energy. A final consequence of this theoretical analysis is the discovery of a new Law of physics, "the Law of acceleration," given in the order of its discovery.

The Relation B/W Time & Energy

1. Introduction

This paper introduces a new physical science, one that does not distinguish between classical and relativistic principles. It provides the final piece of the puzzle started by Newton with his Principia in 1687, and expanded by Einstein with his Special Theory of Relativity in 1905.

What will be shown is the true relationship between time, acceleration, and velocity, and the affect this relationship has on energy and thus our perception of other physical phenomena. We will see, once and for all, that time expansion is real, and its affect on energy is real, but the affects on mass (see appendix A) and distance are only perceptual. We will accomplish this by directly deducing a correct equation for kinetic energy to replace the Newtonian equation and from it develop a correct equation for total energy that will replace Einstein's. In the process, the limitations of the former equations will be clearly demonstrated and the new equations will be validated. The final result is new equations for kinetic and total energy that are valid from 0 to c. With these new equations it is no longer necessary to distinguish between classical physics and relativistic physics. In their place is the beginning of a new physics from which future discoveries may be anticipated.

2. The New Kinetic Energy Equation

Although the classical equation for kinetic energy seems to be supported by the evidence for low values of velocity, it is refuted by the evidence for high values of velocity especially in the area that represents a significant fraction of the speed of light. At the other end of the spectrum is the relativistic equation that seems to be supported by the evidence for velocities that are a significant fraction of light speed, but as will be shown later, is not representative of very low velocities in the area of classical physics. In fact, in both the real and theoretical sense, neither equation is truly correct at any velocity. The causes are as follows:

1. 1. Relativistic effects were unknown during the development period of classical physics. The problem is then compounded through indirect derivation of the classical kinetic energy equation that in turn obscures its true meaning.
2. 2. The relativistic effects, when discovered, were likewise used in an indirect derivation for the new kinetic energy equation that in turn obscured the true meaning that equation.

To avoid such problems we must derive the classical equation in a manner that makes its true meaning unambiguous. Then with our knowledge of relativity it becomes possible to correct the equation in such a manner as to make it properly represent the physical laws of nature at all values of velocity.

In classical physics the following formulas are given for momentum, and constant acceleration:

Where p is momentum, m is mass, and v is velocity, we are given,

$$p = mv. \qquad (1)$$

Where a is the rate of constant acceleration, and t is the time interval, we are given,

$$v = at, \qquad (2)$$

and therefore, $$a = \frac{v}{t}. \qquad (3)$$

And lastly, where d is the distance traveled by an object under constant acceleration we are given,

$$d = \frac{1}{2}at^2. \qquad (4)$$

Using the above formulas, we can formulate a new formula where the variable k_a = momentum over distance traveled by an object under constant acceleration. Thus we have,

$$k_a = (mv)\left(\frac{1}{2}at^2\right). \qquad (5)$$

By substituting v/t for a in the above equation, we get,

$$k_a = mv\frac{1}{2}\frac{v}{t}t^2, \qquad (6)$$

Which simplifies to,

$$k_a = \frac{1}{2}mv^2t. \qquad (7)$$

Now, since the classical formula for kinetic energy is,

$$k = \frac{1}{2}mv^2, \qquad (8)$$

we can state,

$$k = \frac{k_a}{t}, \qquad (9)$$

and by substitution get,

$$k = \frac{\frac{1}{2}mv^2t}{t}. \qquad (10)$$

The reason for deriving the kinetic energy equation in this manner is to make it clear what the various variables and constant represent. This last version of the equation can now be evaluated from a relativistic perspective and corrected to properly represent all values of velocity, v. At this point it is necessary to call upon the s-l transformation factor, a derivative of the Lorentz transformation factor (Appendix B),

$$\frac{\sqrt{c^2 - v^2}}{c}. \qquad (11)$$

This factor (see appendix B) is the equivalent of the Lorentz transformation factor,

$$\sqrt{1 - \frac{v^2}{c^2}}. \qquad (12)$$

Referring now to figure 1, we can compare the relativistic motion of a particle to the Newtonian motion when a constant force is applied. Whereas in Newtonian motion the velocity increases without limit, in relativistic motion the velocity increases asymptotically as the object approaches the speed of light c, and of course the speed of light is never exceeded. From what we understand about relativistic effects, the factors shown above are mathematical definitions of the behavior. If time slows down in the moving frame of reference, it is not unreasonable to assume that this slowing of time directly affects the velocity of the moving object. Thus, as velocity increases, time slows down causing further increases in velocity to require greater and greater amounts of energy. With respect to kinetic energy this is a paradoxical contradiction of Newton's second and third Laws of motion. Since kinetic energy is a direct function of velocity it will increase at a slower rate along with the velocity increases when at the same time it must increase at a greater and greater rate along with the energy causing the acceleration. Obviously it cannot do both. Of the two choices,

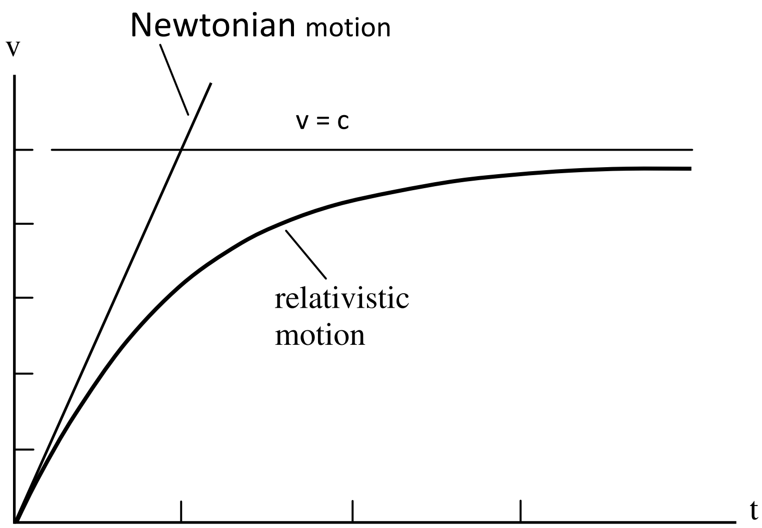

FIGURE 1 The velocity of a particle starting at rest when a constant force is applied.

reason and experience support the view that the kinetic energy must increase along with the input energy.

If we now refer to the kinetic energy equation 8, we can see there are only two variables to choose from, should we wish to modify the formula to bring it into conformance with the evidence. The choices are, mass and, velocity. Einstein made what appeared to be a reasonable choice at the time and selected mass. If mass increases with velocity, it would explain the observed behavior. This, it will be shown, appears to have been the wrong choice and results in inaccuracies that are well hidden in the $E = Mc^2$ equation, but are very apparent in the resulting relativistic kinetic energy equation, $K = Mc^2 - M_oc^2$. It will be shown now, that neither variable should be modified. This is not to say that the kinetic energy equation itself should not be modified.

Referring back to figure 1, and also to equations 2, 4, and 10, it can be seen that equation 10 must be modified in such a manner as to offset the relativistic effect that the motion has on velocity. That is, if equation 10 is to produce the correct result for kinetic energy, the relativistic effect must be reversed. The obvious conclusion is that we must factor the velocity by the reciprocal of the s-l factor, expression 11. If we are right, however, we must also factor the fractional constant, ½, in equations 4 and 10. This conclusion is supported as follows: We know from equation 4 that the distance, d, traveled by an object under constant acceleration = $\frac{1}{2} at^2$. Referring to equation 3, we can see that this is the same as saying distance ½ vt. In other words, the distance traveled by an object under constant acceleration = ½ times the velocity, v, achieved for the interval, t, during which the acceleration takes place. However, when we study the relativistic motion curve in figure 1, we can see that as velocity increases toward c, there is less and less change in velocity over an interval of time. Stated another way, as velocity increases toward c, the distance traveled by the object approaches ct, and not ½ vt. This implies that the constant ½ should increase toward a value of 1. But since at this point, v is not only near the value of c, but its value is being factored dramatically upward by the millennium factor, the constant ½ must actually be modified to decrease rather than increase in order to compensate and be in agreement with the evidence that supports relativity. When these changes are properly implemented, the resulting kinetic energy equation is a correct equation for all values of v, and as stated earlier, replaces both the Newtonian and Einstein's equations for kinetic energy.

Proceeding now with the necessary modifications to equation 10, we derive,

$$k = \frac{\dfrac{1}{1+\dfrac{c}{\sqrt{c^2-v^2}}}\, m\left(v\dfrac{c}{\sqrt{c^2-v^2}}\right)^2 t}{t}, \qquad (13)$$

which reduces to,

$$k = \frac{mc^2v^2}{c\sqrt{c^2-v^2}+c^2-v^2}. \qquad (14)$$

This equation replaces both, the Newtonian and Einstein's equations for kinetic energy. With it, there is no longer any need to differentiate between classical and relativistic physics. (see appendix C).

3. The New Total Energy Equation

If we now add the internal energy term to equation 14, we arrive at a new equation for total energy that replaces Einstein's $E = Mc^2$ equation. Thus, where E is the total energy for an object in motion,

$$E = \frac{mc^2v^2}{c\sqrt{c^2-v^2}+c^2-v^2} + mc^2, \qquad (15)$$

produces a correct result for all values of v. In view of these findings, it is no longer appropriate to refer to mass, m, as a rest mass, or for that matter the term, mc^2 as the rest energy of an object. As can be seen, mass is unaffected by velocity. Nonetheless, the present theory is in agreement with the relativistic concept that matter does contain internal energy as defined by the expression, mc^2.

4. Comparison of the Relativity Equations with the new Energy Equation

Under close evaluation it will be seen that the relativity equation for kinetic energy becomes erratic at low values of v. This behavior is apparent at velocities as high as 100,000 km/hr and becomes very noticeable as the velocity drops below 1000 km/hr. It continues to intensify as the velocity drops below 100 km/hr, and at approximately 16-20 km/hr, the equation produces a result of zero. Obviously then, this equation is not reliable at those velocities where most of our experience resides. There we have to rely on the Newtonian equation for accurate results. The Newtonian equation, however, is non-relativistic and therefore losses accuracy as the velocity increases. Subsequently, neither equation provides a good program for analyzing the entire range of velocities. To make matters worse, it is unclear where reliance on the Newtonian equation should end and reliance on the relativity equation should begin.

Figure 2 is an actual graph comparing the new kinetic energy equation to the relativity equation for velocities below 50 km/hr. At these velocities, and with the 15 decimal place precision used, the 'Aryan curve' is indistinguishable from, and therefore synonymous with, the Newtonian curve. Very evident in the graph is the erratic behavior of the relativity equation as previously discussed.

Interestingly, analysis of the two total energy equations shows the new results to be identical to the relativity results throughout their entire range. The reason for this is simple. At the lower end of the scale, the kinetic energy is insignificant in comparison to the internal energy, MC^2, contained in the equations. Thus the relativity equation for total energy obscures the fact that the kinetic energy result is incorrect. Since the internal energy is also a component of the energy equation, and since it is very significant at low velocities, both, equations will produce the same values for the level of precision used. On the other hand, at the high end of the scale, the kinetic energy component is the most significant component of both equations. And, as was alluded to earlier, at the higher levels of velocity, the relativity kinetic energy equation becomes more and more accurate. Therefore, it is not surprising that both total energy equations produce identical results.

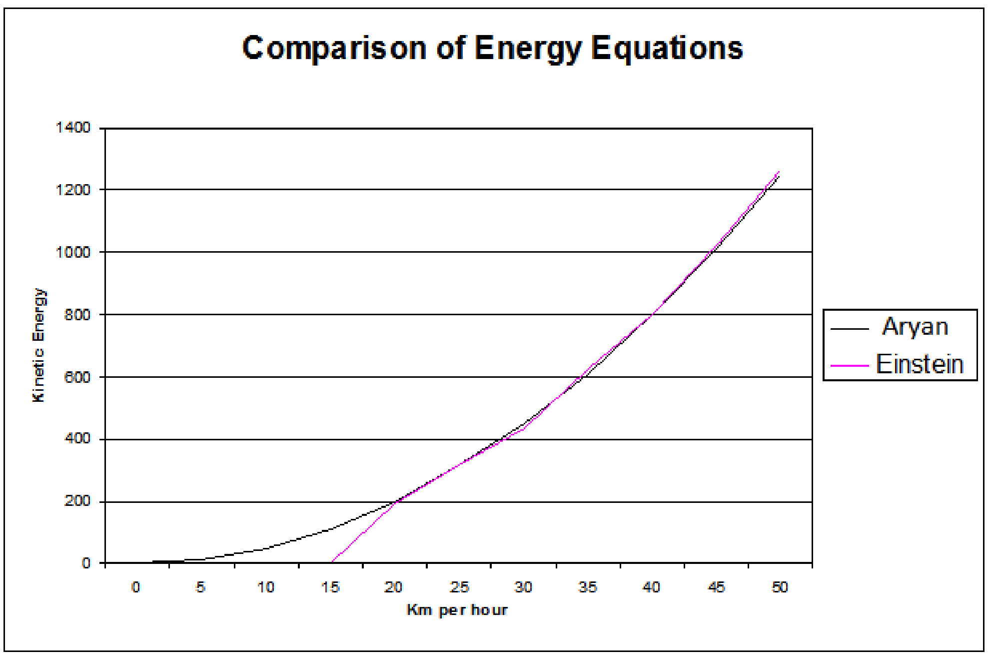

FIGURE 2 Comparision of my new kinetic energy equation with that of special relativity equation

<u>5. The New Momentum and Distance Equations</u>

Referring back to equation 13, and remembering that the top of the right side of the equation represents momentum over distance traveled, we can place it = to pd, where p is momentum and d is distance.

$$pd = \frac{1}{1+\frac{c}{\sqrt{c^2-v^2}}} m\left(v\frac{c}{\sqrt{c^2-v^2}}\right)^2 t \quad (16)$$

Now we can rearrange the right side of the resulting equation and separate the momentum component from the distance component as follows:

$$pd = \left(mv\frac{c}{\sqrt{c^2-v^2}}\right)\left(\frac{1}{1+\frac{c}{\sqrt{c^2-v^2}}} vt\frac{c}{\sqrt{c^2-v^2}}\right) \quad (17)$$

By removing the left component on the right side of the equation and placing it equal to p, we obtain the equation for momentum.

$$p = \frac{mvc}{\sqrt{c^2-v^2}} \quad (18)$$

Here Einstein was only partially correct. Although the most apparent difference between the new energy equation and the older relativity equation is the use of the s-l factor in place of the Lorenz factor, there is a more important difference. In the new equation it is the velocity that is operated on by the factor. In Einstein's equation it is the rest mass that is operated on. This, of course is a profound distinction between the two theories.

If we now take the remaining component from the right side of equation 17 and place it = to d, we have one form of the distance equation for an object under constant acceleration,

$$d = \frac{1}{1+\frac{c}{\sqrt{c^2-v^2}}} vt\frac{c}{\sqrt{c^2-v^2}} \quad (19)$$

which simplifies to,

$$d = \frac{cvt}{c+\sqrt{c^2-v^2}}. \quad (20)$$

Since, v = at, for an object under constant acceleration, by way of substitution in equation 20, we obtain,

$$d = \frac{cat^2}{c + \sqrt{c^2 - v^2}}. \qquad (21)$$

This gives us the alternate form of the new equation for the distance traveled by an object under constant acceleration.

6. The New Acceleration Equations

Now that we understand how the velocity of an object under constant acceleration is affected by the millennium factor, we can formulate new equations for constant acceleration.
Thus, where,

$$v\frac{c}{\sqrt{c^2 - v^2}} = at \qquad (22)$$

it follows that,

$$v = at\frac{\sqrt{c^2 - v^2}}{c}. \qquad (23)$$

This is an important result because, time, t`, in the moving frame of reference is equal to time, t, in the stationary frame multiplied by the s-l factor. Thus it can be seen that,

$$v = at` \qquad (24)$$

where, t`, is the time in the moving frame of reference. This result is consistent with requirement that the rate of acceleration be constant relative to an initially faster frame of uniform motion moving in the same direction as the accelerating object at the instant the object surpasses its velocity. In such a frame, time, t`= t, and the rate of acceleration will be the same as it was initially in the stationary frame. This result thus validates the logic used in deriving these equations. This is strong evidence in support of the present theory.

Going back to equation 22 and solving for the variable a, we get,

$$a = \frac{vc}{t\sqrt{c^2 - v^2}} \qquad (25)$$

for the rate of acceleration, a.

If we now solve for the variable v, we get,

$$v = \frac{atc}{\sqrt{c^2 + (at)^2}}, \quad (26)$$

where, v, is the velocity of an object under constant acceleration.

7. Consistency with Newton's Second Law of Motion

According to Newton's second law of motion, where F is the applied force, the acceleration of a particle is given by,

$$F = ma, \quad (27)$$

while according to the present theory, a, taken from equation 24 may be expressed as,

$$a = \frac{v}{t`}. \quad (28)$$

(For true enlightenment, compare this equation with equation 3 while bearing in mind that the statement, t` = t, is always true in the moving frame, and only true in the stationary frame when v = 0. In view of these findings, it is not unreasonable to suggest that equation 28 is worthy of elevation to the status, "Law of acceleration.")

Continuing on now, by way of substitution, we can then state that,

$$F = m\frac{v}{t`}. \quad (29)$$

Since it is found that v/t` is a constant, (* as a result of the asymptotic nature of v) this relationship between force, mass, and acceleration is consistent with the present theory. In accordance with the present theory, an object under constant acceleration does not experience an increase in mass. Thus, if the acceleration is constant, and the mass is constant, the applied force is constant. Because of time expansion, however, it does require greater amounts of energy than can be attributed to velocity alone to maintain a constant force on the object undergoing the acceleration. In other words, a small amount of energy, in a frame of reference that is moving at a significant fraction of the speed of light, is equal to a large amount of energy, as defined by the energy equations, in the stationary frame of reference. This is a phenomenon of which there are countless analogies in everyday life, involving only Newtonian physics. Consider for example a bullet fired from a gun. If you are in the frame of reference in which the gun was fired and tried to stop the bullet with your hand, you couldn't because of its large amount of kinetic energy. Yet, if you were ahead of the bullet moving at, say, one kilometer per hour slower than the bullet, you would have no trouble at all of stopping it. That is, in your frame of reference the bullet has very little kinetic energy. Relativistic effects on energy are nothing more than an extension of this principle. The only thing that makes it strange is that we are approaching light speed, the standard of measure by which time itself is gauged. This causes time to slow down, which in turn causes required energy increases, to maintain a constant velocity, to be greater than that predicted by Newtonian physics alone.

* (Since v is asymptotic, the velocity v attained during time interval t when expressed as v/t, cannot be a constant. This is because v increases at a slower rate than t. On the other hand t`, does increase at the same rate as v, and thus, v/t` is constant.)

8. Conclusion

The evidence presented here strongly supports the view that mass is not affected by acceleration. The evidence shows convincingly that only those things that are a function of time are affected by the slowing of time. This includes velocity and acceleration. Mass is a function of the quantity of matter contained in an object, and this quantity is not a function of time. These conclusions are not only sensible and logical, but they appear to be self-evident. Time and distance (space), however, have no physical presence and it appears equally self-evident that their quantitative values are interdependent on the activity (motion) of the matter upon which they are referenced to. Even here, it appears that only the variance of time is a real fact of Nature. It was earlier pointed out that the shrinking of distance is not a real effect but rather a perspective effect related to the slowing of time.

Of equal importance here, is the Time-Energy relation challenging the theory of relativity. This connection was established with the derivation of equation 24. This provides strong supporting evidence as to the validity of both theories and suggests that the variance of time may be the unifying element of all physical science.

Appendix

A. For the purpose of this paper mass is defined as a quantitative measure of matter. Mass is detectable through either its gravitational, or inertial force which have been conveniently set equal to each other at the earth's surface by use of the gravitational constant G. To be useful as a quantitative measure, however, it is recognized that apparent changes of mass due to changes in velocity or gravitational field must be taken into account. Thus it is recognized that even on earth, variances of the gravitational field or the experience of g forces imposed by acceleration cause only an apparent change of mass, and not a real change. True mass in the sense meant here is that which is experienced in an isolated system outside of any gravitational field. In such a system it is the inertial resistance such mass offers to acceleration.

B. The s-l factor* is direct derivation of the Lorentz factor. By using the same evidence the Lorentz factor can also be arrived, but it requires more mathematical steps. Thus the s-l factor is just another form of the Lorentz factor. The Lorentz factor can be used in place of the millennium factor in equation 13. After simplification, the result will still be equation 14.

*s-l factor stands for Shivraj-Lorentz factor.

C. Although equation 14 may appear a bit more complicated then the special relativity counterpart, one is reminded that $K = Mc^2 - M_oc^2$ is really an abbreviated form of,

$$K = \frac{M_o c^2}{\sqrt{1 - \frac{v^2}{c^2}}} - M_o c^2.$$

Similar is true for the special relativity total energy equation, $E = Mc^2$ which in the unabbreviated form is,

$$E = \frac{M_o c^2}{\sqrt{1 - \frac{v^2}{c^2}}}.$$