A NEW PHYSICS THEORY

James A. Putnam

This theory proposes a new interpretation of the universe. Its presentation requires a revision of the fundamentals of physics. This revision has a common theme around which all of the analysis is centered. The theme is the interaction of matter and electromagnetic radiation, which I will often refer to as *light*. The first step in developing this theme is to discuss the measurement of motion

.

TWO ELEMENTS OF PHYSICAL ACTION

The successful search for unity in physics depends upon developing an analysis of the universe based firmly upon the two elements of physical action in the universe. These two elements are our only form of knowledge about all physical observations. Empirically, we observe all action as the motion of matter. The two elements of action are the two measurable types of motion of matter. These are velocity and change of velocity.

All of our empirical knowledge about the action of the universe should be expressible in simple to complex arrangements of these two elements of physical action. No matter how far removed an interpretation of action appears to be from an expression of these two basic elements, the interpretation is most exact when including only these two elements.

The use of the word particle has meaning because it relates to a foreknowledge of consistent, predictable measurements of change of velocity. We define gravity by a history of a variety of measurements of acceleration. The measurement of the decay of subatomic particles is a measurement of the time required for a velocity of separation to become detectable. The period of time spent waiting is measured by referencing it to the measure of motion of other particles. Motion and lack of motion are both measured with respect to motion.

Constant Velocity

The first element of action is constant relative velocity. Constant velocity is constant speed in a constant direction as measured from a given reference frame. The measurement of constant velocity is defined as distance traveled per unit of time. Instantaneous velocity is the measurement of velocity at a point and is given by:

$$v = \frac{dx}{dt}$$

For constant velocity, the instantaneous velocity is the same constant value. While constant relative velocity is action, it is change of velocity that makes the universe possible. When there is only constant velocity, current theoretical physics does not feel it necessary to establish a cause of velocity.

Change of Velocity

When there is a change in velocity, physics always looks for a physical cause. In general we define a cause of change in velocity as force. The particles of matter of the universe are all affected by force. Force results in predictable changes in their velocities. The particles of matter are also the sources of the causes of change in velocity. They are the sources of all force.

Theoretically, a change in the velocity of any particle of matter anywhere in the universe causes subsequent changes in the velocities of every other particle in existence. All of these resulting changes cause their own universal effects. Since material particles eventually interact with each other over any length of distance, the interactions of the particles of the universe can be considered as the dissemination of information. In other words, all matter communicates with all other matter in the universe.

The development of life and intelligence in the universe demonstrates that this dissemination of information must include more than just change of velocity. However, physics is the mechanical study of patterns of change of velocity. This new theory is also limited to this mechanical approach to interpreting the operation of the universe. Therefore, cause is defined as force and effect is defined as change of velocity.

Force is defined only by its effects. There is no evidence for a material substance nature for force. It is known that matter is affected by the presence and motion of all other matter and demonstrates this by changing its own velocity. Therefore, cause or force is the potential for matter to be in motion. Effect, change of velocity, is matter in motion.

This process of communication of force is predictable in its effects. We can describe its cause and effects by mathematical formulas. It is this predictability of changes in velocity upon which all of our laws of physics are derived. Our knowledge about this communication between particles of matter is knowledge of change. Our knowledge of change is always knowledge of change of velocity. The instantaneous change in velocity is given by:

$$dv = d\left(\frac{dx}{dt}\right)$$

This change in velocity is given in its differential form because it is not yet measured with respect to another differential. For example, it is not yet properly a derivative with respect to time. The reason is that a change in velocity can be expressed as a function of either time or distance. My use of the word time actually represents duration. The word distance represents length. Neither true absolute time nor space is either of these. When a change in velocity is measured with respect to time it is called acceleration:

$$a_t = \frac{dv}{dt}$$

Newton used acceleration to arrive at his formula:

$$f = ma_t$$

This formula is interpreted as the definition of force as the cause of acceleration. It is a simple interpretation of a clear fundamental empirical observation. We observe that there are particles of matter and that they accelerate. However, the existence of the fundamental cause of the acceleration is known only by the measurement of changes of velocity of matter. The material nature of any force is empirically undetermined.

Physics defines unique fundamental sources of force such as gravitational and electrical. Although there are different definitions of origins of force, the knowledge that each of them can be represented by Newton's formula suggests a probable unity of origin for all. It is the appearance of the same mass, for any particular body of matter, in all applicable force equations, which is the empirically substantiated link.

It is a goal of physicists to find a theory that will establish the common origin for all force. This endeavor should take note of the success of Einstein's special theory of relativity in demonstrating a link between force and the propagation of light. His theory suggests strongly that the search for unity of force depends fundamentally upon first achieving a correct analysis of the nature of light. It is such an analysis, which forms the common basis for this new theory.

In order to perform this analysis of the nature of light, it is helpful to first examine a change in velocity from two perspectives. The first, as mentioned, is acceleration. Acceleration is the measure of a change of velocity with respect to time. Time is an intrinsic reference by which to measure all physical events. There is another intrinsic reference, which is itself clearly of a physical nature. It is distance. All action occurs across a distance and can be measured with respect to it.

Change of Velocity Per Unit Distance

A change in position is an integral part of all physical action. It can be fundamentally revealing to consider a change of velocity with respect to distance. In order to proceed toward a new analysis of the nature of light, I will sometimes make use of this method of measurement. The expression for a change of velocity with respect to distance is:

$$a_x = \frac{dv}{dx}$$

It is related to acceleration by:

$$a_x = \frac{a_t}{v}$$

Substituting differentials:

$$a_x = \frac{dv}{dx} = \frac{\frac{dv}{dt}}{\frac{dx}{dt}}$$

It is convenient to have a name for a change of velocity measured with respect to distance. I will call it *exceleration*. This is the only word I will coin. The name is chosen to reflect the use of the letter x to represent distance.

The use of exceleration will be demonstrated with the example of a freely falling body. It is described in Newtonian physics that a freely falling body, changing its velocity due to gravity, will achieve the same amount of acceleration regardless of the velocity of the body. It is also the custom to approximate the acceleration due to gravity as a constant for sufficiently short distances. Additionally it is common to observe a freely falling object by measuring its motion between two fixed points.

In order to make measurements of the change of velocity of the object as it passes between these two points, it is useful to measure the change in velocity over the distance involved instead of over the period of time involved. If the distance is a differential, i.e. infinitesimally small, quantity then the event measured is exceleration. The exceleration of a freely falling body will be used to develop formulas that will be helpful when discussing the behavior of light.

The body accelerates due to gravity as represented by the letter g. For this example g is considered a constant. Therefore, to a good approximation the body's exceleration is inversely proportional to its velocity:

$$a_x = \frac{g}{v}$$

This formula is useful for helping to define the properties of a freely falling body as measured between two points located along a line which passes through the center of the earth. One property defined in this manner is gravitational potential energy.

Energy of a Freely Falling Object

A clear empirically based understanding of energy is necessary for the development of a unified theory. The relationship between energy and the effect we call gravity is a phenomenon useful for analyzing energy. I will use the analysis of the energy of a freely falling body as a vehicle to introduce formulas that will later be used in an analysis of the properties of light.

The effect we call gravity is a natural empirical and theoretical starting point for analyzing the behavior of light. The existence of a fundamental connection between light and gravity has already been established by the theory of general relativity. A related proof offered in support of Einstein's theory is the Pound-Rebka experiment. This experiment uses the concept of a freely falling body to predict a change in the energy of light due to gravity.

In order to correctly understand the relationship between gravity and light, it is first necessary to examine the potential energy of gravity. It is known that a freely falling body experiences an increase in kinetic energy equal to its decrease in potential gravitational energy.

The change in kinetic energy between two positions of height can be expressed in terms of a corresponding decrease in potential energy by this relationship:

$$\frac{1}{2}mv_2^2 - \frac{1}{2}m_1^2 = mgr_1 - mgr_2$$

For very small distances, I can substitute the differential expression:

$$r_1 - r_2 = dx$$

Simplifying the kinetic energy side, on the left, and substituting the distance dx into the potential energy side, on the right:

$$\frac{1}{2}m(v_2^2 - v_1^2) = mgdx$$

Factoring the kinetic energy side and substituting the general form of acceleration into the potential energy side:

$$\frac{1}{2}m(v_2 - v_1)(v_2 + v_1) = m\frac{dv}{dt}dx$$

For the very small distance dx, I can very closely approximate:

$$\frac{1}{2}(v_2 + v_1) = v_1$$

Substituting this into the equation above:

$$mv_1(v_2 - v_1) = m\frac{dv}{dt}dx$$

Rearranging differentials on the potential energy, right, side:

$$mv_1(v_2 - v_1) = m\frac{dx}{dt}dv$$

For a very small distance, I can approximate:

$$\frac{dx}{dt} = v_1$$

So for a very small distance:

$$mv_1(v_2 - v_1) = mv_1dv$$

And the change in velocity also becomes a differential quantity:

$$v_2 - v_1 = dv$$

I make this substitution:

$$mv_1dv = mv_1dv$$

The differential changes in kinetic energy and potential energy are mathematically identical. It could then be said that for a freely falling object there is one general differential change in energy given by:

$$dE = mvdv$$

This general differential form of energy will be relied upon in a fundamental way in this new theory.

Momentum is also important. It can be expressed as:

$$P = mv$$

The differential energy equation given above can be used to solve for another expression of momentum:

$$P = mv = \frac{dE}{dv}$$

With this introductory analysis completed, I can proceed to analyze the nature and cause of relativity type effects. This new approach eventually leads to improved, clear, logical and interconnected general results embracing all of physics.

LIGHT AND RELATIVITY EFFECTS

The general theory of relativity established a connection between the behavior of light and all other physical phenomena. Space-time is predicted to be a part of every action of the universe. The cause of space-time is defined as the constant nature, in a vacuum, of the speed of light. The successes of the predictions of relativity theory demonstrate that in order to accurately define physics we must first accurately define light. Some primary properties of light are defined by the theory of relativity. That theory addresses the measurement of the speed of light. Therefore, I will first consider the measurement of the speed of light. I then use this new theory to explain light from a different perspective.

Measuring the Speed of Light

The problem of the measurement of the speed of light, considered solved by relativity, can be simply introduced by considering a hypothetical problem in gravity free space. I will use two observers in proximity to each other with no relative velocity. Since there is no gravity, the only possible communication between these observers is by electromagnetic means. For convenience, I refer to electromagnetism as light.

One observer sends out a ray of light toward the second observer. The measurement of the speed of light passing between them may appear to be straightforward without logical complications. If a measuring rod is placed between the two observers, it appears reasonable to think either observer would measure the speed of light to be the known value commonly represented as C. There is some mystery, however, even in this very simple example.

What cannot be explained is how light is propagated, and what is the means by which the speed of light is regulated? It could be said there is nothing present to cause it to vary, but there is equally nothing present to cause it to not vary. This point becomes clearer when relative velocity is introduced into the problem. The correctness of relativity is not presupposed, so both time and space are considered to be symmetrical.

When there is a relative velocity between the two observers then the speed of light needs to be re-measured. There is reason to think the relative velocity may affect the measured speed of light. For example, if the two bodies are moving toward each other it is possible to wonder if the speed of the light passing by either of the observers would travel at the speed C plus their relative speed. However, this seemingly reasonable assumption is not a foregone conclusion. There is also a reasonable basis to expect the speed to be equal to C regardless of the relative velocity.

The idea of a changing speed of light due to relative velocity suggests the observer who emits the light retains control over that ray of light, while the second observer apparently does not have the ability to control it. There is no other potential source of control given. This idea requires the acceptance of multiple measured speeds of light equal to the same number of charged particles in the universe. The core of the problem is: There is implicit in this idea that the local environment has no control over the speeds of light from any number of external sources.

We have no current understanding of why light moves. It could easily be argued: If a particle controls the speed of its own light, then it should also have control over the speed of any light. We can wonder how a body has control over the light it emits, but no control over passing light physically indistinguishable from its own. The point is that there is no empirically demonstrated substance controlling the speed of light. Since the cause of this speed cannot be detected directly, then the motion of light must be determined empirically from the interaction of particles and photons. It cannot, at its level of origin, be logically deduced.

The achievement of the Michelson-Morely experiment was to very accurately demonstrate that there is no detectable variation in the speed of light as measured near the surface of the earth regardless of the relative velocity of the source. The earth's relative velocity within the solar system did not affect the speed of light. By achieving this result, the experiment confirmed the theoretical prediction of Maxwell's equations.

Maxwell's prediction was that the speed of light is a local phenomenon. The specific equation giving this prediction is:

$$C = \frac{1}{(\mu\varepsilon)^{\frac{1}{2}}}$$

Or for free space:

$$C = \frac{1}{(\mu_0\varepsilon_0)^{\frac{1}{2}}}$$

The prediction is: The speed of light depends only upon the local permeability and permittivity of the medium through which the light is passing.

The special theory of relativity agrees partly with this prediction when it accepts that the speed of light will always measure as a constant for an observer on the earth. However, it goes even further than this by extending the constant nature of the speed of light to apply beyond the local environment.

It is important to recognize that neither the Michelson-Morely experiment nor Maxwell's equation can be used as evidence to support this assumption. Each of them deals only with a local phenomenon. The special theory is not a local phenomenon. It maintains that the speed of light would measure as C over any distance. It needs to be demonstrated that the speed of light would always measure as the same constant, even over long distances, whether away from or near to matter.

Even if this prediction could be verified by placing a measuring rod across a long distance, it does not prove that the speed of light remained a constant. Any measuring rod that reaches between two points could be affected by the same environmental changes that affect the speed of light traveling between the same two points. If so, and if the changes in the length of the rod and the speed of light were proportional, then the rod would fail to help measure the change in the speed of light.

The only way to project measurements into other frames of references is to use some feature or features of the universe that can be demonstrated to be absolute constants. Relativity theory makes this claim for the speed of light; however, it is the success of relativity theory in making other predictions that is accepted as proof of the universal constant nature of the speed of light.

Interpreting Pound-Rebka

In order to begin to demonstrate that relativity type effects, which definitely do exist, do not prove the constant nature of the speed of light, I will introduce gravity into an example problem. There are now two charged particles in proximity to each other. There exist both electromagnetic radiation and the force of gravity for each of the particles. The introduction of gravity allows me to include some general relativity effects in this analysis.

A major problem with the non-gravity example is that there is no way to give the traveling light roots. In other words, the light travels through an environment with no assumed substance. This implies the particles must control the speed of light from a distance by an unknown physical means. Special relativity gives the light roots by introducing the medium of space-time.

Since general relativity defines space-time as the real nature of gravity, then the introduction of gravity into my example gives light a physical medium, of theoretical origin, to move through. Gravity theoretically gives light universal roots. We can wonder what gives gravity roots. However, this circular question does not need to be answered here. This simple hypothetical example is sufficient to use to begin analyzing relativity effects.

I begin the analysis by allowing gravity to serve, on a trial basis, as the roots or medium of control over the speed of light. This example problem I am using to explore the relationship between gravity and the behavior of light is, of course, not purely hypothetical. This is the kind of problem which the Pound-Rebka experiment was intended to help resolve.

The Pound-Rebka experiment did result in proof of a relationship between light and gravity. The experiment has been interpreted as a confirmation of the existence of space-time as predicted by relativity theory. Since the Pound-Rebka experiment was performed for the purpose of testing a prediction of the general theory of relativity, I will give some of that theory's background.

According to the theory of relativity the measurement of the speed of light in free space between any two bodies of matter will always be equal to C. Even before the advent of relativity theory, the work of H. Lorentz, analyzing the behavior of charged particles, used an analogous assumption on the atomic particle level. His assumption also produced a new theory.

Lorentz's use of this assumption led to the Lorentz transforms which predicted the variation of particle size and time. In a sense he invented particle-time as the predecessor of space-time. For Lorentz an electron could shrink in size in the direction of motion. His transforms are mathematical equations that do make predictions consistent with empirical evidence. Even though his equations were successful, his theory is not accepted as correct.

Einstein expanded the application of Lorentz's transforms from a description of particle size to a description of space, even to the whole universe. For Einstein it wasn't the size of the particle alone that was shrinking, but instead it was space itself and anything contained within it.

His expanded application of Lorentz's transforms provided a mathematical description of space-time. Einstein's use of the Lorentz transforms led to his pinnacle equation that is interpreted to equate mass with energy:

$$E = mC^2$$

Einstein then applied this energy equation to an analysis of the nature of photons. The application of this equation to photons led to the general theory of relativity.

It was understood photons have energy. The energy mass equation was interpreted early to predict light must then also have mass or at least could be assigned a property called *equivalent mass*. This conclusion implies that light should exhibit effects due to gravity. In other words, gravity should cause effects upon light related to those experienced by freely falling matter.

This interpretation of the relativity mass term for photons had to be reconciled with Einstein's very first assumption about the universal constant nature of the speed of light. Einstein's initial postulate held that light in space couldn’t be measured as having undergone acceleration. However, according to the predictions of the energy mass equation light must, because of its mass nature, exhibit effects consistent with having undergone acceleration.

Einstein showed that the deformations of space and time as predicted by the special theory could also account for the effects of gravity upon light. He predicted that an effect of space-time upon a photon approaching the earth would be to increase the energy of the photon. He showed that while space-time prevents the measurement of a physical acceleration of the speed of a photon, the photon's increase in energy is not masked from us. In other words, treating light as an object falling freely due to gravity, we should measure an increase in photon energy.

This increase should correspond to the known increase of kinetic energy that any freely falling body would achieve due to gravity. This is the effect that the Pound-Rebka experiment was intended to test. In the experiment a discrete particle of light, a photon, is sent vertically through the earth's gravity and is recaptured at a known distance in a manner that gives an accurate measure as to whether or not its energy has changed.

The result of the experiment showed the energy of the photon did change by the percentage predicted by general relativity. However, some caution must be exercised at this point. The interpretation of this result of the experiment has been made based upon other interpretations. The interpretation is chosen to be consistent with an accepted theoretical concept as well as with the empirical evidence. While the result did confirm the predicted percentage of energy change, it is important to keep in mind some of the things it could not do.

The Pound-Rebka experiment did not demonstrate a constant speed of light. It did not demonstrate the unification of space and time. It did not show space and time could be treated as a pliable substance. It did not do away with the action at a distance question. It did not demonstrate that the light suffered effects corresponding with a positive acceleration of light in the direction of the earth. This is an assumption based upon non-light evidence. It is possible light may actually slow down when nearing the earth, and the experiment alone cannot confirm or disprove this.

There is no direct empirical evidence as to the universal constant nature of the speed of light, because any such experiment falls short of the accuracy necessary to detect the magnitude of change expected. When light is treated as an object falling due to the acceleration caused by gravity, the expected increase in speed is very small for the distance used in the Pound-Rebka experiment.

If light did accelerate under these conditions, it would have increased, or possibly decreased, its speed by:

$$\Delta v_c = 7.35x10^{-7}\ \frac{meters}{sec}$$

This magnitude is very small when compared to the magnitude of the speed of light:

$$C = 2.998x10^{8}\ \frac{meters}{sec}$$

This amount of change in the speed of light could exist, and we might not yet have verified it. If it does exist, then it could cause the result observed in the Pound-Rebka experiment.

The prediction of the Pound-Rebka experiment can be, and in practice is, arrived at by treating light as if it really did accelerate. If it wasn't for the prior existence of the theory of relativity, the result of the Pound-Rebka experiment could have been interpreted as evidence that light does accelerate as a function of distance from matter.

In fact, it remains possible to interpret the result as a refutation of the theory of relativity. The problem is that it could be interpreted as either for or against relativity. What it proved was that the energy of a photon will change as a function of gravity or, including another possibility, as a function of the cause of gravity.

There are, of course, many more successful predictions of relativity theory. Einstein's work has been very useful and cannot be dismissed by pure conjecture. On the other hand, if it is true then it should easily stand up against any challenge. Testing it should only make it more attractive. With relativity's success in mind, I ask: What can be inferred from the Pound-Rebka experiment if we do not depend upon the theory of relativity?

I pursue this line of inquiry fully realizing a simple answer will not suffice. If there is new truth to be learned from the experiment, then this truth should prove to be a key to the development of a theory more comprehensive and more successful than relativity. Also, the reason for the success of relativity theory needs to be explained.

Speed of Light

The Pound-Rebka experiment result can be predicted by treating light as if it accelerates due to gravity. Therefore, I will allow for this possibility by representing the speed, and sometimes the velocity, of light as the variable v_c. The subscript c will be used to identify any variables pertaining to light. The single letter C will be used to represent the known measured speed of light.

The possibility for a change in the velocity of light due to gravity will be represented by:

$$\Delta v_c = g\Delta t$$

The value g represents the acceleration due to gravity. This acceleration is typically treated as a constant over the distance of *22.5* meters used in the Pound-Rebka experiment. If the distance is allowed to approach zero, then the expression approaches exactness and can be represented as:

$$dv_c = gdt$$

In this differential equation of the acceleration due to gravity I no longer need to approximate g as a constant. It assumes its true variable form. This is because the acceleration due to gravity g is defined as a differential expression. This equation applies to any infinitesimal point in the gravitational field. It can be solved for the change in velocity of light. I divide the equation by dt:

$$\frac{dv_c}{dt} = g$$

This equation says: The derivative of the speed of light with respect to time equals the acceleration due to gravity*.* This is a mathematical restatement of the initial assumption that light accelerates due to gravity.

The speed of light is assumed to vary with radial distance from the earth. It is useful, therefore, to reference its change of speed with respect to distance instead of time. To do this, I make use of:

$$v_c = \frac{dr}{dt}$$

This equation simply expresses the instantaneous speed of light as it travels along a straight path passing through the center of the earth.

In the Pound-Rebka experiment the distance changing is the radial distance with respect to the center of the earth. I want to reference the possible change in the speed of light to a differential quantity of this radial distance. In order to accomplish this I first solve for dt:

$$dt = \frac{dr}{v_c}$$

Now substituting this into the differential speed of light equation:

$$\frac{dv_c}{dr/v_c} = g$$

Solving for dv_c:

$$dv_c = g\frac{dr}{v_c}$$

The equation has been changed from a measurement with respect to time to an expression referenced to the distance involved. Multiplying by v_c:

$$v_c dv_c = gdr$$

It is known:

$$g = \frac{GM_E}{r^2}$$

The letter G represents the universal gravitational constant, and the expression M_E is the mass of the earth. Substituting this into the previous equation:

$$v_c dv_c = \frac{GM_E}{r^2}dr$$

Setting up the indicated integral:

$$\int_0^{v_c} v_c dv_c = \int_0^r \frac{GM_E}{r^2}dr$$

Performing the integration:

$$\frac{v_c^2}{2} = \frac{GM_E}{r} + k$$

Multiplying by two and retaining the letter k for the unknown constant:

$$v_c^2 = -2\frac{GM_E}{r} + k$$

Solving for k:

$$k = v_c^2 + 2\frac{GM_E}{r}$$

At the surface of the earth:

$$r = 6.378x10^6\ meters$$

And:

$$v_c = 2.998x10^8\ \frac{meters}{sec}$$

Substituting these values and solving for k:

$$k = 8.998x10^{16}\ \frac{meters^2}{sec^2} \cong C^2$$

Approximating this solution as equality and substituting for k:

$$v_c^2 = C^2 - 2\frac{GM_E}{r}$$

Taking the square root of both sides:

$$v_c = \left(C^2 - 2\frac{GM_E}{r}\right)^{\frac{1}{2}}$$

This equation describes the variation of the speed of light as evidenced by the Pound-Rebka experiment. It is not the most fundamental expression of the variation of the speed of light. It is a formula of first approximation based, in part, upon the results of the Pound-Rebka experiment. It can be seen from the formula that for any significant macroscopic distance the results predicted will be in agreement with the assertion that light accelerates due to gravity.

Acceleration Due To Gravity

It is assumed for this analysis that light accelerates in the same manner as any falling object. The equation for the speed of light, as a function of distance from the earth, used g in its derivation. Falling objects of matter ideally accelerate at the rate of g. Since both light and matter are treated here as having the same magnitude of acceleration due to gravity, I can use this acceleration to derive an expression of the change of an object's velocity as a function of the change of light velocity. The definition of the acceleration due to gravity g for freely falling bodies of matter is:

$$g = \frac{dv_p}{dt}$$

Where the subscript p is used to denote particle or object velocity.

The acceleration of light is also assumed equal to g. The Pound-Rebka experiment does not make clear whether light has a positive or negative acceleration. For now I assume that it can be represented by a positive g. If this proves not to be the case then the sign can be changed later. So, the acceleration of light due to gravity is:

$$g = \frac{dv_c}{dt}$$

The equal left sides of these two equations allow me to set up the equality:

$$\frac{dv_p}{dt} = \frac{dv_c}{dt}$$

The relationship between a change in light velocity and a change in particle velocity is given here in a form that does not give much insight. In order to gain more information from it, I find it useful to change from an expression of acceleration to one of exceleration. The inconvenience with using acceleration is that for a given distance two objects moving at different speeds will have different values of dt.

So, for conditions similar to those of Pound-Rebka, the above equation should say:

$$\frac{dv_p}{dt_p} = \frac{dv_c}{dt_c}$$

The denominators are not the same expression for the circumstances of a measurement over a fixed distance. It will prove desirable to have equivalent differential values in the denominators. Pound-Rebka used a fixed distance as its standard for measurement of change of photon energy. This situation lends itself to the use of exceleration. In order to change the denominators to measures of distance I use:

$$dt_p = \frac{dx_p}{v_p}$$

And:

$$dt_c = \frac{dx_c}{v_c}$$

I substitute for each dt and now have differentials of distance in the denominators:

$$\frac{v_p dv_p}{dx_p} = \frac{v_c dv_c}{dx_c}$$

Even though I have given the denominators different subscripts in order to make their identities clear, for this example they are the same value. Both denominators are equivalent to dr the differential length of measurement of the radius of the earth.

A form of this equation will become useful later when discussing the properties of photons. For later convenience I use dx in place of dr. The expression dx represents an extremely small measurement of length. This form will be used to represent situations analogous to the current example. That is, it represents only those situations where the differential length in the denominators is the same. In these cases the formula is:

$$\frac{v_p dv_p}{dx} = \frac{v_c dv_c}{dx}$$

This formula and approximations of it will be useful for analyzing the effects of gravity in general. For the present example, both sides are still equal to g. For the right side of the equation, I can write:

$$g = \frac{v_c dv_c}{dx}$$

I introduce a new variable to represent the exceleration of light:

$$a_{cx} = \frac{dv_c}{dx}$$

The subscript x shows exceleration is defined with respect to distance. Substituting this into the equation above and rearranging:

$$g = a_{cx} v_c$$

This equation defines the acceleration due to gravity as the product of the exceleration of light multiplied by the velocity of light. Its simpler equivalent reflects my initial assumption of light accelerating at the rate of g. It is:

$$g = \frac{dv_c}{dt} = a_{ct}$$

Where, a_{ct} represents the acceleration of light due to gravity. The subscript t represents that acceleration is defined as a change of velocity with respect to time.

An important aspect of both of these equations is, until proven otherwise, they can be read both forward and backward with equal theoretical validity. This introduces the need to test for both possibilities. Each of the formulas, reading them forward, say that gravity causes the speed of light to change.

In reverse, they say: The acceleration due to gravity is caused by the change in the speed of light. In other words, if the speed of light is controlled by matter, then the effect we call gravity follows automatically without the introduction of a fundamental gravitational field.

Freely Falling Matter and Light

I have derived a relationship between the change of velocity of light and the change of velocity of a freely falling body under the influence of the effect known as gravity. The equation expressing this relationship by use of exceleration is:

$$\frac{v_p dv_p}{dx} = \frac{v_c dv_c}{dx}$$

Multiplying by dx yields:

$$v_p dv_p = v_c dv_c$$

This form of the equation describes an equality that holds for measurements made between two points. In other words, the measurement of change of velocity is made over a given distance instead of over a given period of time. I am remaining consistent with the main ideas of the Pound-Rebka experiment.

The values of v_c and dv_c are fixed for any given location. This is a direct result of the assumption that the speed of light is a function of radial distance from matter according to the relationship:

$$v_c = \left(C^2 - 2\frac{GM_E}{r}\right)^{\frac{1}{2}}$$

While the speed and acceleration of light are fixed for a given distance r, the values of v_p and dv_p belonging to matter can vary. The reason dv_p can vary is because, I am considering a situation like the Pound-Rebka experiment. I am describing a value of dv_p that occurs within a given measure of distance and not a given measure of time.

In other words, as velocity is increased any object falling between two points will have a smaller increase in velocity between those two points. The reason is that the period of time for the object to pass the two points becomes less and less. Acceleration is based upon a constant unit of time. If the period of time varies then the change in velocity varies in a corresponding manner. Therefore, if the unit of time is decreased then the size of change in velocity will also decrease.

As a rule, I use exceleration when the dx values are equal and acceleration when the dt values are equal. Returning to the equation:

$$v_p dv_p = v_c dv_c$$

I solve for dv_p:

$$dv_p = \left(\frac{v_c}{v_p}\right) dv_c$$

At any point the values of v_c and dv_c are fixed. Therefore, dv_p is inversely proportional to v_p. This means: The faster the object is moving the less it is increasing its speed over a differential distance. It also says: If an object is moving at very nearly the speed of light the object still has a differential change in velocity approximately equal to that of light.

It has not been shown yet whether light should be treated as increasing or decreasing its speed as it approaches matter. Whichever is the case, the form of the equation should remain the same; only a sign would change. The predicted effects will confirm the correct choice.

Gravitational Energy

The Pound-Rebka experiment showed the energy of light varies as a function of distance from matter due to gravity. The same is true for a freely falling body of matter. Therefore, I should be able to find a relationship between the energy of a falling body of matter and that of light. I will solve for this relationship over a vertical distance between two points. Therefore, I can use the equation:

$$v_p dv_p = v_c dv_c$$

Since I have not yet shown in what direction the acceleration of light is positive, it is possible this equation should have a negative sign in front of the right side. Whether the sign is given as positive or negative at this point, will not affect the form of the equation. The following analysis of the energy of light will produce more complex equations. If I choose the correct sign now then the equations developed will not have to be corrected later. It will become apparent that the speed of light slows as it approaches the earth.

With foreknowledge of the results and for the sake of giving the correct signs in the equations to follow, I choose to include a negative sign at this point. The justification will be given later. The equation becomes:

$$v_p dv_p = -v_c dv_c$$

Setting up the indicated integration equation:

$$\int_{v_{p1}}^{v_{p2}} v_p dv_p = -\int_{v_{c1}}^{v_{c2}} v_c dv_c$$

Performing the integration and multiplying by two yields:

$$v_{p1}^2 - v_{p2}^2 = -(v_{c1}^2 - v_{c2}^2 + k)$$

Zero change in v_p means zero change in v_c, therefore k is zero yielding:

$$v_{p1}^2 - v_{p2}^2 = -(v_{c1}^2 - v_{c2}^2)$$

This equation expresses the relationship between a change in the speed of a falling object and the corresponding change in the speed of light over the distance traveled. For the purpose of maintaining simplicity during this analysis, I set the initial speed of the object v_{p1} at zero. The equation for this special case becomes:

$$-v_{p2}^2 = -(v_{c1}^2 - v_{c2}^2)$$

Multiplying by *-1* and removing the subscript *2* from v_p yields:

$$v_p^2 = v_{c1}^2 - v_{c2}^2$$

Where the variable v_{c2} is the value of v_c closest to the earth.

For a body of matter dropped unhindered above the surface of the earth, the above equation gives the basic relationship of the speed it will achieve as a function of the speed of light at the point where it is released, and the speed of light at the point where the body's speed is measured. I choose to leave it in this squared form for now because I want to use it in an expression of energy.

This formula is my starting point for the analysis of relativity effects. The foundation for the introduction of these effects will now be given. I begin this part of the analysis by converting to the energies involved. I multiply both sides of the equation by $(1/2)m$:

$$\frac{1}{2}mv_p^2 = \frac{1}{2}mv_{c1}^2 - \frac{1}{2}mv_{c2}^2$$

The term on the left is the kinetic energy of the falling object. The two terms on the right also represent values of energy defined as functions of mass and the speed of light. When the theory is more fully developed, the true fundamental relationship expressed by this equation will become clear. For now I will provide a simple fundamental physical interpretation for the right side.

It can be inferred that the right side of the equation represents the difference between two potential energies. I know, by definition, its values are fixed for a given point. Therefore, the right side is anticipated to represent the difference between potential energy levels. This right side expression can be manipulated into its common form beginning with:

$$\frac{1}{2}mv_{c1}^2 - \frac{1}{2}mv_{c2}^2 = \frac{1}{2}m(v_{c1} + v_{c2})(v_{c1} - v_{c2})$$

For sufficiently short distances such as in the Pound-Rebka experiment:

$$\frac{1}{2}m(v_{c1} + v_{c2})(v_{c1} - v_{c2}) = \frac{1}{2}m(2v_c)(\Delta v_c)$$

Taking the right side alone and simplifying it:

$$\frac{1}{2}m(2v_c)(\Delta v_c) = mv_c\Delta v_c$$

The incremental exceleration for the speed of light is:

$$\frac{\Delta v_c}{\Delta x} = \left(\frac{1}{v_c}\right)\left(\frac{\Delta v_c}{\Delta t}\right)$$

Rearranging terms:

$$v_c\left(\frac{\Delta v_c}{\Delta x}\right) = \frac{\Delta v_c}{\Delta t}$$

Multiplying by m:

$$\frac{mv_c\Delta v_c}{\Delta x} = m\frac{\Delta v_c}{\Delta t}$$

Since:

$$g = -\frac{\Delta v_c}{\Delta t}$$

I can write:

$$\frac{mv_c\Delta v_c}{\Delta x} = -mg$$

Rearranging:

$$mv_c\Delta v_c = -mg\Delta x$$

The right side is the definition of potential gravitational energy over a distance small enough for g to be considered a constant. The left side represents what I assumed to be gravitational potential energy in the energy equation derived above. This equation then expresses common gravitational potential energy as a function of the speed of light.

This result is consistent with the initial assumption that light accelerates at the rate g. A little adjustment to the equation just above will show this to be true. It is known:

$$ma = \frac{dE}{dx}$$

Both sides are different expressions of force. The left side is Newton's expression, and the right side is the derivative of energy with respect to distance. From three steps above, I solve for mg:

$$mg = -\frac{mv_c\Delta v_c}{\Delta x}$$

The left side is Newton's expression of gravitational force. The right side is an increment of energy divided by a corresponding increment of distance. I eliminate m:

$$g = -\frac{v_c\Delta v_c}{\Delta x}$$

I let the increment of distance approach zero and the equation becomes a differential equation:

$$g = -v_c\frac{dv_c}{dx}$$

Since:

$$\frac{dv_c}{dx} = a_{cx}$$

Where: a_{cx} is the exceleration of light. Then:

$$g = -a_{cx}v_c$$

I have arrived back at my earlier assertion that light accelerates equal but opposite to the acceleration due to gravity.

There is a question to be raised about my energy equation. I have made the assumption in the equation that the speed of light slows as it approaches the earth. For the energy equation:

$$\frac{1}{2}mv_p^2 = \frac{1}{2}mv_{c1}^2 - \frac{1}{2}mv_{c2}^2$$

This means:

$$v_{c1} > v_{c2}$$

If this is true, then the energy of a photon approaching the earth appears to be decreasing. This would seem to predict the opposite effect from what is proven by Pound-Rebka. This apparent problem will become resolved when I give the definition of electromagnetic radiation based upon this new theory.

Photons are the carriers of electromagnetic energy. As yet, I have not explained how photons become these carriers. Before doing this, I need to establish some physical attributes of photons beginning with their elasticity or change of length. Their change of length is a direct result of the changing speed of light.

Variable Length of Photons

Having length makes photons very versatile in this theory. It helps to lead to the derivation of gravitational effects, electromagnetic effects, relativity effects and quantum effects. This theory accepts photons have length, and it is affected by the variation of the speed of light. For a photon moving toward the earth, its length is affected in a manner somewhat analogous to the distance between two freely falling balls.

To begin the example, each ball is dropped from the same point, but they are separated in their release times by a period of one second. As the two balls continue falling, the distance between them increases. The period of time it takes for one to reach a given point and then for the second ball to reach the same point remains one second. The time of separation is a constant while the distance of separation is a variable.

A photon moving directly toward the earth is assumed to experience an increasing magnitude of negative change of velocity. In other words, it undergoes a braking action that becomes stronger as the photon approaches the earth. Therefore, as the photon approaches the earth the photon length shrinks.

The percentage of shrinkage is extremely small for a distance of the size used in the Pound-Rebka experiment. This is because the photon is moving extremely fast compared to the magnitude of the acceleration due to gravity. Its acceleration is based upon a period of time, but it takes an extremely short period of time to cover 22.5 meters.

The period of time it takes for a photon to pass a given point will prove to be of great importance. It will be shown to be a fundamental constant. I will introduce the magnitude of this time period at a later point in this theory. For now, I represent it with:

$$t_{photon} = \Delta t_c$$

The length of a photon can be defined as a function of this time period:

$$\Delta x_c \cong v_c \Delta t_c$$

For a photon traveling toward the earth, its length is changing as it moves from one radial distance to another. At the higher point, the photon length is represented by:

$$\Delta x_{c1} \cong v_{c1} \Delta t_c$$

At the lower location the length of the photon is represented by:

$$\Delta x_{c2} \cong v_{c2} \Delta t_c$$

I form a useful relationship between these two lengths by dividing the second equation by the first equation:

$$\frac{\Delta x_{c2}}{\Delta x_{c1}} \cong \frac{v_{c2} \Delta t_c}{v_{c1} \Delta t_c} \cong \frac{v_{c2}}{v_{c1}}$$

It would not be exactly correct to use equal signs in the above formulas; however, in this case using them would lose nothing significant. Empirically, we can't measure the minute difference between using the approximate and exact values. With this justification, I take the liberty, and gain the convenience, of using equal signs in these formulas. Solving for the length of the photon at its lower position:

$$\Delta x_{c2} = \Delta x_{c1} \frac{v_{c2}}{v_{c1}}$$

At this point I have developed a sufficient basis to begin the derivation of relativity type effects. I will next address the cause of general relativity type effects.

General Relativity Type Effects

The theory of general relativity uses space-time as its cause for relativity effects. The concept of space-time is the automatic consequence of defining the speed of light to be a universal constant. However, it is possible for the speed of light to always measure as a constant over sufficiently short distances and to not be a universal constant. In other words, it is logically possible for the speed of light to vary and yet measure locally as the same constant everywhere. The beginning analysis of this new theory presents just such a circumstance.

It has been proposed that the speed of light varies as a function of distance from matter. It has been shown if this is true, then the length of a photon will vary accordingly. The coordinated changes of these two properties of photons cause the speed of light to measure as the same constant everywhere. The acceleration of light is thereby masked. However, some effects of these two properties are not always masked. When they are not masked they are observed as relativity type effects.

In this theory, my measuring rod for time is the period it takes for the length of a photon to pass a given point. This period of time will be shown to be a universal constant. This is our most basic unit of time. It is the clock of the universe, and it keeps running with absolute precision. If this is true, then we do have access to absolute time.

There is no absolute unit of measurement of length for us to use. Our fundamental unit of measurement is the length of a photon which is variable. What is true for photons will be shown to be true also for atoms. The length of a photon is the only unit of length an atom knows. When quantum effects are derived in this theory, I will relate the size of an atom to photon length.

The effect on each atom also occurs for molecules and finally for matter in general. The size of all material objects is a function of the local size of photons. An example of how this affects measurements is to consider in detail the problem of the measurement of the speed of light. I will use photon length as my unit of length, and my unit of time is the period for a photon to pass by any point.

The measured speed of light is then always the unit length of the photon divided by this constant time period. Our unit of length changes and we have no way to measure this change. To the local observer there is no reference to use to judge the changing length of a photon. To the local observer a photon is the only fundamental unit of length. Macroscopic units of length are a function of photon length. They cannot help us to measure a change in photon length.

As the speed of light varies, the length of a photon varies. As light slows down, the photon becomes shorter. It becomes shorter by the amount necessary to keep the time period a constant. It travels slower, but it's shorter. It still passes a given point in the universal constant period of time. Since the local observer cannot measure a change in the photon's length, this fundamental unit of length is interpreted as a constant. Therefore, the locally measured speed of light is not a function of distance from matter.

The laws of physics will also be shown to be locally invariant because our measuring apparatus can only be calibrated with respect to the local length and time properties of photons. However, if a remote observer located at one point in the gravitational field, having one speed of light, was able to use their own measuring rod to measure events occurring at another point, having a different speed of light, then there would be a difference in measurement.

While this is not possible it is useful to go through the exercise as if it were possible. I begin by discussing the situation of a stationary observer located at a given distance from the earth. The observer attempts to measure force. He applies a constant force and causes a particle to accelerate. He interprets what occurs by using Newton's force formula:

$$f = ma$$

It is empirically known that this formula is invariant. In other words, within every reference frame it will give the same results of measurement. This is the case because it uses local units of length in the measurement process.

If Newton's force formula is invariant, and if the local speed of light always measures the same, then, what is the evidence the speed of light varies with distance from the earth? One piece of evidence is that acceleration due to gravity does occur. The first step in proving this is to show why relativity type effects accompany the effect we call gravity.

The kinetic energy of a falling object equals the difference in potential energy at the point from which it started to fall and the point at which its speed is measured. The equation I have derived to express this is:

$$\frac{1}{2}mv_p^2 = \frac{1}{2}mv_{c1}^2 - \frac{1}{2}mv_{c2}^2$$

The left side is the kinetic energy of the falling object, and the right side is the difference between the two respective potential energies. If v_{c2} is allowed to go to zero, then:

$$\frac{1}{2}mv_p^2 = \frac{1}{2}mv_{c1}^2$$

This equation describes a specific physical event. To understand it, we need to assume that the mass of the earth exists at the point of the earth's center. This is the same assumption often used when calculating interplanetary motion.

The equation describes the maximum kinetic energy achievable by a falling object starting at any given point and falling to the center of the earth. The speed of light used in the equation is the value that exists at the starting point. There is a direct connection between this formula and Einstein's rest energy equation. To help make this point clear, I rewrite the above equation in the form:

$$E_K = \frac{1}{2}mv_{c1}^2$$

Even though the equation is intended to express kinetic energy, the right side is an expression of gravitational potential energy. I could also write it as:

$$E_{Gp} = \frac{1}{2}mv_{c1}^2$$

And since I have not yet used a variable or relativistic mass, I write:

$$E_{Gp} = \frac{1}{2}m_0v_{c1}^2$$

Einstein's rest energy equation is:

$$E = m_0C^2$$

Expressing it in terms of this new theory:

$$E = m_0v_c^2$$

What my equation expresses is that gravitational potential energy is equal to *1/2* Einstein's rest energy. The connection between the two would be even clearer if it was understood where the factor of *1/2* comes from. The reason for the *1/2* factor is my derivation was performed from the remote observer perspective.

For this example, I define a remote observer as one who is motionless with respect to the gravitational field. This remote observer is assumed to be located at the final position to which the raised object will reach. The remote observer, hypothetically, measures the increasing potential energy of the object as it appears from his perspective at the higher level. The remote observer's measuring rod is based upon the length the photon would have at the higher position.

Einstein's equation was gained from the perspective of the local observer. If I perform the calculation of potential gravitational energy from the perspective of the local observer, then I should achieve the same result as Einstein did for his energy equation.

Before making this calculation, I will explain the physical significance of each perspective. It would help to clarify the differences by first describing the local perspective in some detail. A local observer is one who would make his measurement of the object's potential energy while traveling with the object from the original point of zero potential energy to the location of maximum potential energy. The local observer is measuring the distance the object is raised by applying his local unit of measurement all along the way.

Even though, at any given point, the local observer measures the speed of light as a constant, he still also detects it as a variable. Even if he does not recognize it as so, it is detected as a variable at any given point by virtue of its instantaneous rate of change.

This instantaneous rate of change is measured at a point and is not masked by the changing length of photons. It is the cause of the effect that all observers measure as the acceleration due to gravity.

The local acceleration due to gravity is equal but opposite to the local acceleration of light. The simple expression for this connection is:

$$\frac{dv_p}{dt} = -\frac{dv_c}{dt}$$

This equation does not include any consideration of photon length. So, at a point in space, we can detect the acceleration of light but cannot measure the speed of light. The measurement of the speed of light is a different kind of observation. It must be made over a distance and from this perspective it becomes a function of photon length.

Such a measurement would yield the speed of light to be a constant value. Therefore, the local observer does detect the effect of the changing speed of light but cannot measure the change in the speed of light. In other words, for the local observer, the acceleration due to gravity exists while the speed of light is a constant. This is what he observes, and this is what he uses in his mathematical formulas.

This description is analogous to Einstein's definition of general relativity. He says space-time causes all the effects that would be expected if light actually accelerated due to gravity. However, he insists on having the measurement of the speed of light remain a constant. The interpretations of the theories are different, but we are describing the same event.

The heart of understanding relativity type effects is to understand the problem of measuring a physical event both through local means and through remote means. The local observer is located on the object as a constant force lifts it up, from very close to the theoretical point of origin of gravity, to its final remote position of potential energy. The observer measures the local force required to lift the object through the complete process. The observer calculates the increasing potential energy using:

$$E_{Gp} = \int_0^x f\,dx_L$$

The differential unit of distance used by this moving observer is his local dx_L. To him this appears to remain the same length. However, because he has only one unit of length to fall back upon, the length of a local photon; his unit of length is actually changing. The local observer traveling with the lifted object cannot measure a change in his dx_L, while the remote observer, hypothetically speaking, can measure the change of local photon length using his constant dx_R.

The remote observer, who is at rest at the highest point the object will finally reach, will judge the whole process by use of the maximum dx. He is located where dx is at its maximum value. The differential expression dx_R represents the photon's maximum incremental size. If he uses this remote, or rest, measurement of an increment of distance to gauge what is occurring during the complete lifting process, then he will calculate a different result than does the local observer.

As the remote observer watches the lifting process, he sees the local observer's unit of length changing. He also sees that a constant force is being applied over changing increments of distance. I will show this effect in mathematical detail when I discuss speed and special relativity type effects. These increments of distance are smaller nearer the point source of gravity, and approach zero when very close. Nearer the source the force is consumed in shorter and shorter distances. The force is less effective as the remote observer looks closer to the source of gravity.

As the remote observer watches the object being lifted up from very close to the point source of gravity, he observes, in the early stages, the force required to lift the object is immense but is decreasing. The force necessary to lift the object, using dx_R, becomes strictly normal only when the object has come very close to the observer. It is approximately normal long before this. The remote observer sees more force applied over the total distance than does the local observer.

The remote observer, therefore, also measures a larger amount of energy being invested in raising the object. In order to determine how much energy has been put into raising the object, the remote observer would integrate a formula analogous looking to the one used by the local observer. There are important differences in how dx_L and v_c are treated. For the local observer, dx_L and v_c are both constants. For the remote observer both dx_L and v_c are variables.

When I calculated gravitational potential energy using a variable speed of light, I was necessarily making the calculation from the perspective of a remote observer located at the position to which the object would finally be raised. If I want to calculate the increase in potential energy from the perspective of the local observer, then I must hold the speed of light constant.

The equation would still include the effect of the acceleration of light through the effect of the force of gravity. The force of gravity is determined by observing the local acceleration due to gravity. The local acceleration due to gravity is the local acceleration of light.

I now wish to compare the calculation of gravitational potential energy from the two perspectives. I use the general equation:

$$E_{Gp} = \int_0^x dE$$

I use the differential definition of energy:

$$dE = mvdv$$

Normally the velocity in this equation would be taken to be that of a particle or object of matter. However, for calculations of the effect of gravity between two fixed points I have shown:

$$v_p dv_p = v_c dv_c$$

Therefore, for the purpose of calculating the potential energy of gravity I can make the substitution and use the expression:

$$E_{Gp} = \int_0^x dE = \int_0^{v_c} mv_c dv_c$$

I will use this same formula to make the calculation from the two different perspectives. The perspective of the remote observer requires I treat the velocity of light as a variable. Therefore, the calculation of the integral yields:

$$E_{Gp} = \int_0^{v_c} mv_c dv_c = \frac{1}{2} mv_c^2$$

This is the identical result I have already reached for gravitational potential energy. The remote observer measures this energy to be equal to *1/2* of Einstein's value for rest energy.

The second calculation involves using the same formula, but it requires holding the magnitude of v_c constant. This appears to be a strange thing to do mathematically speaking. The logical problem is dv_c remains as a variable. It looks strange because I am saying the speed of light is always a constant at the same time that I am calculating the effect of the change in the speed of light.

From the point of view of the local observer, these two values are not linked. For the second calculation, then, I will hold the measured speed of light constant while allowing for the physical effect of its acceleration. The calculation is:

$$E_{Gp} = \int_0^{v_{c\,max}} mv_{c\,max}\, dv_c = mv_{c\,max}^2 = mC^2$$

This result shows Einstein's rest energy is the gravitational potential energy of the object from the perspective of the local observer. The local observer is one who travels with the object to its final location. He measures the effect of gravity while measuring the speed of light as a constant.

The connection between rest energy and gravitational energy is not made fully clear at this point. The complete comparison will involve analyzing the kinetic energy of an object in motion. A general understanding of the nature of energy in this new theory requires more analysis of the energy of both particles and photons.

It should be apparent at this point that Einstein's requirement to hold the speed of light constant would necessarily result in his rest energy expression being from the perspective of the local observer. Interestingly, this is not true for the rest of his kinetic energy equation or for his special relativity equations. All of these are derived from the perspective of the remote observer. Even though he believed he was holding the speed of light constant, he did not truly accomplish this.

Einstein did, superficially, hold the speed of light constant in his equations. If Einstein had achieved the effect he was trying for then his equations would have made predictions from the perspective of the local observer. However, he inherited a problem introduced by Lorentz. Lorentz assumed the speed of light was a constant in the free space absolute reference frame. Einstein assumed every free space reference frame is analogous to an absolute reference frame. The result was that he achieved equations from the perspective of the remote observer.

Lorentz used mathematical transforms to bring two dissimilar physical concepts into relation to one another. Normally transforms are an accurate translation of two real systems. However, if one system is unreal it is still possible to derive transforms between the unreal system and a real one. Lorentz took his theory as the first system and empirical evidence as the second system. When he derived transforms to relate the two systems, it did not prove his theory was correct.

Similarly for Einstein, when he made the speed of light a universal constant he took something which is a dependent variable and declared it to be absolute. Just like for Lorentz, in order for the transform equations to help him arrive at the correct empirical answers, something that was absolute had to become a dependent variable. For both of them the absolute something, which became a dependent variable, was the dimension of time. The newly created dependent variable of time negated the effect of holding the speed of light constant.

In Einstein's rest energy equation time does not play a decisive role. Holding the speed of light constant does achieve the effect of defining rest energy from the perspective of the local observer. In his other equations, time is critical to making the equations produce the correct results. In these equations, the warping of time makes them work from the perspective of the remote observer. However, they are still fundamentally wrong in their description of the physical world. So, they have to show themselves to be wrong at some point in their predictions.

The next step toward resolving this matter is to connect my introduction of general relativity type effects, as explained by this new theory, to special relativity type effects. The variable speed of light will be shown to produce all of these effects.

Origin of Special Relativity Type Effects

I define a unique cause for the speed of light and interpret it in a mechanical manner. It will be called the *light-field*. The connection between general relativity type effects and special relativity type effects is made through further consideration of the meaning of the equation:

$$v_p^2 = v_{c1}^2 - v_{c2}^2$$

Since a change in v_c can cause the existence of v_p, then can the reverse also be true? In other words, can the motion of matter through a background light-field cause a decrease in the local speed of light? The above equation can be solved to express the reversed effect:

$$v_{c2} = \left(v_{c1}^2 - v_p^2\right)^{\frac{1}{2}}$$

The Pythagorean form of the equation suggests that the math to follow will develop in a form analogous to that of special relativity.

I earlier showed that the length of a photon varies due to changes in the speed of light. The formula was:

$$\Delta x_{c2} = \Delta x_{c1} \frac{v_{c2}}{v_{c1}}$$

If I substitute for v_{c2}, then:

$$\Delta x_{c2} = \Delta x_{c1} \frac{\left(v_{c1}^2 - v_p^2\right)^{\frac{1}{2}}}{v_{c1}}$$

Factoring out v_{c1} from the numerator:

$$\Delta x_{c2} = \Delta x_{c1} \frac{v_{c1}\left(1 - \frac{v_p^2}{v_{c1}^2}\right)^{\frac{1}{2}}}{v_{c1}}$$

Canceling v_{c1}:

$$\Delta x_{c2} = \Delta x_{c1}\left(1 - \frac{v_p^2}{v_{c1}^2}\right)^{\frac{1}{2}}$$

This formula expresses a physical effect in an analogous mathematical form, as does the equation for length dilation in Einstein's theory of relativity. The two descriptions have some analogy, but are not the same. His formula says that the whole of space changes its size as a function of relative speed for every moving object. Mine says that the length of a photon will change if it is in proximity to a body of matter that has a velocity relative to the background light-field. Its length becomes a function of the object's relative speed.

A photon approaching an object in motion relative to the background light-field will become smaller in length for two reasons. The first is: It will decrease in size because of the expected decrease in the speed of light due to the light-field of the object. The second is: It will decrease amount in size due to the object's relative speed with respect to the background light-field. The object's relative speed slows the local speed of light more than otherwise expected.

In the above equation, the value of v_{c1} is an initial condition, and is treated as a constant. Also, the initial photon length is a constant. The independent variable is v_p. The resulting change in length of photons is a real physical change. The interaction of photons and matter is fundamental. A change in photon properties will result in a corresponding effect upon matter.

Particle to Photon Transfer of Energy

The transition from general relativity type effects to special relativity type effects can be made using the equations and concepts already derived. It will also introduce a new perspective on the nature of force. Force can be expressed as the measure of change in energy with respect to distance. It is known that photons carry energy. This energy is given to the photon by an accelerating charged particle.

It is an incremental change in the kinetic energy of the particle that is given to the photon. The particle's kinetic energy is given by:

$$E_K = \frac{1}{2} m v_p^2$$

The particle’s kinetic energy changes as the particle accelerates. The differential expression of this change is:

$$dE_K = m v_p dv_p$$

This value of change in kinetic energy is emitted away in photons. For reasons to be made clear later, I assume photon length is very small and on the order of subatomic dimension.

I have not yet defined a new theory of electromagnetic effects at this point of the analysis. So, I will analyze photon energy in a more general manner. The analysis will include two components for the acceleration of the particle. For the first part of the analysis, the acceleration of the emitting particle is parallel to the direction in which the photon is being emitted. The counterpart situation, the acceleration of the particle being perpendicular to the direction of emission, will follow separately. Both components are necessary to speak about force in a general sense.

The incremental change in kinetic energy is stored onto a photon that is being emitted. This increment of kinetic energy is stored in the photon's very short length. Because of the very small values of length and time involved in photon calculations, I will often represent these increments, as well as the energy increment, in differential form. I will make it clear when I am doing this by using identifying subscripts on the appropriate variables.

The theoretical representation is that an incremental change in the particle's kinetic energy is communicated to a photon of incremental length. I will follow the process of emission of the photon, its travel through a changing environment and its reception by a second charged particle. I will derive the mathematics to describe this transfer of kinetic energy.

The increment of energy is transferred during an increment of time. This increment of time has a physical origin. It is the time dt_c required for the photon to be fully released. This is, of course, the fundamental constant increment of time of a photon passing a given point. During this increment of time, the emitting particle is accelerating. Therefore, I expect the leading end of the photon to be released at a different speed than is the trailing end.

The increment of particle acceleration is assumed to be much less in magnitude than the local speed of light. Therefore, the incremental distance dx_p moved by the particle during the release of the photon is much less than the length of the photon. The increment of kinetic energy given up over the distance dx_p is stored in a photon of length dx_c. The distances are not the same, but the time period for either to occur is the same. For this reason I use formulas which include acceleration as opposed to exceleration.

In the introduction of the acceleration due to gravity, I treated the accelerations of matter and of light as being equal with opposite signs. I will not do that in the analysis for this problem, the reason being that the physical circumstances are not identical. A negative sign would represent undue speculation about the nature of what are new and different physical circumstances.

The physical circumstances here do not make clear that there is a specific direction attached to the change in the speed of light. The empirical evidence of the aberration of light supports the approach that there is no favored direction. The relationship between the relative speed of matter and a change in the local speed of light is appearing here in a more general form than it did for gravity. In order to begin the analysis in this general manner, I use:

$$\frac{dv_p}{dt} = \frac{dv_c}{dt}$$

When this formula was first introduced in connection with an analysis of the acceleration due to gravity, it was interpreted to mean: It is the change in the speed of light that causes an equal change in the speed of a falling object. I move beyond the scope of this interpretation with:

$$v_{c2} = \left(v_{c1}^2 - v_p^2\right)^{\frac{1}{2}}$$

I used this equation to suggest the possibility of the local speed of light being a function of the speed of an object with respect to the background light-field. I now assume this effect to be real. I am assuming the equation can be read in either direction and retain valid physical meaning. In other words, the equation is being read to say the change of magnitude of velocity of an object of matter will cause a change of the local speed of light.

This assumption will be kept as consistent as physical circumstances will permit with what has already been given concerning the potential energy of gravity. For example, a freely falling object approaching the earth gains kinetic energy. This kinetic energy is defined as having been potential energy stored in the force of gravity. The decrease in potential energy of the object is converted into an increase in kinetic energy.

The kinetic energy was defined by the use of v_p. An increment of kinetic energy involves the use of dv_p. The potential energy was defined with the use of v_c. An increment of potential energy involves the use of dv_c. In the example problem that follows, I remain consistent with this concept. The differential variables used in this problem will retain the same subscripts as used in the gravity example.

I wish to manipulate the acceleration equation into the form I need for the purpose of defining an increment of kinetic energy carried by a single photon. I begin with:

$$dt = \frac{dx_p}{v_p} = \frac{dx_c}{v_c} = dt_c$$

This increment of time is not an arbitrary value. It is the time period required for a photon to pass a given point so I identify it as dt_c.

When I use the equation showing the equivalence of accelerations, I am interested in tracking the incremental changes occurring to both the particle speed and to the local speed of light during the time increment dt_c. I am also interested in comparing the incremental distances the particle and the photon travel during this time increment.

I use descriptive subscripts to depict each of these increments of change that occur during the event of a photon being released. The constant time increment fixes the distance increments:

$$dt_c = \frac{dx_p}{v_p} = \frac{dx_c}{v_c}$$

I will substitute these two expressions, equaling the same increment of time, into the acceleration equation:

$$\frac{dv_p}{dt_c} = \frac{dv_c}{dt_c}$$

Performing the substitutions:

$$\frac{dv_p}{dx_p/v_p} = \frac{dv_c}{dx_c/v_c}$$

Rearranging terms:

$$v_p \frac{dv_p}{dx_p} = v_c \frac{dv_c}{dx_c}$$

I want to arrive at expressions of increments of energy per increments of length, so I multiply both sides by the mass of the emitting particle:

$$mv_p \frac{dv_p}{dx_p} = mv_c \frac{dv_c}{dx_c}$$

Rearranging the terms so as to have just numerator and denominator on both sides:

$$\frac{mv_p dv_p}{dx_p} = \frac{mv_c dv_c}{dx_c}$$

The numerator on the left is the incremental change of kinetic energy of the charged particle during the time dt_c. This increment of energy is divided by the distance the particle traveled during the time dt_c. The complete term on the left side is the mathematical expression defining the increment of force applied to the particle in order to cause the particle to accelerate during the time dt_c.

Since the left side of the equation represents an increment of force then the right side must do the same. In other words, not only acceleration is conserved but force is also conserved. The known relativity type effect of relative speed on force has not yet become apparent.

Although the right side must be an equivalent expression of force, it is not given in the familiar form of the normal definition of force. That is, the increment of energy is divided by an increment of distance different from the increment of distance the particle moved. For that matter, the right side numerator, which is an expression of an increment of energy, is not the same magnitude as the numerator on the left side.

The left side of the equation is the definition of force from the perspective of the particle. The right side is a different kind of definition of force. It is from the perspective of a photon. The right side is not less correct than the left side. The increment of force that accelerated the particle has been transferred to the photon and is stored on it.

When it reaches another particle, it communicates or delivers the increment of force to that particle. This increment of force is transported over any distance at the speed of light until it interacts with the new particle. The photon is the known carrier of information and the delivery system for force throughout the universe. It has its own mathematical expression for showing this.

The acceleration equation shows force is conserved. However, because of the different way in which this is expressed from the photon point of view, it is helpful to refer to the photon as carrying potential force. In principle, a photon has no original energy of its own. In practice, every photon must have at least some very small amount of energy due to there always being some relative motion even in the background light-field.

What needs to be shown next is what happens to the increment of force carried by the photon as the photon moves from an area of one speed of light to an area with a different speed of light. I will develop a model to represent this phenomenon. The potential force stored in the photon is:

$$f_c = \frac{dE_c}{dx_{c1}} = \frac{mv_{c1}dv_c}{dx_{c1}}$$

The m represents the mass of the emitting particle. The value of mass of the emitting particle is stored in the photon. We know from the conditions of origin of the stored increment of energy that all this information must be there even if it is combined into a single magnitude. I do know how this storage of the value of mass is accomplished; however, the explanation needs to be given later when the nature of mass is defined in this new theory.

The speed of light v_{c1} is the speed of light within the area in which the photon is first located and from which it is moving. The speed of light is a variable. The incremental change of light speed dv_c caused by the acceleration of the particle is stored in the photon. The stored values of mass and an incremental change of light speed are treated as constants. The reasons for this will become apparent when I introduce electromagnetism and later the nature of mass.

The value of the speed of light will change as a function of the changing environment encountered by the photon traveling on its way. For this example, the photon moves out of its original light speed environment into a new environment with a different local speed of light. This change is represented by:

$$mv_{c1}\frac{dv_c}{dx_{c1}} \to mv_{c2}\frac{dv_c}{dx_{c2}}$$

The subscript $_2$ used on the right side depicts the changed values of the two variables. These changes in magnitude are caused by the variation of the speed of light.

Photon length changes along with the change in light speed just as in the analogous example of gravity. The relationship between the two lengths is also the same:

$$dx_{c2} = dx_{c1}\frac{v_{c2}}{v_{c1}}$$

Substituting this relationship into the transfer expression above:

$$mv_{c1}\frac{dv_c}{dx_{c1}} \to mv_{c2}\frac{dv_c}{dx_{c1}\frac{v_{c2}}{v_{c1}}}$$

Simplifying:

$$mv_{c1}\frac{dv_c}{dx_{c1}} \to mv_{c1}\frac{dv_c}{dx_{c1}}$$

This result makes obvious that:

$$mv_{c1}\frac{dv_c}{dx_{c1}} = mv_{c1}\frac{dv_c}{dx_{c1}}$$

I can then write:

$$mv_{c1}\frac{dv_c}{dx_{c1}} = mv_{c2}\frac{dv_c}{dx_{c2}}$$

The transfer expression has revealed itself to be equality. This means that force, active or stored, is conserved as the photon moves through a changing speed of light. The conservation of force, as depicted by the transfer of energy from a particle to a photon, applies not only at the point of the transfer but also applies as the photon travels through space.

Speed and Special Relativity Type Effects

I will now analyze the complete transfer process of a single photon between two particles of matter. Each particle has its own independent speed with respect to the background light-field. Each particle is accelerating at different values. They are sufficiently separated to allow for the region between them to be considered as unaffected by their motion.

Particle one's motion decreases its local value for light speed. This value is identified as v_{c3}. The middle region has the light speed of the background light-field v_{c1}. The motion of the second particle causes its own decrease in its local light speed v_{c2}.

The work above shows the entire transfer process can be set up as a series of equalities of force. The physical circumstances in order of occurrence are these:

a. There is an infinite, homogeneous background light-field with the speed v_{c1}.

b. A charged particle of mass m has an initial velocity relative to the background light-field. The particle's relative speed lowers the local speed of light to v_{c3}.

c. This same charged particle is accelerated to a higher relative speed by an incremental amount during the time dt_c. This positive acceleration drops the local speed of light by the incremental amount represented by dv_c.

d. A photon is released during dt_c, the time unit of incremental acceleration. The photon begins to be released at the light speed v_{c3}. At the time that the end of the photon is released the local light speed has decreased by the incremental amount dv_c. The local light speed is assumed to be much larger than this incremental decrease in light speed. Therefore, the new speed of light can be approximated as equaling the initial local light speed v_{c3}.

e. The photon moves away from the particle entering an unaffected region having the background light speed v_{c1}.

f. At some further distance away there is a second charged particle also of mass m. This particle has an initial relative velocity v_p with respect to the background light-field. The particle's relative motion lowers the local speed of light to v_{c2}.

g. The photon approaches very close to the second particle, and is now moving at very close to the speed v_{c2}.

h. The photon then interacts with the second particle. The particle receives an increment of positive acceleration from the increment of force that was stored in the photon. In other words, the potential for force is converted into the act of applying force to the particle.

I observe that throughout this exchange both acceleration and force are conserved. I will next work through the full exchange using the individual expressions of the increment of force for each step. This complete transfer process can be represented in a simplified way by a series of equalities describing either active force or stored force.

The expressions representing what is occurring to the particles are expressions of applied force. The expressions representing the photon are expressions of stored force. These expressions of force form a series of equalities written as the products of mass times acceleration:

$$m\frac{dv_p}{dt} = m\frac{dv_c}{dt} = m\frac{dv_c}{dt} = m\frac{dv_c}{dt} = m\frac{dv_p}{dt}$$

This redundant looking formula does say something important. It says Newton's force equation is valid on a local basis. However, it doesn't show the details of what changes are occurring all along the process. By converting from expressions using an increment of time to expressions using increments of length, I can rewrite the series. It will say the very same thing; however, it gives the details of the events involved. This converted equivalent expression is:

$$mv_{p1}\frac{dv_p}{dx_{p1}} = mv_{c3}\frac{dv_c}{dx_{c3}} = mv_{c1}\frac{dv_c}{dx_{c1}} = mv_{c2}\frac{dv_c}{dx_{c2}} = mv_{p2}\frac{dv_p}{dx_{p2}}$$

It is instructive to slightly modify the positions of some quantities in order to show each equation in the form of increments of energy per distance traveled. I do not say per unit of distance because the incremental measures of distances traveled are different for each expression. The modified series of equalities is:

$$\frac{mv_{p1}dv_p}{dx_{p1}} = \frac{mv_{c3}dv_c}{dx_{c3}} = \frac{mv_{c1}dv_c}{dx_{c1}} = \frac{mv_{c2}dv_c}{dx_{c2}} = \frac{mv_{p2}dv_p}{dx_{p2}}$$

a. The first term represents the incremental change in kinetic energy of the first charged particle divided by the incremental distance it moved while acquiring the increment of increase of speed.

b. The second term has an expression in the numerator for an increment of stored energy in the photon. The denominator is the photon length. The numerator and denominator are different from those contained in the particle's expression. However, they give the same measure of force.

c. The third term represents the changes the photon has undergone as a result of moving a sufficient distance into the unaffected background light-field. The photon's length has increased to dx_{c1} consistent with the speed of light increasing to v_{c1}.

d. The fourth term represents the changes the photon has undergone as it approaches very close to the second charged particle. Its length has decreased to the value dx_{c2}.

e. The fifth term shows the second particle has been acted upon by the photon. The transfer of stored force has been completed, and the particle has changed its speed by an incremental amount.

It can be seen in this series that there are three attributes belonging to the first particle that are conserved all through the process. These attributes are the value of its mass, the increment of its acceleration and, these two things together making up the third, the force exerted upon the particle that caused its acceleration.

Three attributes of the photon are not conserved. The first is the speed of light that varies according to particle velocities and the dictates of the background light-field. The other two are respectively the energy type expression in the numerator and the length of the photon in the denominator.

The conservation of force means Newton's law of force is invariant at every point. Even though this is true for a local observer, it is not true for the remote observer. It is this difference between local measurement and remote measurement that introduces relativity effects into the example problem.

For example, a remote observer standing stationary on the surface of the earth applies a constant force to a particle causing it to accelerate along a path in line with a stationary measuring rod. As the particle's speed increases the stationary observer will notice the applied force will result in less and less acceleration.

Even though the stationary observer sees a diminishing of the effect of force, this is not the case for an observer traveling with the particle. A local observer moving with the particle as it travels along the length of the stationary measuring rod sees the rod grow longer. His fundamental unit of measurement, the photon, is becoming smaller. The local observer is using dx_{c2}, and the stationary observer is using dx_{c1} as their fundamental units of measurement. Locally all seems to be remaining normal, but the remote world appears to be expanding.

This causes the local observer to measure his distance traveled per increment of time at a greater value than does the stationary observer. Both observers are making their measurements between the same two points. The distance x_d between these two points does not change. Only the local measurement is varying. The local measurement of distance between the two points is larger than the remote measurement.

For the remote observer the measurement of the particle's velocity is:

$$v_{pR} = \frac{dx_d}{dt}$$

The local observer measures the particle's velocity and finds:

$$v_{pL} > \frac{dx_d}{dt}$$

In order to measure the velocity or change of velocity of the particle from the perspective of the local observer, it is necessary to use the ratio of the constant remote unit of measurement to the changing local unit of measurement. This ratio has been derived as:

$$\frac{dx_R}{dx_L} = \frac{dx_{c1}}{dx_{c2}} = \frac{v_{c1}}{v_{c2}}$$

The remote observer measures an increment of the distance x_d as dx_{dR}. The local observer measures this same increment of distance as dx_{dL}:

$$dx_{dL} = dx_{dR}\frac{dx_R}{dx_L} = dx_R\frac{dx_{c1}}{dx_{c2}} = dx_{dR}\frac{v_{c1}}{v_{c2}}$$

Therefore:

$$v_{pL} = \frac{dx_{dL}}{dt} = \left(\frac{dx_{dR}}{dx_L}\right)\left(\frac{dx_R}{dt}\right) = \left(\frac{dx_R}{dx_L}\right)\left(\frac{dx_{dR}}{dt}\right) = \frac{v_{c1}}{v_{c2}}v_{pR}$$

Substituting for v_{c2} and simplifying:

$$v_{pL} = \frac{v_{c1}}{\left(v_{c1}^2 - v_{pR}^2\right)^{\frac{1}{2}}}\, v_{pR} = \frac{v_{pR}}{\left(1 - \frac{v_{pR}^2}{v_{c1}^2}\right)^{\frac{1}{2}}}$$

The local observer can use his measurement of speed to calculate the force applied to his particle. Force is conserved locally, so he should calculate the true applied force:

$$f = \frac{d}{dt} m v_{pL} = \frac{d}{dt} \frac{m v_{pR}}{\left(1 - \frac{v_{pR}^2}{v_{c1}^2}\right)^{\frac{1}{2}}}$$

If the source of force at the remote location is increased in a manner that causes the particle to maintain a constant acceleration as measured by the remote observer, then from a local perspective the acceleration increases in accordance with the change in the applied remote force. As the remote force is increasing the acceleration measured locally is correspondingly increasing.

The local observer does not measure a diminishing of the effectiveness of force with increasing speed. The arrival of force on the local level will produce the same measure of acceleration on the local level as would be expected from the perspective of the remote level if there were no relativity type effects. What the remote observer would predict as a result of non-relativistic calculations is what the local observer measures.

This formula for force can be used to calculate the expression for particle kinetic energy:

$$E_K = \int_0^x f dx$$

The solution of the kinetic energy equation, it will shortly be discussed further, is:

$$E_K = \frac{m v_{c1}^2}{\left(1 - \frac{v_{pR}^2}{v_{c1}^2}\right)^{\frac{1}{2}}} - m v_{c1}^2$$

Electromagnetism and Relativity Type Effects

The example problem used here is a single charged particle accelerated in a straight line by a force. As the particle is accelerated it releases a photon in a perpendicular direction. This event is the fundamental starting point for the theory of electromagnetic radiation.

Before beginning to describe the transfer of energy to the emitted photon, it needs to be established that the acceleration of the particle will change the orientation of the released photon. In other words, the changing velocity of the particle will impart a tilt to the released photon. Before doing this I will first demonstrate when tilt does not occur. In the absence of a secondary or background light-field, there can be no tilt.

The simplest example is to consider the event to occur in the absence of a background light-field. If there is no background light-field, then there is no way to define a change in speed. A change in speed has to be movement with respect to something. We cannot define motion of any kind with respect to space alone, because this implies detectable physical properties of space. The only thing established empirically about space is that it exists.

We know space is there because we measure distances in it. We cannot define a measurement of distance as occurring across nothing, so there must be something. This new theory makes no claim to predict physical properties for space other than to say it exists and gives us room to move about. In the absence of using space to serve as a source of control over either photons or matter, there is no basis upon which to determine any movement at all of an isolated particle.

Fortunately, this situation does not represent the conditions of the universe. The introduction of a background light-field approximates the real condition of the universe. So, I introduce into the example the existence of a background light-field. The change in speed of the particle can now be measured against the reference frame of the background light-field which, for this example, is considered to be stationary.

The problem is to analyze the emission process of the photon. The photon begins to leave the particle when the particle's velocity is at the initial value. However, all through the very quick emission process the particle accelerates in a perpendicular direction. During this process the remaining part of the photon is not yet emitted and is dragged along with the particle as the particle's velocity increases.

This is the case because of the relative strengths of the two light-fields. This conclusion results from the recognition there are two light-fields at work here. There are both the background light-field and the particle's light-field. Each exercises the same fundamental method of control over photons. The background light-field is composed of the combined effects of many light-fields belonging to distant particles.

When the photon is very close to the particle, the particle's light-field strength is high compared to the background light-field. Therefore, it is the particle's light-field that is the main reference of control for the photon. The propagation speed of the particle's light-field is treated as being much larger than C and possibly infinite. As the photon moves away from the particle the particle's light-field decreases rapidly in strength, and the photon becomes under the control of the background light-field.

The speed of the photon is controlled by the combined effects of both light-fields. At a point very close to the center of the emitting particle, the effect of the background light-field can be approximated as not even existing. Therefore, at that point there is virtually no effect of relative speed. As the photon moves away, the effect of the background light-field quickly becomes very significant. Under these conditions there is a very significant relative speed.

The result of this effect upon the photon, as it is released, is to cause the trailing end to be dragged along by the accelerating particle. As the photon is leaving the particle this dragging effect quickly diminishes and the leading end has a speed that is no longer referenced primarily to the particle. The leading end now has a speed strongly referenced to the background light-field that is not moving. The resulting effect upon the photon is to be left with a constant tilt relative to the direction it is moving.

While I am offering this physical example as an aid to visualize what is occurring, I am not insisting this is the precise physical event that occurs. It is intended as an aid to show how I bring together what we have learned from empirical evidence and the mathematics of this new theory. The purpose of this visual description is to make it clear why I solve the problem by working with a common increment of distance. This method is different from the one used in the preceding analysis of the horizontal component of acceleration.

The analysis of the horizontal component used a common increment of time for the measurement process. In that case the distance traveled by the particle was not equal to the distance the photon traveled during the time of emission. In this new example, concerning a perpendicular component of motion for the photon, the two distances are the same. In other words, the increment of distance across which the particle accelerates during the time of emission can be approximated as being the same as the offset distance for the trailing end of the photon. Therefore, I must define a different cause for relativity type effects for this case.

Since the distances traveled are the same, the change of velocities for both the particle and the speed of light can be treated in a manner analogous to an object falling freely between two points due to gravity. The previously derived equation using exceleration, which I can use here, is:

$$v_p dv_p = -v_{c1} dv_c$$

When I derived this equation, it described the effect of gravity. There was a clear singular direction for the gradient of the velocity of light. The direction of this gradient of v_c was unique so I included the appropriate sign.

In the example problem at hand, of a photon moving between two particles, the induced gradient of v_c may not have a singular direction. It may be the case that general relativity type effects are a special case of special relativity type effects. What I will try first is to apply opposite signs to the change in light speed and the change in particle speed. I also know that the change in kinetic energy of the particle has been of the opposite sign as that of the change in the energy of the light-field.

Until the implications of this new approach are made clear, I will continue to use:

$$v_p dv_p = -v_{c1} dv_c$$

Next I wish to solve for momentum and, it can be calculated from:

$$P = \frac{dE}{dv_p}$$

So, I set up the increment of energy:

$$dE = mv_p dv_p$$

Substituting from three steps above:

$$dE = m(-v_{c1} dv_c)$$

The variable speed of light is given by

$$v_c = \left(v_{c1}^2 - v_p^2\right)^{\frac{1}{2}}$$

Taking the differential:

$$dv_c = \frac{-v_p dv_p}{\left(v_{c1}^2 - v_p^2\right)^{\frac{1}{2}}}$$

I substitute this expression into the second increment of energy equation given above:

$$dE = \frac{mv_{c1} v_p dv_p}{\left(v_{c1}^2 - v_p^2\right)^{\frac{1}{2}}}$$

Simplifying:

$$dE = \frac{mv_p dv_p}{\left(1 - \frac{v_p^2}{v_{c1}^2}\right)^{\frac{1}{2}}}$$

Finally, dividing by the differential of particle velocity gives the momentum:

$$\frac{dE}{dv_p} = \frac{mv_p}{\left(1 - \frac{v_p^2}{v_{c1}^2}\right)^{\frac{1}{2}}} = P$$

Newton's original formula for force is the derivative of momentum with respect to time:

$$f = \frac{dP}{dt}$$

Then for this example:

$$f = \frac{d}{dt} \frac{mv_p}{\left(1 - \frac{v_p^2}{v_{c1}^2}\right)^{\frac{1}{2}}}$$

At this point of this theory, the value of mass is treated as the constant rest mass, therefore the m can be moved out of the differential expression:

$$f = m \frac{d}{dt} \frac{v_p}{\left(1 - \frac{v_p^2}{v_{c1}^2}\right)^{\frac{1}{2}}}$$

The normal use of this formula in a standard derivation of energy will give the equation for particle kinetic energy previously derived in this new theory. That equation is:

$$E_K = \frac{mv_{c1}^2}{\left(1 - \frac{v_p^2}{v_{c1}^2}\right)^{\frac{1}{2}}} - mv_{c1}^2$$

This result is analogous to Einstein's energy equation. However, it will predict more. For example, there is a connection between this energy equation and our concepts of frequency and wavelength.

There is also an observation that can be made with respect to how a photon's energy will change as it descends through the earth's light-field. The velocity of light is decreasing therefore; the length of the photon is becoming shorter. However, the perpendicular component of photon tilt, which is the origin of electromagnetism, has not been shown to also shrink.

This is a situation analogous to increasing the tilt of the photon. An increased tilt is representative of an increase in electromagnetic energy. This is a reason why a photon, which is slowing down as it approaches the earth, would actually increase its electromagnetic energy. I will more fully develop this new electromagnetic theory in later sections.

Particle Energy and Frequency

The concept of wavelength is accepted by quantum physics as a fundamental property of photons and matter. This new theory will present a different perspective on this concept. However, I will begin with the normal concept of wavelength for the purpose of using familiar theory to help introduce this analysis.

I earlier derived an equation defining the energy of a particle. I did not take the concepts of frequency or wavelength into consideration during its derivation, and yet it will inherently suggest a physical origin from which these proposed properties could be derived. In order to be able to conveniently relate this analysis to later work, I will not work directly with wavelength, but, instead, will first derive an interpretation of its counterpart, frequency.

The form of my energy equation is chosen to show its analogy to Einstein's energy equation; however, it has another useful form. I proceed through the following mathematical manipulative steps for the purpose of presenting my energy equation in a form where the origin of our concept of frequency can be seen.

I multiply the first term on the right side by an expression equaling unity:

$$E_K = \frac{v_{c1}}{v_{c1}} \frac{mv_{c1}^2}{\left(1 - \frac{v_p^2}{v_{c1}^2}\right)^{\frac{1}{2}}} - mv_{c1}^2$$

Performing the multiplication:

$$E_K = \frac{mv_{c1}^3}{\left(v_{c1}^2 - v_p^2\right)^{\frac{1}{2}}} - mv_{c1}^2$$

Since:

$$v_{c2} = \left(v_{c1}^2 - v_p^2\right)^{\frac{1}{2}}$$

I substitute this expression and have:

$$E_K = m\frac{v_{c1}^3}{v_{c2}} - mv_{c1}^2$$

Now rearranging terms:

$$E_K = mv_{c1}^2 \left(\frac{v_{c1} - v_{c2}}{v_{c2}}\right)$$

The form of the energy equation given above contains an expression within the parenthesis representing the physical origin of our concept of frequency. It says: Kinetic energy is equal to rest energy multiplied by this expression that I suggest is directly related to frequency. I will develop this relationship more fully.

The known empirical relationship between kinetic energy and frequency is given by:

$$E_K = h\omega$$

Where ω represents frequency, and h is Planck's constant. Setting the right sides of these two kinetic energy equations equal to each other produces:

$$h\omega = mv_{c1}^2 \left(\frac{v_{c1} - v_{c2}}{v_{c2}}\right)$$

Then, solving for a value I call kinetic energy frequency:

$$\omega_K = \frac{mv_{c1}^2}{h} \left(\frac{v_{c1} - v_{c2}}{v_{c2}}\right)$$

The term inside the parenthesis is without units. The terms outside the parenthesis are all constants, and their combined units are inverse seconds; therefore, I will represent them by:

$$\omega_0 = \frac{mv_{c1}^2}{h}$$

I will refer to this as the rest frequency of a particle. Substituting this into the kinetic frequency equation:

$$\omega_K = \omega_0 \left(\frac{v_{c1} - v_{c2}}{v_{c2}}\right)$$

Now for kinetic energy I can write either:

$$E_K = h\omega_0 \left(\frac{v_{c1} - v_{c2}}{v_{c2}}\right)$$

Or:

$$E_K = h\omega_K$$

It follows that I can write for total energy:

$$E_T = h\omega_0 \frac{v_{c1}}{v_{c2}}$$

And for rest energy:

$$E_R = h\omega_0$$

When I introduce quantum effects, I will present a new perspective on the quantum wave-particle duality of matter. New concepts will be developed in this theory for frequency and wavelength, but their introduction is more easily accomplished when speaking of photons. This introduction will require the use of a physical model of a photon to be used as a guide.

I will next develop a theoretical model to represent photons. The photon model must be able to account for wave and particle aspects of photons. In order to develop this model I will first introduce mathematical expressions for the energy and momentum of photons.

Photon Energy

The evidence shows that when a photon leaves a particle undergoing a change of velocity, the photon carries away an increment of energy. The increment of energy originates from the particle. The characteristics of this increment of energy, all other things being constant, must have been brought into existence from the properties of the emitting particle. The properties of the photon only fix its time of duration and cause after-effects on its magnitude.

During the first stages of this derivation, I will use the term mass in connection with photons. I expect most people who trust in current theoretical physics will frown upon this practice. However, it is current theoretical physics that is challenged as being wrong. The reason I speak of mass in connection with photons is because I am trying to develop new theory that maintains a direct line with the fundamentals. The equations of relativity theory were derived from a base which is heavily dependent upon $f = ma$.

The mass term must be properly interpreted every step along the way in order to properly move forward. It cannot be arbitrarily dismissed at a certain level simply because we cannot see how it may fit with photon theory. If it is to be discarded then the reason for that action must come from the bottom up and not the top down.

In other words, the fundamentals should lead naturally to the disappearance of the mass term for photons. If this does not occur naturally in the derivation of the theory of photons then it demonstrates a reason for re-evaluating our current understanding of mass. This kind of fundamental re-evaluation does occur in this new theory.

Einstein's work in analyzing photon energy and deriving a photon interpretation of momentum does not embrace this position. I will proceed to show why this is the case. The formula derived by Einstein to describe the kinetic energy of matter is:

$$E_K = \frac{m_0 C^2}{\left(1 - \frac{v^2}{C^2}\right)^{\frac{1}{2}}} - m_0 C^2$$

Even though the formula was derived as an expression of kinetic energy, it revealed a new term describing the total energy of the particle.

The kinetic energy is expressed as the difference between the first expression representing the total energy and a second expression representing the particle's rest energy. It is the concept of total energy which leads to the idea that this equation could be used to apply to everything which has energy. Einstein then applied it to photons.

However, the energy formula given above was derived specifically to define the kinetic energy of a particle in motion. A photon carries away only an increment of this energy. This suggests that the energy of a photon should be defined using the incremental form of the kinetic energy equation of the particle. It is convenient here to use the differential form to represent the incremental.

Einstein erroneously used the particle kinetic energy equation directly to describe the energy of a photon. In spite of this he achieved useful results. I will demonstrate why this is so. I first offer a line of reasoning useful for presenting Einstein's conclusions regarding photon energy and momentum. Then I will offer an alternate approach. I will conclude with results from this new theory that give a new mathematical description of photon energy and momentum.

In analyzing the possibility of applying Einstein's energy equation directly to photon energy, a problem immediately arises. It is easily reasoned: Since photons travel at the speed of light, then his energy equation, shown above, cannot directly give a useful answer. For example, if v is set equal to C then the denominator of the first term becomes zero and the kinetic energy becomes infinite. This answer is known to be incorrect. Empirical evidence shows photons to have well defined kinetic energy of varying amounts.

A possible way out of this dilemma is to reason: Since photons are never at rest, then they have no rest mass. If this is accepted then the equation reduces to:

$$E_{Kc} = \frac{(0)C^2}{\left(1 - \frac{C^2}{C^2}\right)^{\frac{1}{2}}} - (0)C^2 = \frac{0}{0}$$

The energy equation becomes indeterminate. Mathematically there is no way to say a solution does or does not exist.

It is known empirically that each photon does have a specific kinetic energy. Einstein chose to solve this problem by defining the mass term for a photon in a manner mathematically different from that used for the mass of a particle. He determined it was only necessary to define an interim relativity mass of a photon by the expression:

$$m = \frac{E_{Kc}}{C^2}$$

This is a reduced form of the kinetic energy equation. He set the rest energy expression equal to zero, but not the rest mass. He absorbed the rest mass of the total energy expression into the new letter m. This m is replacing:

$$m = \frac{m_0}{\left(1 - \frac{v^2}{C^2}\right)^{\frac{1}{2}}}$$

The new expression absorbs the rest mass while, at the same time, denying its existence. It absorbs the term for velocity that was derived as a velocity of a body of matter, while denying matter is even involved. In other words, this step is not derived. It is assumed. It is a reasoned, subjective decision to apply the energy equation in the most general theoretical way possible.

There is no denying that the results of this decision have been extremely useful, but the irony is that, theoretically, this maneuver has accomplished nothing. To show this, I use Einstein's kinetic energy equation for photons:

$$E_{Kc} = mC^2$$

I set the right side of this equation equal to the right side of his kinetic energy equation for particles. I can do this because this represents what Einstein was actually doing:

$$mC^2 = \frac{m_0 C^2}{\left(1 - \frac{v^2}{C^2}\right)^{\frac{1}{2}}} - m_0 C^2$$

Simplifying to:

$$m = \frac{m_0}{\left(1 - \frac{v^2}{C^2}\right)^{\frac{1}{2}}} - m_0$$

This shows what Einstein was really defining as the relativity mass of a photon. Logically, if the right side of this equation is not interpretable, then the left side is also not interpretable. The problem hasn't gone away, and it must be resolved in order to understand the nature of photons.

With regard to the success of Einstein's predictions, it will be shown that no practical harm was done so long as the equation was used to make energy calculations. However, this dilemma of the mass term for photons does do harm to predictions when it is used to calculate photon momentum. This new theory can give an explanation for what was done incorrectly, and will offer new solutions for both photon energy and momentum.

The explanation begins by recognizing that Einstein made a fundamental error when defining the mass term for photons. The error occurred when he used his kinetic energy equation for a particle to describe the kinetic energy of a photon. The specific mistake was: He assumed the velocity v in his kinetic energy equation applied to photons in the same manner as it applied to matter. It is true photons must travel at the speed of light simply because they are light. This does not justify the conclusion that their kinetic energies are related to their own velocity.

It is known empirically that the energy of a photon is determined by the acceleration of the particle emitting it. Logically then, the properties of the particle define the energy of the emitted photon. The value of velocity to be used to determine the kinetic energy carried by a photon must relate to the change of velocity of the emitting particle. In other words, the energy of the photon should be defined by using an increment of change of velocity of the particle.

The photon can be considered as containing a stored increment of velocity. This incremental value can be solved for later when the incremental length of time of release of a photon has been determined. For now, I begin by defining the kinetic energy of a photon as:

$$E_{Kc} = \Delta E_{Kp}$$

This equation says: The kinetic energy of a photon equals some incremental change of the kinetic energy of a particle. I need to derive an expression for this increment of particle kinetic energy. I have already determined for a particle:

$$E_{Kp} = mv_{c1}^2\left(\frac{v_{c1} - v_{c2}}{v_{c2}}\right)$$

I allow the kinetic energy of the particle to increase by an incremental amount and write:

$$E_{Kp} + \Delta E_{Kp} = mv_{c1}^2\left[\frac{v_{c1} - (v_{c2} + \Delta v_{c2})}{v_{c2} + \Delta v_{c2}}\right]$$

Since:

$$\Delta E_{Kp} = \left(E_{Kp} + \Delta E_{Kp}\right) - E_{Kp}$$

I can write:

$$\Delta E_{Kp} = m v_{c1}^2 \left[\frac{v_{c1} - (v_{c2} + \Delta v_{c2})}{(v_{c2} + \Delta v_{c2})} - \frac{v_{c1} - v_{c2}}{v_{c2}}\right]$$

Simplifying:

$$\Delta E_{Kp} = m v_{c1}^2 \left[\frac{-v_{c1} \Delta v_{c2}}{v_{c2}(v_{c2} + \Delta v_{c2})}\right]$$

Yielding:

$$\Delta E_{Kp} = -m \frac{v_{c1}^3}{v_{c2}} \left(\frac{\Delta v_{c2}}{v_{c2} + \Delta v_{c2}}\right)$$

This equation gives the energy of a photon as a function of the changing local speed of light. The change in the local light speed is dependent upon both the relative speed of the particle and the incremental change of its speed.

The equation can be further simplified for most cases. Specifically, when:

$$\Delta v_{c2} \ll v_{c2}$$

Then the equation can be approximated by:

$$\Delta E_{Kp} = -m v_{c1}^3 \frac{\Delta v_{c2}}{v_{c2}^2}$$

And, if also:

$$v_{c2} \cong v_{c1}$$

Then it can be further simplified to:

$$\Delta E_{Kp} \cong -m v_{c1} \Delta v_{c2}$$

What this result reveals is that, for most cases, the approximate form of the energy equation for a photon is analogous to the approximate form of the energy equation for a particle. There is, however, a very significant difference. The form for the particle uses a change in light speed that represents the full difference from the background light speed

v_{c1}. The form for the photon uses a change in light speed that represents only the incremental change in the local light speed due to the change in the speed of the emitting particle during the fundamental increment of time.

The mass m given in the kinetic energy equation for the particle or for the photon emitted by the particle is always the mass of the particle. In other words, the photon does carry a value of mass with it, but that value is imparted by the particle that emitted it. The approximate formula given above for the kinetic energy of a photon is the form that should be used for photons in place of Einstein's energy equation.

As mentioned earlier, it happens that the use of Einstein's equation does not harm calculations involving energy; however, it leads to a clear error when he defines photon momentum. I will show that this new equation, derived, above leads to the resolution of the problem encountered when calculating photon momentum.

Compton Effect

Particles and their effects are not interactions at a point only. They are theoretically infinite. Particles of matter are members of a continuum. Their centers are peaks in the continuum of the universe. What this means for the interaction of photons and particles is that it also is continuous. Photons do not wait until they reach the point source of a particle before delivering their energy. There is nothing new at the center of the particle than there is anywhere along the path of approach to the particle's center. The differences are of degree and not of kind.

It is accepted that photons give energy to particles and particles give energy to photons. Since particles are a continuum of an effect upon the speed of light, the light will react to the whole continuum of the particle. The result of this interaction is: The photon is always giving energy to the particle and the particle is always giving energy to the photon.

The degree of this interaction is a function of relative position. For a photon following a path that misses the point source of the particle, only a partial transference of energy will occur. The Compton Effect is the measure of the partial interaction between photons and particles.

The most important implication of this effect is: It is empirical evidence that photons and particles are interacting with each other at every point in the particle's light-field. In other words, the process of exchange of energy is not discrete. I will shortly address the analysis of the Compton Effect.

Photon Momentum

It is known that photons have energy. If Einstein's kinetic energy equation is to be used to apply to photons then the mass term must be not be glossed over or ignored. Its use suggests they have a property that is connected through the fundamentals in some way to mass. If they have such a property, then they can be defined, using the fundamentals, as having momentum. In general, momentum is defined by:

$$P = mv$$

Einstein formed his photon momentum equation in this manner. He used the speed of light as the magnitude of the velocity to be substituted into the above equation:

$$P_c = mC$$

The m used was his relativity or variable mass term derived in his energy expression:

$$m = \frac{E_{Kc}}{C^2}$$

Substituting the mass equation into the momentum equation:

$$P_c = \frac{E_{Kc}}{C}$$

This definition of photon momentum predicts excessive momentum for a photon over that which a particle with equivalent kinetic energy would have. For example, in a collision involving a photon and particle, momentum is not conserved according to Einstein. Another classic case in point occurs with the apparent conversion of photons into matter, where momentum is again predicted to not be conserved. Even though the total photon energy equals the total particle energy, the total photon momentum exceeds the total particle momentum.

For this reason, Einstein's equation is interpreted to predict that for photon energy to be converted to matter, the collision must occur near an already existing body of matter. The body normally used is a heavy atomic nucleus. This additional body of matter is included for the purpose of carrying away the excess momentum from the photons. I will later offer an explanation for the evidence of the creation of matter. Having foreknowledge of this information, I continue with a new definition of photon momentum.

The prediction of excessive photon momentum does not occur in this new theory. From the perspective of this theory, a photon's momentum consists of an increment of momentum given to it by a charged particle that is accelerated an incremental amount. I will now derive photon momentum using concepts from this new theory. I have given the definition of momentum, in general, as:

$$P = \frac{dE_K}{dv_p}$$

I have used this formula to derive the momentum of an accelerating particle. The specific example used was of an accelerating particle emitting a photon in a perpendicular direction. The momentum of the particle was derived as:

$$P = \frac{dE_K}{dv_p} = \frac{mv_p}{\left(1 - \frac{v_p^2}{v_{c1}^2}\right)^{\frac{1}{2}}}$$

The released photon carries away an increment of energy and an increment of momentum. The actual size of the increment of momentum can be calculated only after I have defined the length of time of emission for the photon. This will be done during an analysis of the electromagnetic properties of the hydrogen atom. At this time the increment of momentum will be represented by:

$$\Delta P = m\,\Delta \frac{v_p}{\left(1 - \frac{v_p^2}{v_{c1}^2}\right)^{\frac{1}{2}}}$$

I treat the mass m as a constant, because in this theory, so far, it has represented only the rest mass of the particle. I simplify the appearance of the formula by defining:

$$\Delta v_L = \Delta \frac{v_p}{\left(1 - \frac{v_p^2}{v_{c1}^2}\right)^{\frac{1}{2}}}$$

Where, the subscript $_L$ denotes that the velocity is measured from the perspective of a local observer traveling with the particle. Now I can, more simply, represent the increment of momentum as:

$$\Delta P = m\Delta v_L$$

The concept of momentum is integral to the derivation of the atomic electron quantum energy levels. For this reason, I will wait until the section on quantum effects to carry out further analysis of momentum.

The incremental quantities involved in this description of the characteristics of a photon are normally very small. They have magnitudes such that they could be calculated to a very good approximation from the differential forms of equations. The fundamental increment of time and photon length can be used in conjunction with the differential rates of change to calculate the incremental values.

Taking advantage of this, I represent the increment of momentum as a differential value:

$$dP = m dv_L$$

Most theory in physics makes use of differential calculus because, in general, force is treated as if it is not quantized.

In this new theory, force is quantized; however, it is still convenient at times to approximate the application of force as a continuum. My use of this method is temporary; I will develop the quantization of force during my analysis of the electromagnetic properties of the hydrogen atom.

I have argued that Einstein's definition of photon momentum is incorrect. The analysis of the Compton Effect uses Einstein's treatment of photon momentum, and the results of this treatment are in agreement with empirical evidence. Why does this analysis appear to work?

The answer is that the analysis does not truly rely upon Einstein's theory of photon momentum. Even though it uses momentum to help define the problem, it reverts to the use of photon energy for the conclusion of the analysis. Calculations involving Einstein's definition of photon energy do not cause quantitative problems. The calculations involving photon momentum are incorrect, and if the analysis were completed using only photon momentum then the result would not be supported empirically.

Einstein's photon momentum is too large. The interaction of a photon and particle cannot conserve Einstein's momentum. The analysis of the Compton Effect works because energy is conserved. The energy values are quantitatively correct so the photon wavelength calculations flowing from them are quantitatively correct.

In order to give support to this claim, I will put my definitions of photon energy and momentum to work. These quantities are crucial to the development of a general theory of physics. If they are wrong then the theory will go astray. I will show that the definitions given here will outperform those of Einstein, and will help lead to a more successful general theory.

Now I have sufficient mathematical models for both photon energy and photon momentum. I will proceed to derive a new electromagnetic theory using the photon model of this new theory. Photon energy and momentum will play an important role in deriving formulas analogous to those of current electromagnetic field theory.

ELECTRIC EFFECTS AND THE HYDROGEN ATOM

The hydrogen atom has a nucleus of a single proton with a single electron orbiting the proton. Both of these are charged particles. They interact with each other, for any measurable amount, only through electromagnetic means. This interaction is the simplest natural environment in which to analyze the cause of electromagnetic effects.

I am not saying the action of a hydrogen atom is simple. I am saying I will examine electromagnetism from a simple atomic perspective. The origins of electromagnetism must be expected to be a part of the properties of each photon. I will use a simple model of the hydrogen atom for the purpose of theoretically isolating the properties of a single photon.

What I rely upon, for my fundamental unit of time, is the time of passage of a photon to pass a given point. In this theory, that time is a fundamental constant. I don't have a constant fundamental unit of distance. I use the length of a photon that is a varying unit of length. When I look for another natural unit of length there is the radius of the atom to consider. When this radius changes, due to an electron moving between energy levels, a single photon is involved. This length of radius and its variations are not accidental. There must be a clear physical cause for their size.

The length of a photon is directly related to the speed of light. The measurement of the speed of light is ultimately dependent upon the length of a photon. Therefore, the locally measured speed of light is a fundamental constant. The fundamental unit of time is everywhere a constant. Even the photon length has to be accepted as the local fundamental constant unit of length.

Atomic Radius

For this section the speed of light and the length of a photon are treated as constants. This has the effect of averaging their values and permitting the equations to give some numerical results in agreement with empirical measurements made from our macroscopic perspective.

The electric force due to the proton nucleus acts upon the orbiting electron, and the electron exerts an equal but opposite electrical force upon the proton. This force is predicted by the formula:

$$f_\xi = \frac{q_e q_p}{4\pi\varepsilon r^2}$$

The values of electric charge for the electron and proton are represented in the numerator on the right side. Both of these values are the same measure of the fundamental unit of electric charge.

The fundamental unit of electric charge is an empirically determined constant of electromagnetic theory. The value of electric charge is commonly given the units of coulombs. As I have stated earlier, anything defined in units higher than distance and time is evidence we may not have correctly determined its origin. We really have only distance and time to work with when measuring any physical event. Therefore, all empirical evidence is some measure of distance or time or both of these.

The measure of force described by the above equation is commonly given the units of newtons. Here again, there is a need to look to the demonstrable properties of photons for a physical interpretation of what is force. There is in the denominator on the right side a quantity ε called electrical permittivity. This is an empirically determined quantity having no clear explanation as to its physical origin.

There is only one term in the equation that is a measure of something physically observed. This is the letter r for the radius of the atom. Everything else in the equation needs yet to be explained by physics. However, the magnitudes of everything in the equation have been empirically determined, and I will use them to begin my analysis.

Substituting the appropriate known values, actually their absolute values, into the above force equation:

$$f_\xi = \frac{(1.602x10^{-19}\,Coulombs)^2}{4\pi\left(8.85x10^{-12}\,\frac{coulombs^2}{newton \cdot meter}\right)(5.28x10^{-11}\,meters)}$$

I am purposefully avoiding polarities for electric charge. The cause of polarities needs yet to be identified. It is accepted that the electron and proton attract each other by a force of magnitude:

$$f_\xi = 8.28x10^{-8}\,newtons$$

I wish to describe a photon coming from the proton and acting upon the electron. To attempt this, I will use the formula:

$$f_\xi = \frac{\Delta E}{\Delta x}$$

The numerator is all of, or some division of, the potential energy between the proton and the electron. The size of the increment of energy depends upon what increment of distance is used in the denominator. I will shortly decide this.

The potential energy of the electron is known to be twice the electron's kinetic energy. The kinetic energy of the electron is:

$$E_{Ke} = 13.58\,electron\ volts$$

Doubling this gives:

$$E_{pe} = 27.16\,ev = 4.35x10^{-18}\,joules$$

This is the magnitude of the potential energy of the electron. This value divided by the radius of the orbit would give the magnitude of the force shown above.

What must be decided at this point is what will be the first trial length of the photon? Then also, what corresponding division of the potential energy is carried by an individual photon? There is only one fundamental physical representation of length; therefore, until the results suggest otherwise, it is reasonable to assume the length of a photon and the length of the radius of the first energy level of an atom to be the same.

I will make this assumption for my starting point. I substitute the appropriate values into the second form of the force equation given above:

$$f_\xi = \frac{\Delta E}{\Delta x} = \frac{4.35x10^{-18}\,joules}{5.28x10^{-11}\,meter} = 8.28x10^{-8}\,newtons$$

Whether or not the denominator is the true length of a photon will be made clear in later calculations where the length of the photon is critical to giving correct known results.

The assumption made is that there is a single photon that has been emitted by the proton. At a particular instant of time, its length reaches from the proton to the electron. This assumption is only for the purposes of introducing a concept. It does not preclude the possibility that many photons may be arriving and departing at anytime. This more general treatment is not being addressed at this time.

The primary purpose of this exercise is to assume a reasonable beginning value for the length of a photon. If the length of a photon can be determined, then its value, divided by the speed of light, will yield the time of passage of a photon passing a given point. This value would be a fundamental constant with primary importance in physics.

I want to show a relationship between the photon and the energy that is transferred from one particle to the other. The complete nature of stored energy in a photon cannot be defined until mass is defined in terms of distance and time. For this reason, I will simplify the problem and treat the whole incremental value of energy involved as just stored energy.

I will solve for this energy increment by assuming it to be stored in a single photon traveling between the electron and the proton of a hydrogen atom. It is commonly known that the electron is accelerating toward the proton even though its radius of orbit does not change. The acceleration of the electron is given by:

$$\frac{dv_{er}}{dt} = \frac{v_{eT}^2}{r}$$

The left side denotes the radial acceleration of the electron. The right side denotes the square of the tangential velocity of the electron divided by the radius of orbit. I solve for the change in velocity:

$$dv_{er} = v_{eT}^2 \frac{dt}{r}$$

The radius is also the length of the photon, and the increment of time is the time of passage for the photon. Therefore:

$$\frac{r}{dt} = \frac{dx_c}{dt_c} = v_c$$

Substituting:

$$dv_{er} = \frac{v_{eT}^2}{v_c}$$

For this example, the common reference of measurement is the universal increment of time dt_C. I can, therefore, use equations analogous to those developed for the acceleration due to gravity. For measurements of acceleration:

$$dv_{er} = dv_c$$

Substituting this into the equation above:

$$dv_c = \frac{v_{eT}^2}{v_c}$$

Rearranging:

$$v_c dv_c = v_{eT}^2$$

Multiplying by the mass of the electron yields an equality of energies:

$$m_e v_c dv_c = m_e v_{eT}^2$$

The energy term on the left is an expression of photon energy. The expression on the right is the potential energy of the electron. This equation says: A photon moving between the electron and proton and holding the electron in orbit carries the potential electrical energy necessary to accomplish this. Why do we not observe photons to be emitted by the orbiting electron? The assumed answer is that when the electron is in a stable orbit, the photons involved in holding it there are passed back and forth between the electron and proton only. They do not leave the atom. This situation allows for a new approach to interpreting electric charge.

Electric Charge

The electron and proton of the hydrogen atom are said to be equally and oppositely charged. They carry the fundamental constant called electric charge with them. The magnitude of this value appears empirically to be the same for both. The current explanation of electric charge is given by electric field theory. It is normally said that a charged particle radiates an electric field away from it at the speed of light. Theoretically, for a particle that has always existed, this field is never ending. It is in existence over the size of the universe.

Since there is no empirical evidence for the substance of an electric field, its existence is only an assumption. This new theory does not use the electric field model. There is only the variation of the speed of light. Electromagnetic effects must then be derived from the variable speed of light. For all the variables and constants used in electromagnetic field theory, there needs to be a physical explanation arising naturally from the variation of the speed of light.

The first challenge is to explain the fundamental constant nature of the effect we call electric charge. I will not be distinguishing between opposite polarities at this time. The origin of opposite polarities needs to await the definition of mass. The source of the fundamental constant electric charge, however, can be identified at this time. The formula for electric force is:

$$f_{\xi} = \frac{qq}{4\pi\varepsilon r^2}$$

The letter q represents the electric charge. The example problem I am using to analyze electromagnetic effects is the hydrogen atom. The letters qq, therefore, represent the electric charge of an electron and a proton. These values are empirically determined to be of the same magnitude but to have opposite signs.

It is necessary to pursue an introductory explanation of the nature of the fundamental property of electric charge as it can be ascertained within the parameters of this new theory. Electromagnetic field theory does not provide a definition for electric charge. It is empirically determined and, therefore, it is a given. It is explained through its effects.

Since there is no empirical evidence for the substance of anything defined as a field, I need to see if this new theory can give a clear physical meaning to the origin of the phenomenon identified as electric charge. The empirical value of q is:

$$q = 1.602x10^{-19}\, coulombs$$

This value is a fundamental constant, and I should expect it to reappear as such in this new theory. The only fundamental constant I have identified for this new theory is the time period for a photon to pass a given point.

The example problem I am using is the hydrogen atom, and I have assumed the radius of the first orbit, or energy level, might be the length of a photon. This is only an assumption, but I will see if it can help to provide some useful predictions. I will use this assumption to determine a value for the increment of time required for a photon to pass a given point. This time period can be calculated to a good approximation by using the known value for the speed of light.

This theory defines the velocity of light by the expression:

$$v_c \cong \frac{\Delta x_c}{\Delta t_c}$$

The value for the increment of time in the denominator on the right side is this fundamental time period. It is also the normal increment of time I will use throughout this theory. Time is the companion to all events. This universal measure of time will be used to unify the theory.

It was Einstein's use of time dilation that allowed the theory of relativity to be applied to almost all physical events without deriving their direct physical connection. For this new theory time will again help to connect almost all physical events. However, because this increment of time has a clear physical meaning it will also help to provide the physical connections for almost all events.

The value of this increment of time can be calculated to a good approximation using:

$$\Delta t_c \cong \frac{\Delta x_c}{v_c}$$

Substituting the measured value for the speed of light, and the Bohr radius for the length of a photon gives:

$$\Delta t_c \cong \frac{5.28x10^{-11}\ meters}{2.998x10^{8}\ \frac{meters}{second}} = 1.76x10^{-19}\ seconds$$

The magnitude of the fundamental increment of time is very close to the magnitude of q. In fact, if the radius of the orbit for a hydrogen atom is assumed to be approximately:

$$\Delta x_c = 5.0x10^{-11}\ meters$$

As is indicated by empirical evidence, then:

$$\Delta t_c = 1.67x10^{-19}\ seconds$$

The coincidence of the magnitudes of the two fundamental constants grows curiously stronger. This gives cause to wonder if they are the same phenomenon. This may seem very strange to try to equate one value having the units of coulombs to another value having the units of seconds. However, a coulomb is a high level artificial unit. A guiding principle of this new theory is: A physical quantity is not properly defined until it can be explained in units of time and/or distance.

The existence of electric charge is a theoretical assumption without a physical explanation. No one knows what electric charge is. The fundamental increment of time used in this theory has a clear physical explanation. If this period of time is the real origin of the concept of electric charge then it will help and not hurt to use it in the derivation of electromagnetic effects. If the units of seconds are wrong, then the units will not match and the results will be nonsense.

I will use the fundamental increment of time in place of electric charge. It was for this reason that I did not use polarities with electric charge. Time cannot have polarities. Polarity will later be identified as a property of mass. Mass is not just a neutral resistance to force. Mass causes positive and negative variations of the speed of light. This positive and negative variation is the cause of polarity.

Electric Permittivity

The common formula for electric force contains two quantities that have not had clear physical explanations. The charge q represents an unknown nature. Also, the permittivity is only understood as a part of k, the constant of proportionality for the formula. However, since permittivity does vary, then k is not a true constant of proportionality. It might then be possible to establish k as having a physical relationship to electric force.

I wish to determine an expression for permittivity using the variables of this theory. It will be an interim expression to serve in place of the final expression that will be defined as a part of the development of my analogy to electromagnetic field theory. The reason for this interim step is that I can use it to demonstrate the physical origin of the fine structure constant.

I will use the formula for force to help form the expression for permittivity. I also use the fundamental increment of time in the place of electric charge. If this step is valid, then a crucial block to achieving a unified theory will have been removed.

The example will deal with electromagnetic effects of the hydrogen atom. The use of the hydrogen atom example allows me to conduct the derivations of electromagnetic effects as they might apply to a single photon. The formula for electric force is:

$$f_\xi = \frac{qq}{4\pi\varepsilon r^2}$$

As explained above, I substitute the fundamental increment of time for electric charge. For atomic dimensions, it cannot be approximated as a differential quantity. Therefore:

$$f_\xi = \frac{\Delta t_c \Delta t_c}{4\pi\varepsilon r^2}$$

Force is also generally defined as:

$$f = \frac{\Delta E_K}{\Delta x}$$

For this new theory, and for this example, this formula takes the form:

$$f_\xi = \frac{m_e v_c \Delta v_c}{\Delta x_c}$$

Setting the two expressions for force equal to each other gives:

$$\frac{m_e v_c \Delta v_c}{\Delta x_c} = \frac{\Delta t_c \Delta t_c}{4\pi\varepsilon r^2}$$

For the first energy level of the hydrogen atom:

$$r = \Delta r = \Delta x_c$$

The subscript c is used to denote this increment of length is specifically the length of a photon. Substituting:

$$\frac{m_e v_c \Delta v_c}{\Delta x_c} = \frac{\Delta t_c \Delta t_c}{4\pi\varepsilon \Delta x_c^2}$$

Simplifying:

$$m_e v_c \Delta v_c = \frac{\Delta t_c \Delta t_c}{4\pi\varepsilon \Delta x_c}$$

For convenience, I replace the left side with the appropriate energy symbol:

$$E_{Kc} = \frac{\Delta t_c^2}{4\pi\varepsilon \Delta x_c}$$

The subscript c on the left-hand side denotes this quantity of energy to be the increment of kinetic energy carried by the photon. Solving for permittivity:

$$\varepsilon = \frac{\Delta t_c^2}{4\pi E_{Kc}\Delta x_c} = \frac{\Delta t_c}{4\pi E_{Kc}C}$$

Multiplying by unity:

$$\varepsilon = \left(\frac{\Delta x_c}{\Delta x_c}\right)\left(\frac{\Delta t_c}{4\pi E_{Kc}C}\right) = \frac{\Delta x_c}{4\pi E_{Kc}C^2}$$

Yielding:

$$\varepsilon = \frac{1}{4\pi f_{\xi H1}C^2}$$

Where, $H1$ represents the first energy level of the hydrogen atom. The proportionality constant of the electric force equation is:

$$k = \frac{1}{4\pi\varepsilon}$$

Substituting the expression for permittivity into this equation:

$$k = \frac{1}{4\pi\frac{1}{4\pi f_{\xi H1}C^2}} = f_{\xi H1}C^2$$

The proportionality constant of the Coulomb electric force equation is equal to the product of the increment of force carried by the photon and the speed of light squared. The force is that which applies to an electron in the hydrogen-atom's first energy level.

Fine Structure Constant

The magnitude of the fine structure constant is the ratio of the speed of an electron in the first energy level of a hydrogen atom to the speed of light. What is of great interest about it are the values that make up its definition. It contains constants that come from electromagnetic theory, relativity theory and quantum theory. I have previously redefined some of these constants using expressions from this new theory.

I will demonstrate how these new interpretations offer a clear, simple physical origin to the fine structure constant. The standard formula defining the fine structure constant is:

$$\alpha = \frac{2\pi ke^2}{hC}$$

And in this theory is:

$$\alpha = \frac{2\pi k e^2}{h v_c}$$

Where, e is electron charge. I have previously redefined each expression on the right side with the exception of h or Planck's constant. For the purposes of this section, I will use Planck's constant as it would normally be used. With the exception of Planck's constant, I substitute expressions from this new theory for the constants contained in the equation. The expression I derived for k is:

$$k = f_{\xi H1} C^2 = \frac{E_{Kc}}{\Delta x_c} C^2 = \frac{E_{Kc}}{\Delta x_c} \frac{\Delta x_c^2}{\Delta t_c^2} = E_{Kc} \frac{\Delta x_c}{\Delta t_c^2}$$

The expression for e is:

$$e = \Delta t_c$$

Therefore:

$$ke^2 = E_{Kc} \frac{\Delta x_c}{\Delta t_c^2} \Delta t_c^2 = E_{Kc} \Delta x_c$$

My definition of the velocity of light is:

$$C = \frac{\Delta x_c}{\Delta t_c}$$

The normal use of h is:

$$h = \frac{E_{Kc}}{\omega}$$

This says: The energy of a photon divided by its corresponding frequency is equal to Planck's constant. Substituting all of the above expressions into the equation for the fine structure constant gives:

$$\alpha = \frac{2\pi k e^2}{hC} = \frac{2\pi k e^2}{h v_c} = \frac{2\pi E_{Kc} \Delta x_c}{\frac{E_{Kc}}{\omega} \frac{\Delta x_c}{\Delta t_c}}$$

Simplification yields:

$$\alpha = 2\pi \omega \Delta t_c$$

This suggests that the fine structure constant may be a measure of a specific angle in radians of something moving in a circular or sinusoidal motion for the period of time required for a photon to be emitted. Since the fine structure constant appears to relate in some direct way to the properties of the hydrogen atom, then I might expect the use of my theory to produce a result pertaining directly to the hydrogen atom.

The frequency of this motion can be calculated from the above result. Solving for frequency:

$$\omega = \frac{\alpha}{2\pi\Delta t_c}$$

Substituting the appropriate values:

$$\omega = \frac{7.299x10^{-3}}{2\pi(1.602x10^{-19}\,second)} = 7.25x10^{15}\,sec^{-1}$$

This answer is close to the frequency of the electron that is orbiting in the first energy level of the hydrogen atom. Most significantly, I made a radical change to the units of electric charge; however, the units that appear in this result fit properly. It leads to the interpretation that the fine structure constant is the angle in radians moved by the electron during the time required for a photon to be released. The angle, in radians, is the distance the electron has moved divided by the radius of the orbit:

$$\alpha = \frac{\Delta x_{pe}}{\Delta x_c}$$

Dividing the numerator and denominator by the fundamental increment of time:

$$\alpha = \frac{\frac{\Delta x_{pe}}{\Delta t_c}}{\frac{\Delta x_c}{\Delta t_c}} = \frac{v_p}{v_c}$$

The units of this result also fit properly. The result shows that the distances traveled by the electron and the photon, during the fundamental increment of time, are relevant to the origin of the fine structure constant. It is in agreement with the initial assumption that the radius of the first energy level of the hydrogen atom is equal to the length of a photon. I chose to manipulate the known definition of the fine structure constant, because it adds credibility to this interpretation.

Magnetic Permeability

It is known through empirical evidence that there is a direct connection between the existence of a varying electric field and the existence of a varying magnetic field. The varying electric field is credited with bringing into existence the varying magnetic field. The magnitude and behavior of the varying magnetic field are functions of the varying electric field. The varying magnetic field is said to then, in turn, cause the varying electric field. In other words the electric field and magnetic field are said to be continuously producing each other as both move through a given distance.

The relationship between the electric and magnetic fields will be described later. For now, it is the known relationship between electrical permittivity and magnetic permeability which is of specific interest. Electrical permittivity is related to the proportionality constant of the electrical force equation. Magnetic permeability is related to the proportionality constant of the magnetic force equation. It is known, in the case of electromagnetic radiation, that the two are related to each other by the formula:

$$\frac{1}{\mu\varepsilon} = C^2$$

Or, for this theory:

$$\frac{1}{\mu\varepsilon} = v_c^2$$

Solving for permeability:

$$\mu = \frac{1}{\varepsilon v_c^2}$$

I have derived:

$$\varepsilon = \frac{1}{4\pi\, f_{\xi H1}\, v_c^2}$$

Substituting this gives:

$$\mu = \frac{4\pi\, f_{\xi H1} v_c^2}{v_c^2} = 4\pi\, f_{\xi H1}$$

This equation says permeability is a function of the force felt by an electron in the first energy level of the hydrogen atom.

I postponed my derivation of electromagnetism for the purpose of first introducing the concept of electric charge as the fundamental increment of time. This was necessary in order to properly use this increment of time in the differential equations that make up this analysis. I will next derive equations showing the connection between my definitions of photon momentum and photon energy to electromagnetic theory.

ORIGIN OF ELECTROMAGNETIC RADIATION

Electromagnetic radiation is a phenomenon physics associates with particles of light called photons. However, the particles of charged matter are the sources for all electromagnetic photons. The properties of the charged particles, in general, give rise to the properties of the emitted photons. Therefore, the mathematics describing the properties of photons should be translatable into expressions using the properties of the charged particles that emitted them.

Varying Electric Field

The fundamental properties which are of principal use in describing particles are: mass, velocity, and rate of change of velocity. The rate of change of velocity can be measured with respect to either time or distance. Two very useful higher-level properties are energy and momentum. These two properties are complex forms of the fundamental properties of mass and velocity.

It is commonly accepted that energy and momentum are qualities applicable to both material particles and photons. I will use these properties to derive equations analogous to electromagnetic field theory. For convenience in comparing mathematical expressions from electromagnetic field theory with analogous expressions from this theory, I will take the liberty of using differential instead of incremental expressions in the following analysis.

Since photons are themselves incremental and not so small as to be defined by differential values, this approach is not entirely correct. However, the true incremental values are of sufficiently small size so that, for macroscopic purposes, using this approach loses nothing of significance. The benefit gained will be clarity when showing correlation to electromagnetic field theory.

I will now derive equations for this new theory to describe the effects attributed to electromagnetic fields. Force can be expressed as a function of a change in energy:

$$f = \frac{dE}{dx_p}$$

The force can also be expressed as a function of a change in momentum:

$$f = \frac{dP}{dt}$$

Combining these two expressions:

$$\frac{dE}{dx_p} = \frac{dP}{dt}$$

This formula has a form similar to this one from electromagnetic field theory:

$$\frac{d\xi}{dx} = \mu \frac{dH}{dt}$$

And since:

$$B = \mu H$$

I compare it also with:

$$\frac{d\xi}{dx} = \frac{dB}{dt}$$

The similarity in form between this formula and the one above expressed in terms of energy and momentum is striking. I will show there is an indirect connection. Before I can show this, I will develop new formulas that will account for electromagnetic effects. It is known:

$$f = q\xi$$

That can be rewritten, for this new theory, as:

$$f = \xi dt_c$$

Solving for the electric field gives:

$$\xi = \frac{f}{dt_c}$$

And since:

$$f = \frac{dP}{dt_c}$$

I can write:

$$\xi = \frac{d^2P}{dt_c^2}$$

This formula suggests our concept of electric field is equivalent to the second derivative of the emitting particle's momentum with respect to time. Taking the derivative of the electric field with respect to time yields:

$$\frac{d\xi}{dt_c} = \frac{d^3P}{dt_c^3}$$

I have presented this formula because it, along with three others to be derived next, begins the process of expressing the phenomenon described by electromagnetic field equations in terms of the properties of the emitting particle. I will now derive the three other equations. Returning to the equation:

$$\xi = \frac{f}{dt_c}$$

I can substitute:

$$f = \frac{dE}{dx_p}$$

Making the substitution:

$$\xi = \frac{d^2E}{dx_p dt_c}$$

Taking the derivative of the electric field with respect to time:

$$\frac{d\xi}{dt_c} = \frac{d^3E}{dx_p dt_c^2}$$

This is the second equation that I will be using for the purpose expressed above. The remaining two equations are:

$$\frac{d\xi}{dx_s} = \frac{d^3P}{dx_s dt_c^2}$$

And:

$$\frac{d\xi}{dx_s} = \frac{d^3E}{dt_c dx_s dx_p}$$

These two equations result from taking the derivative of the electric field with respect to distance. In the first case I take the derivative of the electric field where it is expressed as a function of particle momentum. In the second case, I take the derivative of the electric field where it is expressed as a function of energy.

The increment of distance used in taking the derivative cannot be the same increment of distance the particle moved during the same increment of time. This new increment of distance has to do with observing the motion of photons after they have been emitted from the particle. The increment of distance is not yet a specific value. It represents a moving observer making measurements of the motion of photons as they move away from their source.

Also, the incremental change of distance cannot be equal to the length of a photon. In that case the observer would necessarily be moving at the speed of light. The observer would be traveling at the same speed as the photons. The observer could not then detect a change in the motion or even orientation of the photons with respect to time.

The observer also cannot be standing still or there could be no change observed with respect to distance. Therefore, the observer is assumed to have a magnitude of velocity between zero and the speed of light, and is moving in the same direction as the photons. Further development of electromagnetic effects will offer an interesting identity for the observer’s magnitude of velocity.

The work of Maxwell has been interpreted to prove the existence and the uniting of a varying electric field and a varying magnetic field. He produced equations that are credited with fundamentally defining electromagnetic radiation effects. I will now derive analogous equations from this new theory.

Definition of Electric Field

The equations I will derive are not just symbolic substitutes adding nothing to Maxwell's discoveries. The very first step in this derivation goes to the heart of separating the results of this theory from electromagnetic field theory. The electric field is defined as:

$$\xi = \frac{f}{q}$$

I will use this equation as it applies to a force caused by a single charged particle. Since I am seeking to form equations using concepts developed for this theory, I substitute:

$$q = dt_c$$

In this theory, the fundamental quantity of electric charge is actually the fundamental time period for passage of a photon:

$$\xi = \frac{f}{dt_c}$$

With this substitution, I separate the work that follows from any theoretical connection with electromagnetic field theory. The resulting equations will be analogous in form, but will have interpretations very different from field theory.

Electric Field Varying With Distance

I now proceed to derive electromagnetic equations analogous to the Maxwell equations. Since force can in general be expressed as:

$$f = \frac{dE}{dx_p}$$

Then I can substitute this definition into the electric field equation given above:

$$\xi = \frac{d^2E}{dx_p dt_c}$$

Taking the derivative with respect to an increment of distance which a photon would move during a fundamental increment of time:

$$\frac{d\xi}{dx_c} = \frac{d^3E}{dx_c dx_p dt_c}$$

I want to convert this equation into a form analogous to the Maxwell equation:

$$\frac{d\xi}{dx} = \mu \frac{dH}{dt}$$

I begin with:

$$dE = v_p dP$$

I change the incremental length of distance of particle motion to a measure of photon motion. I do this by multiplying the right side by unity:

$$dE = \frac{v_c}{v_c} v_p dP$$

Or:

$$dE = \frac{dx_c}{dt_c} \frac{v_p}{v_c}\ dP$$

Rearranging terms:

$$\frac{dE}{dx_c} = \frac{v_p}{v_c} \frac{dP}{dt_c}$$

I will change this equation, using its left side as a guide, into the form shown above on the right side of my expression for the electric field varying with distance. I rewrite it as:

$$\frac{dE}{dx_c} = \frac{dx_p}{dt_c} \frac{1}{v_c} \frac{dP}{dt_c}$$

Rearranging:

$$\frac{d^2E}{dx_c dx_p} = \frac{1}{v_c} \frac{d^2P}{dt_c^2}$$

Multiplying by particle velocity:

$$v_p\ \frac{d^2E}{dx_c dx_p} = \frac{v_p}{v_c} \frac{d^2P}{dt_c^2}$$

Or:

$$\frac{dx_p}{dt_c} \frac{d^2E}{dx_c dx_p} = \frac{v_p}{v_c} \frac{d^2P}{dt_c^2}$$

Rearranging:

$$\frac{d^3E}{dx_c dx_p dt_c} = \frac{v_p}{v_c} \frac{d^3P}{dx_p dt_c^2}$$

I submit that this equation is analogous to the Maxwell equation given above. In order to see this more clearly, I will manipulate its form. I have previously derived:

$$\frac{d\xi}{dx_c} = \frac{d^3E}{dx_c dx_p dt_c}$$

Substituting this into the equation above:

$$\frac{d\xi}{dx_c} = \frac{v_p}{v_c} \frac{d^3P}{dx_p dt_c^2}$$

Rewriting this equation:

$$\frac{d\xi}{dx_c} = \frac{v_p}{v_c} \frac{d}{dt}\left(\frac{d^2P}{dx_p dt_c}\right)$$

Comparing this result to Maxwell's:

$$\frac{d\xi}{dx} = \mu \frac{dH}{dt}$$

The magnetic field is seen to be a function of the emitting particle's changing momentum:

$$H = \frac{d^2P}{dx_p dt_c}$$

Of special interest, by analogy, it is suggested the physical basis for magnetic permeability is represented here by:

$$\mu = \frac{v_p}{v_c}$$

The magnetic permeability is a ratio of the magnitudes of two velocities. One is the velocity of light and the other was introduced as the velocity of an observer moving in the same direction as the photons, but with an unspecified magnitude. Its appearance as part of magnetic permeability indicates it is not just any magnitude. Its magnitude is fixed according to the measured permeability of a particular substance.

Interpreting Magnetic Permeability

The equation for magnetic permeability contains a particle velocity that must be explained. Clearly this velocity cannot be a variable representing an observer's velocity in general. It must have a specific magnitude. This magnitude can easily be calculated:

$$v_p = \mu v_c$$

Substituting the appropriate values:

$$v_p = \left(12.6x10^{-7}\frac{newton \cdot second^2}{coulomb^2}\right)\left(2.998x10^{8}\frac{meters}{second}\right)$$

Solving and assigning the units of velocity:

$$v_p = 378\ \frac{meters}{second}$$

I stated at the beginning of this work that all units of action must be reducible to some combination of distance and time. I will shortly show that the units for the work above are correct. I have already replaced the units of seconds for coulombs. I still need to redefine the units of newtons with units from this theory. The answer above gives a clue to what is to come.

The magnitude of v_p for magnetic permeability is approximately the speed of sound. I anticipate that it is representative of the speed of sound in air. I will shortly achieve more accuracy by using the speed of sound in a solid. For this reason I will identify v_p as v_s:

$$\mu = \frac{v_s}{v_c}$$

It may seem strange to relate the speed of sound to the speed of light; however, the speed of sound must have a physical cause. In this theory all physical cause is somehow related to the nature of light. I will be offering a physical interpretation of this result. What has been accomplished is to show that a physical relationship between the speed of light and the speed of sound could become established by this theory.

Interpreting Electric Permittivity

The solution for magnetic permeability allows for a quick solution of electrical permittivity. It is known:

$$v_c = \frac{1}{(\mu\varepsilon)^{\frac{1}{2}}}$$

Or:

$$v_c^2 = \frac{1}{\mu\varepsilon}$$

Solving for electrical permittivity:

$$\varepsilon = \frac{1}{\mu v_c^2}$$

I have a suggested identity for magnetic permeability of:

$$\mu = \frac{v_s}{v_c}$$

Substituting:

$$\varepsilon = \frac{v_c}{v_s v_c^2}$$

Or:

$$\varepsilon = \frac{1}{v_s v_c}$$

This result suggests electrical permittivity is inversely proportional to the product of the speed of light and a speed approximately that of sound. I will interpret this result shortly.

Electromagnetism and the Speed of Sound

There is a related equation I wish to offer at this time. It gives another representation of this particle velocity in a form spanning this new theory and electromagnetic theory. I use the equation:

$$\frac{d\xi}{dx_c} = \frac{v_s}{v_c}\frac{d}{dt_c}\left(\frac{d^2P}{dx_p dt_c}\right) = \frac{v_s}{v_c}\frac{dH}{dt_c}$$

Or:

$$\frac{d\xi}{dx_c} = \frac{dt_c}{dx_c}\, v_s\, \frac{dH}{dt_c}$$

Simplifying:

$$d\xi = v_s\, dH$$

Solving for v_s:

$$v_s = \frac{d\xi}{dH}$$

This says the speed of sound is the rate of change of the electric field with respect to the magnetic field. In electromagnetic field theory, there is nothing moving at the speed of sound. What then is the origin of a relationship between the speed of sound and electromagnetic radiation? Since electromagnetic radiation consists of discrete photons that are carrying increments of energy given to them by an accelerating particle, then I can look back to the emitting particle for an answer.

I have derived for this theory analogous expressions for both the electric field and magnetic field of electromagnetic theory. I will use these to trace the speed of sound back to the emitting particle. The definition of the electric field of a single photon is:

$$\xi_c = \frac{d^2 E_p}{dx_p dt_c}$$

And, this theory's definition of the magnetic field of a single photon is:

$$H_c = \frac{d^2 P_p}{dx_p dt_c}$$

I substitute these two expressions into the formula for the speed of sound:

$$v_s = \frac{\xi_c}{H_c} = \frac{\frac{d^2 E_p}{dx_p dt_c}}{\frac{d^2 P_p}{dx_p dt_c}} = \frac{dE_p}{dP_p}$$

So, the photon's increment of electric field divided by its increment of magnetic field is equal to the rate of change of the kinetic energy of the emitting particle with respect to the rate of change of the momentum of the particle. Furthermore, they are both equal to the speed of sound:

$$\frac{\xi_c}{H_c} = \frac{dE_p}{dP_p} = v_s$$

I want to extend the meaning of this formula directly to the emitting particle. It is known an incremental change of kinetic energy of the particle is given by:

$$dE_p = m_e v_p dv_p$$

And an incremental change of momentum of the particle is given by:

$$dP_p = m_e dv_p$$

Dividing the first by the second:

$$\frac{dE_p}{dP_p} = v_p$$

I have already shown the rate of change of the kinetic energy with respect to the rate of change of the momentum is equal to the speed of sound. Therefore, I can write:

$$v_p = v_s$$

This says the free electrons in a metal, those producing electromagnetic radiation, move at the speed of sound. For an electron in space v_p may be a variable, but not for an electron roaming relatively free inside a metal. For example, electrons inside an antenna are suggested to be roaming randomly around at the speed of sound.

When a potential is applied to the antenna, some of these electrons are impacted by incoming energetic photons. The electrons accelerate in an organized manner by the same average incremental amount. When they are accelerated they cause other photons to carry away their incremental change in velocity. This explanation is a simplified interpretation I offer to suffice for now.

In order to support this idea as applying to at least the solid materials in general, I will use the speed of sound in glass to calculate the magnetic permeability of glass. I use the formula:

$$\mu = \frac{v_s}{v_c}$$

The typical speed of sound in glass is:

$$v_{sGL} = 6.0x10^3 \, \frac{meters}{second}$$

Substituting this into the equation above:

$$\mu = \frac{v_s}{v_c} = \frac{6.0x10^3 \, \frac{m}{sec}}{3.0x10^8 \, \frac{m}{sec}} = 2.0x10^{-5}$$

This is the correct magnetic permeability of glass. I will perform the analogous calculation for the metals of gold, copper, and steel. The speed of sound in gold is:

$$v_{sAU} = 2.0x10^3 \frac{meters}{second}$$

Substituting:

$$\mu_{AU} = \frac{2.0x10^3 \, \frac{m}{sec}}{3.0x10^8 \, \frac{m}{sec}} = 6.7x10^{-6}$$

The speed of sound in copper is:

$$v_{sCU} = 3.5x10^3 \ \frac{meters}{second}$$

Substituting:

$$\mu_{CU} = \frac{3.5x10^3 \ \frac{m}{sec}}{3.0x10^8 \ \frac{m}{sec}} = 1.2x10^{-5}$$

The speed of sound in steel is:

$$v_{sST} = 5.0x10^3 \ \frac{meters}{second}$$

Substituting:

$$\mu_{ST} = \frac{5.0x10^3 \frac{m}{sec}}{3.0x10^8 \frac{m}{sec}} = 1.7x10^{-5}$$

Each of these answers gives the empirically measured value of magnetic permeability of the material in question.

The relationship developed between the speed of sound and both electrical permittivity and magnetic permeability allows for the speed of sound to be theoretically introduced into the dynamics of a single atom. The force attracting the first energy level electron is given by:

$$f_{\xi e1} = \frac{q^2}{4\pi\varepsilon r_1^2} = \frac{\Delta t_c^2}{4\pi\varepsilon\Delta x_c^2} = \frac{1}{4\pi\varepsilon v_c^2}$$

I have derived:

$$\varepsilon = \frac{1}{v_s v_c}$$

Substituting:

$$f_{\xi e1} = \frac{v_s v_c}{4\pi v_c^2} = \frac{v_s}{4\pi v_c}$$

This equation suggests the existence of a relationship between the speed of sound and a single atom. I will wait until a later time to interpret this result. There is, however, a very important immediate use for this formula. It shows force is dimensionless. The units of velocity cancel each other out.

This result presents a profound opportunity for expanding this new theory of physics. The first step in pursuing this opportunity for discovery is to see how a unit free definition of force can be used to define new units for other physical phenomena.

Defining the Units of Physics

Force is a pure number. How could something as physically real as force be free of units? The answer lies in following this lead to its logical conclusion. Newton's force formula is:

$$f = ma$$

It follows that: If force is dimensionless, then, the units of mass must be the inverse of acceleration. What acceleration is represented by mass? The answer is that mass consists only of acceleration. It is the acceleration of light that defines the existence of any particle.

What is being shown here is that mass both experiences acceleration and causes acceleration. In other words, acceleration comes from acceleration. The only given in the universe is the cause of a change of velocity of light. Everything else results from it. We have used the units of kilograms to represent the units of mass. However, this has always been known to be another name for how the acceleration of one mass compares to the acceleration of another mass.

Our concept of mass is a representation of the effect each particle has upon the acceleration of light. Force is defined by comparing, by means of a ratio, the particle's own acceleration to its acceleration of light. If the units of mass change, then, the units of energy and momentum also change. The definition of kinetic energy is:

$$E_K = \frac{1}{2} m v_p^2$$

And the definition of remote observer gravitational potential energy is:

$$E_p = \frac{1}{2} m v_c^2$$

If the mass in these equations is given the units of inverse acceleration, then it follows that the units of energy reduce down to meters. In its simplest form energy is a measure of a distance:

$$E_{units} = \frac{1}{\frac{m}{sec^2}} \frac{m^2}{sec^2} = meters$$

An expression of momentum is:

$$P = mv_p$$

Substituting the new units of mass:

$$P_{units} = \frac{1}{\frac{m}{sec^2}} \frac{m}{sec} = seconds$$

The new unit of measurement for momentum is seconds. All other units can now be derived from those given above. For example, the electric field is defined as:

$$\xi = \frac{d^2E}{dx_p dt_c}$$

The new units of electric field are:

$$\xi_{units} = \frac{m}{m \cdot sec} = \ seconds^{-1}$$

For the magnetic field:

$$H = \frac{d^2P}{dx_p dt_c}$$

The new units of magnetic field are:

$$H_{units} = \frac{sec}{m \cdot sec} = meters^{-1}$$

Electric current has the units of:

$$I_{units} = \frac{coul}{sec} = \frac{sec}{sec}$$

Planck's constant has the units of:

$$Planck_{units} = joule \cdot seconds = meters \cdot seconds$$

Another interesting change, that I will soon interpret and support, is the new units of the universal gravitational constant. The common units for this constant are:

$$G_{units} = \frac{newtons \cdot meters^2}{kilogram^2}$$

Since force is dimensionless, then newtons no longer exist. The units of kilograms are now the inverse of acceleration. Making these substitutions:

$$G_{units} = \left(\frac{meters}{second}\right)^4$$

Or perhaps it will prove instructive to use acceleration times distance, the quantity squared:

$$G_{units} = \left(\frac{meters}{second^2} \cdot meters\right)^2$$

In any case, the implementation of new units for physics gives us a new opportunity to discover new physical meanings for what we are measuring.

Electric Potential

My development of photon electromagnetism has so far been directed from the characteristics of the emitting electron. Once the photon has left, the primary consideration is what will be the effect upon a receiving particle. For simplicity I use another electron as the receiving particle.

For the receiving electron the increment of energy is the same as what was first stored onto the photon:

$$\xi_c = \frac{d^2E}{dx_p dt_c}$$

Therefore, all the quantities in the electric field expression remain valid. The way in which it is interpreted depends upon which electron is being observed. For example, the incremental change in position of the receiving electron is the same as was undergone by the emitting electron. This means dx_p also applies to the receiving electron.

I define the electric potential of the receiving particle due to a single photon as:

$$\phi_c = d\phi = \xi \, dx_p = \frac{dE}{dt_c}$$

This equation says the incremental electric potential applied to the electron is equal to the increment of photon energy divided by the fundamental increment of time.

If photons are arriving one after the other with no delay in between, then I can easily perform the indicated integration:

$$\int_0^{\phi} d\xi = \int_0^{x} \xi \, dx_p = \int_0^{t} \frac{dE}{dt_c}$$

For which the solution is:

$$\phi = \xi x = \frac{E}{t}$$

This equation says: The potential energy of an electron moving a distance x away from the emitting electron will equal the total of energy emitted by that electron during the time period it takes for the receiving electron to complete the move. I am assuming, for simplicity, the emission of a continuous stream of photons, all of which are received by the electron.

The units of electric potential are commonly defined as those of potential energy per unit of electric charge. It can be seen from the above result that the new units are those of potential energy per unit of time, or electric field times distance. The new units for electric potential are:

$$\phi_{units} = \frac{meters}{second}$$

Although the units are those of velocity, it can be read as energy per unit of time.

Magnetic Field Varying With Distance

I need to complete the electromagnetic radiation equations. I will now offer another analogy to a Maxwell equation. The Maxwell equation, I have in mind here, is:

$$\frac{dH}{dx} = -\varepsilon \frac{d\xi}{dt}$$

I have derived:

$$\xi = \frac{d^2E}{dx_p dt_c}$$

Taking another derivative with respect to time gives:

$$\frac{d\xi}{dt_c} = \frac{d^3E}{dx_p dt_c^2}$$

I have also derived:

$$H = \frac{d^2P}{dx_p dt_c}$$

Taking another derivative with respect to photon length:

$$\frac{dH}{dx_c} = \frac{d^3P}{dx_p dx_c dt_c}$$

I use Maxwell's equation as a guide and write:

$$\frac{d^3P}{dx_p dx_c dt_c} = -\varepsilon \frac{d^3E}{dx_p dt_c^2}$$

Now substituting a result previously derived for electrical permittivity:

$$\frac{d^3P}{dx_p dx_c dt_c} = -\frac{1}{v_s v_c} \frac{d^3E}{dx_p dt_c^2}$$

I offer this equation as being analogous to the Maxwell equation.

Origin of Atomic Electric Effects

This theory does not use either an electric field or magnetic field. There is no fundamental electric force. Even electric charge has been discarded. Instead, electrical and magnetic effects are the result of the acceleration of particular particles of matter. These particles transfer increments of their changes of velocity to photons.

It follows, if such particles are not undergoing a change of velocity, then they have no electric or magnetic effects. For example, if an electron and a proton were passing each other at constant velocities, and if neither of them were accelerated by photons, then they would experience no electrical attraction toward each other.

They work together properly when they are formed into a hydrogen atom only because they are already undergoing acceleration. They then trade a stored form of this change of velocity back and forth between themselves. The acceleration they achieve has its origin in the normal rate of change of the speed of light due to mass. In other words, the same effect we interpret as gravity also causes electrical force. The difference is that for the electric effect the acceleration of light has become stored onto the photon by virtue of its tilt.

ELECTRON ATOMIC ENERGY LEVELS

Modern physics has found it useful to define physical existence in two different ways. One way to define certain physical properties is to use frequency and wavelength. These properties have been interpreted as belonging uniquely to the description of a wave phenomenon.

A second way to define other important physical properties is to use energy and momentum. These two properties are themselves defined with the use of mass. The concept of mass has been interpreted as belonging uniquely to the description of a particle phenomenon.

Wave-Particle Duality

The basis of quantum physics is the belief that everything material in the universe has both of these two natures. This belief is named wave-particle duality. It is known empirically that the effects attributed to the wave nature, and the effects attributed to the particle nature do not exist simultaneously. They are aptly described as mutually exclusive.

Electromagnetic radiation was first believed to consist of only a wave nature. With the discovery of the photoelectric effect, which is the emission of electrons caused by electromagnetic radiation, it appeared necessary to consider light as also having a particle nature. Einstein suggested this duality of a wave nature and a particle nature, and he used the term photon for the particle nature of electromagnetic radiation.

The initial interpretation was that electromagnetic radiation could, for some purposes, be considered to consist of discrete packets or quanta of energy. These quanta of energy were observed to interact with particles of matter in a manner consistent with themselves being particles. The particle nature of electromagnetic radiation, however, remains fundamentally different from the particle nature of matter.

Photons are particles that move at the speed of light. Material particles, on the other hand, cannot move at the speed of light, and may move at any speed below it. So, even though photons are called the particle representation of electromagnetic radiation, they are not yet theoretically united with the type of particles constituting matter.

The idea of wave-particle duality has become a cornerstone of theoretical physics. There have resulted from this idea some mathematical representations that would appear to allow for the conclusion that these two particle natures could possibly be united. This is the case for the de Broglie relation. The de Broglie relation was a fundamental step in the development of a wave nature for matter. Therefore, it will be examined from the perspective of this new theory.

De Broglie Relation

The de Broglie relation makes successful predictions of the stable energy levels for electrons orbiting a nucleus. The formulation of the de Broglie relation is a fundamental application of the theory of wave-particle duality to a material particle. It begins with the assumption that since electromagnetic radiation appears to have a particle nature, particles of matter might in turn have a wave nature.

The relation does not establish a wave nature for particles of matter; however, it assumes this to be true from the beginning. The way in which it incorporates this assumption is to assign the existence of a wavelength to the particle. The de Broglie relation is expressed as:

$$\lambda = \frac{h}{P}$$

It says the wavelength of a particle is equal to Planck's constant divided by the momentum of the particle.

The relation can be described as having two distinct parts. The left side represents a wavelength that can only make sense when describing a wave nature. The right side of the equation contains momentum, descriptive of a property belonging to a particle. So, this simple formula is putting together the two natures of wave and particle.

For this new theory, the concept of a wavelength has no direct physical reality. Yet, quantum physics has been very useful in the analysis of atomic scale phenomena. There is empirical support for the concept of a wavelength for particles. For example, particles exhibit diffraction properties considered unique to a wave nature. Therefore, it is essential that I address the wave phenomenon.

At this time, I will deal with just a part of this phenomenon. The specific analysis will concern the connection between wavelength, frequency and atomic energy levels. I will analyze the de Broglie relation, and explain what this relation is actually describing. Then, I will use this new theory to give a new physical basis for the prediction of atomic energy levels.

The analysis of the de Broglie relation needs to begin with a reconsideration of Einstein's quantum interpretation of electromagnetic energy. The formula for equating energy and frequency already existed:

$$E_{Kc} = h\omega$$

It says the energy of electromagnetic radiation is proportional to its frequency. Einstein concluded from empirical evidence that electromagnetic energy could be considered to be traveling in discrete packets or quanta. He then applied his own energy equation to the analysis of the problem:

$$E = mC^2$$

He deduced: Since these packets contained energy, then his own energy formula implied they would also have a corresponding value of some property represented by what I will call relativity mass. This application of his energy equation says a photon can be represented as a particle having this relativity mass m moving always at the speed of light. Einstein accepted that photons are never at rest; therefore, he concluded they have no rest mass.

I have shown earlier that Einstein’s theory of the mass term for photons, does not lead to incorrect predictions so long as we are considering energy relationships. However, the error becomes apparent when calculations are made in terms of momentum. Einstein used momentum in its conventional sense:

$$P = mv$$

Here it matters greatly what velocity is used. The problem arises because Einstein deduced the correct magnitude for velocity to use when expressing photon momentum is the speed of light. I have already dealt with this matter earlier; however, it is useful to point out in this context that Einstein’s error leads to the prediction that photon momentum, for a given energy content, exceeds particle momentum.

The de Broglie relation also uses momentum, and I will show how this problem of photon momentum is related to de Broglie's relation. Einstein defined photon momentum as:

$$P = \frac{E}{C} = \frac{mC^2}{C} = mC$$

The frequency of the photon is given by:

$$\omega = \frac{E}{h} = \frac{mC^2}{h}$$

The wavelength of the photon is given by:

$$\lambda = \frac{C}{\omega} = \frac{C}{\frac{mC^2}{h}} = \frac{h}{mC} = \frac{h}{P}$$

De Broglie reasoned: Since light has both a wave and particle nature, then perhaps particles of matter also have a wave nature. The manner in which he moved from the idea of a wavelength for light to a wavelength for a particle was to allow the P in the above equation to represent momentum in general.

Since the expression for momentum is not correct, then de Broglie's use of it should be expected to fail. Regardless of the faulty equation he started with, his idea appeared to work. I need to show why this idea appears to work. Then, I will derive the new wavelength formulas for this new theory.

In order to give a physical interpretation to what de Broglie did, I will use the example of an electron moving in a circle. I am not including, for now, a nucleus at the center of the orbit because an electron in a stable orbit is said to not radiate energy. I will use only the electron, which can radiate energy, moving in a circular path.

I hypothetically assume the photons are emitted from the electron in a singular direction, one after another without interruption. These photons, if seen, would be traveling through space at the speed of light and in the formation of a sine wave. The wavelength, as depicted by the photon formation, is representative of our macroscopic idea of a wavelength.

The wavelength of this sine wave formation is the distance an individual photon travels while the formation moves through one cycle. The cycle of the formation corresponds to one cycle for the electron. The wavelength of the photon formation is given by:

$$\lambda_c = \frac{hC}{E_{Kc}} = \frac{h}{P_c}$$

The wavelength of the emitted photons will change with a change in electron speed. The photon wavelength is inversely proportional to the velocity of the electron.

If we define the electron as having a wavelength, then it would have to be the circumference of the circular path in which it moves. The wavelength of the electron is:

$$\lambda_e = \frac{hv_e}{E_e} = \frac{h}{P_e}$$

The calculation of the electron wavelength is only the calculation of the circumference of its circle. Its circumference gives no physical basis for explaining diffraction and interference effects.

There has to be a clear physical explanation for an electron to exhibit these two effects; renaming its orbital circumference, as the wavelength of its wave nature, gives no insight into a possible explanation. The real explanation will have to do with the nature of photons, and that a particle of matter has an equal but opposite reaction to the effect exerted on it by photons.

The formula given above is written in a form that expresses wavelength as a function of electron momentum. However, the photon wavelength formula given before it contains an expression that falsely represents photon momentum. I have shown photon momentum is not a function of the velocity of light.

Therefore, the photon formula written in a form purporting to show wavelength as a function of momentum is an error. De Broglie's transference of the form of the photon equation onto the electron equation works because an error is corrected. The velocity of the particle involved is the correct velocity to use.

This action taken by de Broglie was physically and mathematically unwarranted. It was a purely intuitive step that unknowingly compensated for the error of Einstein. The important part of the problem did not go away.

The import of de Broglie’s relation is the defining of the circumference of the electron's cycle as wavelength and then solving for it. Changing the name of the circumference does not explain wave phenomenon. This new theory needs to show how it can predict atomic energy levels.

First Atomic Energy Level

For this theory there is no wave nature type of wavelength for either a photon or a particle. The prediction of stable electron orbits must be derived from the acceleration of light. In this case, it is the stored acceleration of light contained within a photon. The radius of orbit of the electron is a function of photon length. There is no other means for either measuring or for communicating between particles. The electron energy levels are predicted, in this theory, by assigning them to orbits with radii equal to integer numbers of photon lengths.

I will move from the concept of wavelength to the concept of photon energy. I wish to begin with an expression of photon wavelength and use it to develop an expression of photon energy in terms of electron energy. In order to proceed, it is necessary to correct an error made by Einstein. His equation for the energy of a photon is:

$$E_{Kc} = mC^2$$

I have shown the replacement equation for the energy of a photon emitted by an electron to be:

$E_{Kc} = m_e v_c \Delta v_{c2}$

The expression for photon wavelength is:

$$\lambda_c = \frac{h v_c}{E_{Kc}}$$

Substituting my photon energy equation into the photon wavelength equation:

$$\lambda_c = \frac{h v_c}{m_e v_c \Delta v_{c2}} = \frac{h}{m_e \Delta v_{c2}} = \frac{h}{P_c}$$

Where photon momentum is defined as:

$P_c = m_e \Delta v_{c2}$

Instead of Einstein's:

$P_c = m_c C$

So, the specific description of photon momentum is changed, but the general form of the wavelength equation is retained for now.

The incremental change in v_c and the incremental change in v_{pe} are both measured with respect to the fundamental increment of time. They are a part of the measurement of acceleration. The acceleration of light and particles is always equal but opposite:

$\Delta v_{c2} = \Delta v_{pe}$

Substituting this into the wavelength equation:

$$\lambda_c = \frac{h}{m_e \Delta v_{pe}}$$

Next, I need to establish that the electron is in the first energy level of the hydrogen atom. I use the known radial acceleration relation:

$$\frac{\Delta v_{pe}}{\Delta t} = \frac{v_{pe}^2}{r}$$

Using the fundamental increment of time:

$$\frac{\Delta v_{pe}}{\Delta t_c} = \frac{v_{pe}^2}{r}$$

Establishing that the radius of orbit is equal to one photon length:

$$\frac{\Delta v_{pe}}{\Delta t_c} = \frac{v_{pe}^2}{\Delta x_c}$$

Solving for the incremental change in electron velocity:

$$\Delta v_{pe} = \frac{v_{pe}^2}{\Delta x_c} \Delta t_c$$

Since:

$$\frac{\Delta t_c}{\Delta x_c} = \frac{1}{v_c}$$

Then:

$$\Delta v_{pe} = \frac{v_{pe}^2}{v_c}$$

Substituting this into the wavelength formula:

$$\lambda_c = \frac{h v_c}{m_e v_{pe}^2}$$

For the first energy level of the hydrogen atom:

$$v_{pe} = \alpha v_c$$

Substituting:

$$v_{pe} = \frac{h v_c}{m_e \alpha^2 v_c^2} = \frac{h}{m_e \alpha^2 v_c}$$

The energy of the photon is given by:

$$E_{Kc} = \frac{h v_c}{\lambda_c}$$

Substituting the wavelength equation into the energy equation:

$$E_{Kc} = \frac{hv_c}{\frac{h}{m_e \alpha^2 v_c}} = m_e \alpha^2 v_c^2$$

Yielding:

$$E_{Kc} = \alpha^2 E_{e0}$$

This says the energy of the photon is equal to the square of the fine structure constant times the rest energy of the electron. Now I wish to show the relationship between photon energy and particle kinetic energy. Since:

$$v_{pe} = \alpha\ v_c$$

Then:

$$\frac{1}{2} m_e v_{pe}^2 = \frac{1}{2} m_e \alpha^2 v_c^2$$

Or, saying the same thing:

$$E_{Ke} = \frac{\alpha^2}{2} E_{e0}$$

Now, using the equation:

$$E_{e0} = \frac{E_{Kc}}{\alpha^2}$$

I substitute this into the equation immediately above and obtain:

$$E_{Kc} = 2E_{Ke}$$

This says the energy of the photon is equal to twice the kinetic energy of the electron. Since the photon is carrying electrical potential energy, then the equation is giving the established answer: The potential energy of the electron is twice its kinetic energy.

Higher Atomic Energy Levels

Higher electron orbits cannot be deduced from what has been defined in modern physics as particle wavelength. This wavelength is simply a substitute for the circumference of the orbit of an electron in the first energy level of an atom. The circumference of this orbit is not a physical basis for explaining the higher orbits. In other words, the practice of using integral half wavelengths to establish radii of orbit is without a substantive physical explanation.

The explanation for all radii of orbit will have to do with photon length. The quantum theory of half wavelengths for defining stable atomic orbits does make good predictions. This follows automatically from the fact that the theory takes the first level circumference and multiplies it by integer values.

We know empirically that the potential energy due to the proton nucleus decreases with the first order of increasing radius. Therefore, if an electron is positioned at a distance of two photon lengths, then the energy received from the proton is diminished by one half. The potential energy diminishes because the proton is emitting a set number of photons. The photons emitted by the proton are diminishing in number per unit area as the distance of separation increases. For this theory, the higher energy levels are assumed to necessarily be multiples of photon length.

The actual number of photons received by the electron is diminishing inversely with distance. The interesting feature of having the electron receive fewer of the same kind of photons is that when the orbiting electron receives one of these photons, it receives the same increment of energy regardless of the energy level it is in. It receives this increment a proportionately fewer number of times, but its momentary radial acceleration is the same at every level.

The significance of this is that the electrons in higher energy levels are not moving in circular orbits. They would seem to have to move in a path approximating a saw tooth type of waveform. I am not offering this as fact, only as suggested. The most important point to be made is simply that the length of a photon can be used as one criterion for the fundamental distance of separation between energy levels, and this assumption offers a clear physical basis for the existence of stable energy levels.

The Bohr Atom

Neils Bohr explained the early known frequencies of light emitted by the hydrogen atom. He postulated that: The stationary states for the electron orbiting the hydrogen atom are those energy levels where the electron's angular momentum is equal to integer multiples of Planck's constant divided by 2π :

$$\wp_n = m_e v_n r_n = n\frac{h}{2\pi} = n\hbar$$

Where $\wp_n$ is the angular momentum and n is an integer called the principal quantum number.

This new theory suggests that the stable energy levels have radii equal to integer multiples of photon length. This is just one criterion. There is another. The second criterion is that: Both the energy and momentum of each photon are constant values that do not change for different energy levels. They are quantized at the values necessary for the first energy level and retain those values regardless of the distance traveled. Their numbers decrease as the square of the distance, but, their individual values of energy and momentum stay the same. Therefore, the stable energy levels are those that satisfy both criteria.

A property that changes for each possible level is also the only common variable for energy and momentum values. It is velocity. Energy is given by:

$$E_n = \frac{1}{2} m_e v_n^2$$

And momentum is given by:

$$P_n = m_e v_n$$

The problem to be solved is: How can both the final energy and momentum be integer values? The answer depends upon velocity being quantized in a manner that allows v_n and v_{n^2} to both be integer values. Therefore, I divide velocity by the integer n:

$$v_n = \frac{v_1}{n}$$

This says that the velocities of each possible energy level are integer quotients of the electron velocity in the first energy level. Momentum is then given by:

$$P_n = m_e \left(\frac{v_1}{n}\right)$$

Energy is also given by:

$$E_n = \frac{1}{2} m_e \left(\frac{v_1}{n}\right)^2 = \frac{E_1}{n^2} = F_n r_n$$

Where F_n is force and r_n is the radial distance. F_n is given by:

$$F_n = \frac{ke^2}{r_n^2}$$

Substituting this into the energy equation:

$$E_n = \frac{ke^2}{r_n^2} r_n = \frac{ke^2}{r_n}$$

Therefore:

$$r_n = \frac{ke^2}{E_n} = \frac{ke^2}{\frac{E_1}{n^2}} = n^2\frac{ke^2}{E_1}$$

Where:

$$\frac{ke^2}{E_1} = r_1$$

Therefore:

$$r_n = n^2 r_1 = n^2 \Delta x_c$$

The stable orbits are those for which the radii are n^2 multiples of the first level radius.

The angular momentum for each stable energy level is given by:

$$\wp_n = P_n r_n = \frac{m_e v_1}{n} n^2 r_1 = n m_e v_1 r_1 = n\hbar$$

Electric Force Quantum Numbers

Quantum numbers are currently associated with energy levels. In a sense they are more fundamentally linked to force. Once force is quantized then this effect can easily be extended to energy and momentum. Also, I will shortly define gravitational force as being quantized through the same method employed here. The simple formula for electric force in the first energy level of the hydrogen atom is:

$$f_{\xi H1} = \frac{k}{v_c^2} = \frac{f_{\xi H1} v_c^2}{v_c^2} = \frac{f_{\xi H1} v_c^2 dt_c^2}{dx_c^2}$$

This formula can be expanded to apply to distances greater than one photon length. I do this by introducing a quantum number. This number is the number of photon lengths that separate two charged particles. I define it as:

$$n_r = \frac{r}{dx_c}$$

Or:

$$r = n_r dx_c$$

Inserting this into the electric force equation gives the electric force between two distant charged particles:

$$f_\xi = \frac{f_{\xi H1}\, v_c^2\, dt_c^2}{n_r^2\, dx_c^2}$$

This is equivalent to the electric field theory force equation:

$$f_\xi = \frac{kq^2}{r^2}$$

I can also expand the formula to include more than two charged particles. I introduce two more quantum numbers representing the number of charged particles at each of two locations:

$$f_\xi = \frac{f_{\xi H1}\, v_c^2\, n_1\, dt_c\, n_2\, dt_c}{n_r^2\, dx_c^2}$$

Where, $n_1\, dt_c$ and $n_2\, dt_c$ are equivalent to the two amounts of electric charge used in electric field theory.

FUNDAMENTAL FREQUENCY RELATIONSHIPS

The theoretical concept of frequency is a useful vehicle for describing energetic photons. The energy of a photon is related to frequency through a very simple relationship. This relationship uses Planck's constant as its proportionality constant.

Planck's Constant

Planck's constant is the proportionality constant relating energy to frequency. This relationship is a primary tool of quantum physics. It is interpreted to show where there is energy there is also frequency. Where there is frequency there is also wavelength. In other words, where there is energy there is a wave nature. The relationship is:

$$E = h\omega$$

In this theory, the units of energy are meters. The units of frequency remain inverse seconds. Therefore, the units of Planck's constant are meters times seconds.

Boltzmann's Constant

Planck's relation between energy and frequency is one of three such relations. There is an analogous relationship between force and frequency. To show this I begin with:

$$h = \frac{E}{\omega}$$

For a photon:

$$E_c = \Delta E$$

So I write:

$$h = \frac{\Delta E}{\omega}$$

Dividing both sides by the incremental Δx_c:

$$\frac{h}{\Delta x_c} = \frac{1}{\omega} \frac{\Delta E}{\Delta x_c}$$

Since:

$$f = \frac{\Delta E}{\Delta x_c}$$

Then:

$$\frac{h}{\Delta x_c} = \frac{f}{\omega}$$

Solving for force:

$$f = \frac{h}{\Delta x_c} \omega$$

In order to divide Planck's constant h by a theoretically accurate length of a photon, I will use the ideal radius of the hydrogen atom. In this theory this ideal size is given by:

$$\Delta x_c = v_c \Delta t_c$$

Substituting:

$$f = \frac{h}{v_c \Delta t_c} \omega$$

In the terms of current modern physics, this equation is analogous to:

$$f = \frac{h}{Cq_e}\omega$$

Where C is the speed of light and q_e is the fundamental unit of electrical charge. Substituting the appropriate values:

$$f = \frac{(6.625x10^{-34}\ meters \cdot seconds)\omega}{\left(2.998x10^{8}\ \frac{meters}{second}\right)(1.602x10^{-19}\ second)} = (1.38x10^{-23})\omega$$

I used the units that are correct for this new theory. Even so, the value of the constant of proportionality is very recognizable. Its magnitude is the same as that of Boltzmann's constant. The units are not the same. However, this circumstance only represents that there is a major conflict between the units of this theory and those of current modern physics. I offer the possibility that:

$$f = k\omega$$

Where k represents Boltzmann's constant. I did not include my usual subscripts because I want to show it in a form consistent with the well-known energy as a function of frequency equation given before it. I will shortly show an application for this new relationship.

Momentum and Frequency

There can also be shown a relationship between photon momentum and frequency. I will solve for the proportionality constant of this relationship. Force is defined as:

$$f = \frac{\Delta P}{\Delta t_c}$$

Then, using the equation derived in the last section, I can write:

$$k = \frac{1}{\omega}\frac{\Delta P}{\Delta t_c}$$

Where k is Boltzmann's constant. Solving for momentum:

$$\Delta P = k\ \Delta t_c\ \omega$$

The proportionality constant is:

$$k\ \Delta t_c = (1.38x10^{-23}\ sec)(1.602x10^{-19}\ sec) = 2.21x10^{-42}\ seconds^2$$

Introducing a symbol for this constant:

$$b = k\ \Delta t_c = \frac{h}{\Delta x_c}\ \Delta t_c = \frac{h}{v_c} = 2.21x10^{-42}\ seconds^2$$

The relationship can then be written for photons as:

$$P = b\omega$$

Temperature and Frequency

It is of theoretical importance that Boltzmann's constant appears to be a part of the frequency relationships discussed above. This occurs because:

$$h = k\ \Delta x_c$$

This relationship now allows me to mix formulas that contain either of these constants. For example, I can investigate the possible theoretical meaning of equating:

$$E = \frac{3}{2}kT$$

And:

$$E = h\ \omega$$

Combining these equations yields:

$$\frac{3}{2}k\ T = h\ \omega$$

Rearranging terms:

$$\frac{T}{\omega} = \frac{2}{3}\ \frac{h}{k}$$

Or:

$$\frac{T}{\omega} = \frac{2}{3}\ \Delta x_c$$

The right side of this equation offers an interesting interpretation that is consistent with a new result offered by this theory. The value of the incremental x_c is the local measurement of the radius of the hydrogen atom. I will show in the section titled **Mass**

and the Radius of the Hydrogen Atom that the remote measurement is *2/3* the local measurement. This result then offers an explanation for the value of *3/2* in the known expression for the kinetic energy of an ideal gas molecule. That expression is:

$$E = \frac{3}{2}\, kT$$

The fraction *3/2* is an inverse representation of the remote measurement of the radius of the hydrogen atom. Solving for T:

$$T = \frac{2}{3}\,\frac{E}{k} = \frac{2}{3}\,\frac{E}{h/_{\Delta x_c}} = \frac{2}{3}\,\Delta x_c\,\frac{E}{h}$$

This formula shows that temperature is a remote measurement. The units of temperature are those of velocity. It appears that temperature is the rate of propagation of kinetic energy between gas atoms. Substituting the value of length of the photon:

$$T = \frac{2}{3}\,(4.8x10^{-11}\, meters)\,\frac{E}{h} = \frac{2}{3}\,(4.8x10^{-11}\, meters)\,\omega$$

Yielding the relationship:

$$T = (3.2x10^{-11}\, meters)\,\omega$$

Which says, what is already commonly established: That temperature is directly related to frequency.

These equations were derived using photon qualities. Therefore, they demonstrate the quantization of force, energy, momentum and temperature. They are applicable to helping define quantum mechanics type properties of the universe.

THERMODYNAMIC ENTROPY

Thermodynamic entropy is defined as a mathematical function. It does not have a physical explanation in the classical terms from which it was derived. In this theory, temperature, entropy, Boltzmann’s constant and Planck’s constant will be given clear, physical meanings.

Thermodynamic Equilibrium

My use of the term, thermodynamic properties, refers to those for which we may make macroscopic measurements. Pressure and temperature are representative of this definition. There is one further general requirement. The measurement of such properties must be done under conditions of equilibrium. Temperature is commonly defined as a property that demonstrates when two or more systems are in thermal equilibrium.

If two systems have the same temperature, they are in thermal equilibrium. If they are placed in contact, separated only by a wall that readily transfers heat, then, from the macroscopic perspective no heat will be exchanged. Heat is energy in transit, and there is no resultant energy transferred.

Equilibrium can be approximated even for systems undergoing change, so long as the changes are quasi-static. When external forces act on a system, or when the system exerts a force that acts on its surroundings, then all such forces must act quasi-statically. This means forces must vary so slightly that any thermodynamic imbalance is infinitesimally small. In other words, the system is always infinitesimally near a state of true equilibrium. If a property such as temperature changes, it must occur so very slowly that there is no more than an infinitesimal temperature variation between any two points within the system.

In the work that follows, all parts of a system are in states of equilibrium with one another. Different systems are not necessarily in equilibrium with one another. However, all changes that occur between systems or parts of systems occur sufficiently slowly that each part of all systems, and each system as a whole, from the macroscopic perspective, remain infinitesimally close to equilibrium.

Definition of Thermodynamic Entropy

Entropy is defined as a mathematical function demonstrating an ideal relationship between the transfer of heat and constant temperature. The entropy function is:

$$\Delta S = \frac{\Delta Q}{T}$$

Where ΔS is a change in entropy, ΔQ is the transfer of heat either into or out of a system, and T is the temperature of the system in degrees Kelvin. This equation is based upon an ideal model of an engine called a Carnot engine. The engine operates in a Carnot cycle.

a. There are two near infinite sources of heat. One is at temperature $T_{high,}$ the other at temperature $T_{low.}$ The Carnot engine operates cyclically between these two temperatures. The engine will absorb heat from source T_{high} and reject heat to source T_{low}. For this example the working substance is a simple gas. Before the cycle begins, the engine is in contact and thermal equilibrium with heat source $T_{low.}$ This is the point from which the cycle will start:

b. The engine is separated from source T_{low} and the first part of the cycle begins. The gas is adiabatically, i.e. no conduction of heat either into or out of the gas, compressed until its temperature rises to the level of T_{high}.

c. The engine is placed in contact with source T_{high} and the second part of the cycle begins. The gas volume expands while remaining at temperature T_{high}.

d. The engine is removed from contact with T_{high}. The heated gas continues to expand adiabatically, i.e. no heat flows in or out, until its temperature falls to that of source T_{low}.

e. The engine is put in contact with source T_{low} and, the gas is compressed while remaining at temperature T_{low} until the engine has returned to its initial state of temperature and volume.

It is known for a Carnot cycle that:

$$\frac{\Delta Q_{high}}{T_{high}} = \frac{\Delta Q_{low}}{T_{low}}$$

The values of T_{high} and T_{low} may both vary, but the relationship remains true. This relationship is the basis of the definition of thermodynamic entropy. The entropy definition is:

$$\Delta S = \frac{\Delta Q}{T}$$

The entropy of the gas will increase when expanding while in contact with T_{high} and will decrease when compressing while in contact with T_{low}. Therefore, the increase in entropy is given by:

$$\Delta S_{increase} = \frac{\Delta Q_{high}}{T_{high}}$$

And the decrease in entropy is given by:

$$\Delta S_{decrease} = \frac{\Delta Q_{low}}{T_{low}}$$

For a Carnot cycle, their sum is:

$$\Delta S_{increase} + \Delta S_{decrease} = 0$$

There is no net change in entropy for the Carnot engine. For a series of Carnot engines joined side by side, they would have an increase in entropy given by:

$$\Delta S_{increase} = \frac{\Delta Q_{high1}}{T_{high1}} + \frac{\Delta Q_{high2}}{T_{high2}} + \frac{\Delta Q_{high3}}{T_{high3}} + \cdots\cdots + \frac{\Delta Q_{highi}}{T_{highi}}$$

For the latter part of the cycle, the decrease in entropy would equal:

$$\Delta S_{decrease} = \frac{\Delta Q_{lowi}}{T_{lowi}} + \cdots\cdots + \frac{\Delta Q_{low3}}{T_{low3}} + \frac{\Delta Q_{low2}}{T_{low2}} + \frac{\Delta Q_{low1}}{T_{low1}}$$

The convention is that heat entering the engine is positive and heat leaving is negative. For both series of variations of heat, it does not matter how their individual temperatures vary. The change in entropy, whether increasing or decreasing, is always equal to its final value minus its initial value. In other words, the sums of changes in entropy, either increasing or decreasing, will be the same regardless of how the temperature varies.

If the series of engines each have infinitesimally small transfers of heat, then the equations become differential. The equation for the increase in entropy becomes:

$$dS_{increase} = \frac{dQ_{high1}}{T_{high1}} + \frac{dQ_{high2}}{T_{high2}} + \frac{dQ_{high3}}{T_{high3}} + \cdots\cdots + \frac{dQ_{highi}}{T_{highi}}$$

The corresponding decrease in entropy would have an analogous change in form. In the differential form, the equations for the series of Carnot engines accurately represent a continuous path on a generalized work diagram so long as the engine represented is quasi-static, i.e. no dissipative effects, and reversible, i.e. returns to initial conditions at the end of each cycle. The differential forms of these equations may be solved by means of calculus for the changes in entropy of this ideal type of engine.

The classical definition of entropy, expressed in terms of macroscopic properties, shows how entropy is calculated, but does not make clear what entropy is. It is a mathematical function and not an explained physics property. Heat is energy in transit. I am using the mks system of units, so the units of entropy are joules per degree Kelvin.

It is temperature that masks the identity of entropy. Temperature is an indefinable property in theoretical physics. It is accepted as a fundamentally unique property along with distance, time, mass, and electric charge. If the physical action that is temperature was identified, then, entropy would be explainable.

What is entropy? It is something whose nature should be easily seen, because, its derivation is part of the operation of the simple, fundamental Carnot engine. The answer can be found in the operation of the Carnot engine. The Carnot engine is the most efficient engine, theoretically speaking. Its efficiency is independent of the nature of the working medium, in this case a simple gas. The efficiency depends only upon the values of the high and low temperatures in degrees Kelvin. Degrees Kelvin must be used because the Kelvin temperature scale is derived based upon the Carnot cycle.

The engine's equation of efficiency and the definition of the Kelvin temperature scale are the basis for the derivation of the equation:

$$\frac{Q_{high}}{T_{high}} = \frac{Q_{low}}{T_{low}}$$

Something very important happens during this derivation that establishes a definite rate of operation of the Carnot cycle. The engine is defined as operating quasi-statically. The general requirement for this to be true is that the engine should operate so slowly that the temperature of the working medium should always measure the same at any point within the medium. This is a condition that must be met for a system to be described as operating infinitesimally close to equilibrium.

There are a number of rates of operation that will satisfy this condition; however, there is one specific rate above which the equilibrium will be lost. Any slower rate will work fine. The question is: What is this rate of operation that separates equilibrium from disequilibrium? It is important to know this because this is the rate that becomes fixed into the derivation of the Carnot engine. This occurs because the engine is defined such that the ratio of its heat absorbed to its heat rejected equals the ratio of the temperatures of the high and low heat sources:

$$\frac{Q_{high}}{Q_{low}} = \frac{T_{high}}{T_{low}}$$

This special rate of operation could be identified if the physical meaning of temperature was made clear. In this new theory, temperature is indicative of the rate of exchange of energy between molecules. It is not quantitatively the same as the rate, because, temperature is assigned unique units of measurement that are not time, distance, or a combination of these two. Temperature is assigned the units of degrees and its scale is arbitrarily fitted to the freezing and boiling points of water.

The temperature difference between these points on the Kelvin scale is set at 100 degrees. For this reason, the quantitative measurement of temperature is not the same as the quantitative measurement of exchange of energy between molecules. However, this discrepancy can be moderated with the introduction of a constant of proportionality:

$$\frac{dQ}{dt} = k_T T$$

Multiplying by dt:

$$dQ = k_T dt\ T$$

This equation indicates that the differential of entropy is:

$$dS = k_T dt$$

Both dS and dt are variables. It is necessary to determine a value for the constant k_T. This value may be contained in the ideal gas law:

$$E = n\frac{3}{2}kT$$

Where k is Boltzmann's constant. If I let $n=1$, then the equation gives the kinetic energy of a single molecule. In this case E becomes ΔE an incremental value of energy. Substituting:

$$\Delta E = \frac{3}{2}kT$$

This suggests that for an ideal gas molecule:

$$\Delta S = \frac{3}{2}k$$

In other words, the entropy of a single ideal gas molecule is a constant. The condition under which this is true is when the gas molecules act like billiard balls and their pressure is very close to zero. Near zero pressure for any practical temperature requires that the gas molecules be low in number and widely dispersed.

I interpret this to mean, under these conditions, that the thermodynamic measurement of temperature and kinetic energy approach single molecule status. Normally, thermodynamic properties do not apply to small numbers of molecules. However, sometimes it is instructive to establish a link between individual molecules and thermodynamic properties, as is done in the development of the kinetic theory of gases. The case at hand is an inherent part of the kinetic theory of gases.

The ideal gas law written for a single gas molecule gives reason to consider that for a single molecule:

$$\Delta S = \frac{3}{2}k$$

Substituting for Boltzmann's constant:

$$\Delta S = \frac{3}{2}\left(1.38x10^{-23}\ \frac{joules}{molecule \cdot {}^\circ Kelvin}\right) = 2.07x10^{-23}\ \frac{joules}{molecule \cdot {}^\circ Kelvin}$$

I have defined Entropy as:

$$\Delta S = k_T \Delta t$$

Therefore, I write:

$$k_T \Delta t = 2.07x10^{-23}\ \frac{joules}{molecule \cdot {}^{\circ}Kelvin}$$

If I could establish a value for Δt, then I could calculate k_T. Since this calculation is assumed to apply to a single gas molecule and is a constant value, I assume that in this special case, Δt is a fundamental increment of time. In this theory, there is one fundamental increment of time. It is:

$$\Delta t_c = 1.602x10^{-19}\ seconds$$

Substituting this value and solving for k_T:

$$k_T = \frac{2.07x10^{-23}\ \frac{joules}{molecule \cdot {}^{\circ}Kelvin}}{1.602x10^{-19}\ second} = \ 1.292x10^{-4} \frac{joules}{molecule \cdot second \cdot {}^{\circ}Kelvin}$$

Substituting the units for each quantity as determined by this new theory and dropping the single molecule indicator:

$$k_T = 1.292x10^{-4}$$

The value k_T is a unit free constant of proportionality. It also follows that Boltzmann's constant is defined as:

$$k = \frac{2}{3} k_T\ \Delta t_c$$

For the ideal gas equation, the entropy of each molecule is a constant:

$$\Delta S = k_T\ \Delta t_c$$

However, thermodynamic entropy is defined as an aggregate macroscopic function. I have a value for the constant k_T, but the increment of time in the macroscopic function is not a constant. There are a great number of molecules involved and their interactions overlap and add together. It is a variable. I expand the meaning of entropy into its more general form and substitute k_T into the general thermodynamic definition of entropy:

$$\Delta S = k_T\ \Delta t$$

The Δt in this equation is not the same as the Δt_c in the equation for a single molecule. In the macroscopic version, it is the time required for a quantity of energy, in the form of heat, to be transferred at the rate represented by the temperature in degrees Kelvin. Substituting this equation for entropy into the general energy equation:

$$\Delta E = \Delta S\ T = k_T\ \Delta t\ T$$

Recognizing that the increment of energy represents an increment of heat entering or leaving the engine, and solving for ΔS:

$$\Delta S = \frac{\Delta E}{T} = \frac{\Delta Q}{T} = k_T\ \Delta t$$

Solving for Δt:

$$\Delta t = \frac{\Delta S}{k_T} = \frac{\Delta Q}{k_T T}$$

This function of Δt is what would have become defined as the function of entropy if temperature had been defined directly as the rate of transfer of energy between molecules. The arbitrary definition of temperature made it necessary for the definition of entropy to include the proportionality constant k_T. Writing an equation to show this:

$$\frac{\Delta Q}{k_T T} = \frac{\Delta Q}{\Delta Q / \Delta t}$$

In particular:

$$\frac{\Delta Q_{high}}{k_T\ T_{high}} = \frac{\Delta Q_{high}}{\frac{\Delta Q_{high}}{\Delta t}}$$

For a Carnot engine:

$$\frac{\Delta Q_{high}}{k_T\ T_{high}} = \frac{\Delta Q_{low}}{k_T\ T_{low}}$$

Therefore:

$$\frac{\Delta Q_{high}}{\frac{\Delta Q_{high}}{\Delta t}} = \frac{\Delta Q_{low}}{\frac{\Delta Q_{low}}{\Delta t}}$$

And the increments of time must be equivalent. This is why the increase in entropy is exactly the opposite of the decrease in entropy for the Carnot engine. The increments of time are identical. The increment of heat entering the engine carries the positive sign, and the increment of energy leaving the engine carries the negative sign.

Now, I consider an engine that operates infinitesimally close to equilibrium conditions, but has heat loss that does not result in work. The heat that is successfully converted into work can be represented by a series of Carnot engines. For this series, the change in entropy per cycle is zero. The lost heat can be treated as if it just passes through the engine. The engine becomes a pathway for the lost heat to travel from the high heat source to the low heat source.

The entropy of the engine is not changed by this loss of heat. The entropies that are affected are those of the high heat source and the low heat source. The entropies are measures of time required for the lost heat to be released by the high heat source and later absorbed by the low heat source. The net change in entropy is:

$$\Delta S = \frac{Q_{lost}}{T_{low}} - \frac{Q_{lost}}{T_{high}}$$

The quantity of heat transferred is the same in both cases. The rates at which that heat will be transferred are different. The low temperature represents a slower rate of exchange of heat than for the high temperature. This means it takes longer for the low temperature source to absorb the quantity of lost heat than it does for the high temperature source to emit the heat.

This time difference is the change that occurs and it is what is represented by the measure of change of entropy. The high heat source loses entropy because it requires extra time for the lost heat to leave the source. The low heat source gains entropy because it requires extra time to absorb the heat that is simply passing through the engine without being converted into work.

Heat that leaves a source is negative heat. Heat that enters a source is positive heat. There is a decrease in molecular activity for the heat source that gives up the heat. There is a corresponding increase in molecular activity for the heat source that receives the heat. There is no net change of energy. What is lost here is gained there.

In my definition of entropy, I established meaning for Boltzmann’s constant. In this theory, giving meaning to Boltzmann’s constant necessarily means establishing meaning for Planck’s constant. Establishing meaning for fundamental constants contributes to achieving a unified theory.

Interpreting Planck's Constant

In this theory, Boltzmann’s constant has acquired the definition of:

$$k = \frac{2}{3} k_T \Delta t_c$$

I have previously shown a relationship between Planck's constant h and Boltzmann's constant k:

$$h = k \Delta x_c$$

Substituting for k and rearranging terms:

$$h = k_T \left(\frac{2}{3} \Delta x_c\right) \Delta t_c$$

I moved the fraction into the parenthesis with photon length because, as has been shown earlier in the theory, this term demonstrates the definition to include a remote measurement. In other words, we determine the value of Planck's constant by making remote macroscopic measurements of the energy of photons.

This interpretation of Planck's constant allows for a modification to the definition of entropy. Using the equation:

$$\Delta E = \Delta S\, T$$

Since:

$$T = \frac{2}{3} \Delta x_c \omega$$

Substituting:

$$\Delta E = \Delta S\, \frac{2}{3} \Delta x_c\, \omega$$

Since:

$$\Delta S = k_T \Delta t_c$$

Substituting:

$$\Delta E = k_T\, \Delta t_c\, \frac{2}{3} \Delta x_c\, \omega$$

Rearranging:

$$\Delta E = k_T \frac{2}{3} \Delta x_c \, \Delta t_c \, \omega = h\omega$$

Planck's constant is a part of the above equation so long as it applies to an ideal gas. However, for the entropy definition Δt_c was replaced with the variable Δt in order that the equation may apply to more general cases. Making the same change in this analogous derivation:

$$\Delta E = \left(k_T \frac{2}{3} \Delta x_c \, \Delta t\right) \omega$$

Defining an analogy to entropy for frequency:

$$\Delta S_p = \left(k_T \frac{2}{3} \Delta x_c \, \Delta t\right)$$

Substituting:

$$\Delta E = \Delta S_p \omega$$

So, Planck's constant is the constant ΔS_p for an ideal gas, while the form above is the variable form for general cases. Now I wish to give a detailed general definition for Planck's constant.

Analyzing Planck's Constant

The potential energy of the hydrogen electron in its first energy level is:

$$\Delta E_{eH1} = h\omega_{eH1}$$

Where:

$$\omega_{eH1} = \frac{\nu_{eH1}}{\lambda_{eH1}} = \frac{\nu_c \alpha}{2\pi \Delta x_c}$$

Substituting for the speed of light:

$$\omega_{eH1} = \frac{\left({}^{\Delta x_c}/_{\Delta t_c}\right)\alpha}{2\pi \Delta x_c} = \frac{\alpha}{2\pi \Delta t_c} = \frac{1}{2\pi \alpha^{-1} \Delta t_c} = \frac{1}{2\pi (137) \Delta t_c}$$

The denominator on the right side is the period of the frequency. Therefore:

$$\Delta E_{eH1} = \frac{h}{2\pi\alpha^{-1}\Delta t_c}$$

Also, the potential energy for a circular orbit can be expressed as:

$$\Delta E_{eH1} = f_{eH1}\,\Delta x_c$$

Therefore:

$$f_{eH1}\,\Delta x_c = \frac{h}{2\pi\alpha^{-1}\,\Delta t_c}$$

Solving for Planck's constant:

$$h = f_{eH1}\,\Delta x_c\,\Delta t_c\,2\pi\alpha^{-1}$$

This result defines Planck's constant in terms of properties of the hydrogen atom.

Defining Temperature

I have preliminarily defined temperature as:

$$T = k_T\,\frac{\Delta E}{\Delta t_c}$$

I have also derived:

$$h = k_T\left(\frac{2}{3}\,\Delta x_c\right)\Delta t_c$$

Solving for k_T:

$$k_T = \frac{h}{\left(\frac{2}{3}\,\Delta x_c\right)\Delta t_c}$$

Since:

$$h = f_{eH1}\,\Delta x_c\,\Delta t_c\,2\pi\alpha^{-1}$$

Then:

$$k_T = \frac{f_{eH1}\, \Delta x_c\, \Delta t_c\, 2\pi\alpha^{-1}}{\left(\frac{2}{3}\, \Delta x_c\right)\, \Delta t_c} = \frac{3}{2} f_{eH1} 2\pi\alpha^{-1} = 3 f_{eH1} \pi\alpha^{-1}$$

Defining Boltzmann's Constant

I have established a relationship between Planck's constant and Boltzmann's constant in the form of:

$$k_B = \frac{h}{\Delta x_c}$$

Substituting for Planck's constant:

$$k_B = \frac{k_T\, \frac{2}{3} (\Delta x_c)\, \Delta t_c}{\Delta x_c} = k_T\, \frac{2}{3} \Delta t_c$$

Substituting for k_T :

$$k_B = \frac{3}{2} f_{eH1} 2\pi\alpha^{-1}\, \frac{2}{3} \Delta t_c = f_{eH1} 2\pi\alpha^{-1}\, \Delta t_c$$

Or, in terms of momentum:

$$k_B = \Delta P_{eH1}\, 2\pi$$

Where:

$$\Delta P_{eH1} = f_{eH1}\, \alpha^{-1}\, \Delta t_c = f_{eH1}\, \Delta t_{eH1}$$

Defining Frequency

I have defined:

$$h = k_B\, \Delta x_c$$

Substituting for k_B:

$$h = \Delta P_{eH1}\, 2\pi \Delta x_c = \Delta P_{eH1}\, \lambda_{eH1}$$

Also:

$$\Delta E_{eH1} = h\omega = \Delta P_{eH1}\, \lambda_{eH1}\, \omega_{eH1} = \Delta P_{eH1}\, v_{eH1}$$

And, from an earlier result:

$$h = f_{eH1}\, \Delta x_c\, \Delta t_c\, 2\pi\alpha^{-1}$$

Yielding:

$$\Delta E = h\omega = f_{eH1}\, \Delta x_c\, \Delta t_c\, \alpha^{-1}\, 2\pi\omega = (f_{eH1}\, \Delta x_c)(\alpha^{-1}\, \Delta t_c)(2\pi\omega)$$

The first set of parenthesis contains the potential energy of the hydrogen electron in its first energy level. The second set is the period of time required for the electron to complete one radian. The third set is the angular velocity of the electron in units of radians per second.

This theory's definition of Planck's constant first changes frequency into radians per second. Then, it converts radians per second, for the subject frequency, into a measure of the number of radians traveled during the period of time required for the hydrogen electron to travel one radian. Finally, the result of the first two steps is multiplied by the potential energy of the hydrogen electron in its first energy level. In other words, Planck's constant uses fundamental properties of the hydrogen atom as the standard by which to convert frequencies into quantities of energy.

THE NATURE OF MASS

This theory has identified the property of mass as being the inverse of a fundamental measure of change of velocity of light. This nature of mass can be expressed as the property of acceleration of photons. The direction of this acceleration is different for different particles. It is the size of the associated acceleration and its direction that gives magnitude and polarity to mass.

Mass and the Radius of the Hydrogen Atom

Since the speed of light varies widely between the proton and electron of the hydrogen atom, then the length of a photon passing between them should change accordingly. In this case I cannot treat the whole photon length as a differential value. In this case, the differential of photon length is a much smaller value. It is useful to imagine a very small length of photon traveling from the proton to the electron. I will call this very small section of photon length a sub-photon.

The accelerating proton stores energy in this sub-photon. As the sub-photon moves away from the proton center, the speed of light increases dramatically and the sub-photon length increases dramatically. I have shown earlier that force is conserved in the photon and, for this example, in the sub-photon length. The force stored in the sub-photon is given by:

$$f_c = \frac{dE}{dx_{cc}} = \frac{m_p\, v_c\, dv_{cc}}{dx_{cc}} = m_p \frac{dv_{cc}}{dt_{cc}}$$

Since force is measured at a point then this formula applies equally well to each part of the sub-photon.

The effect of the changing length of the sub-photon with force remaining a constant is to cause a relativity type effect. The force is conserved while the sub-photon length increases. This means the same force is applied over a longer and longer distance. When the sub-photon reaches the electron, it is longer by the ratio:

$$dx_{cc2} = dx_{cc1}\ \frac{v_{ce}}{v_{cp}} = dx_{cc1}\ \frac{m_p}{m_e}$$

The electron has the force carried by the sub-photon applied to itself over a distance much longer than if a second proton had received the sub-photon. For this reason the electron accelerates *1,836* times faster than a proton. This is the reason why we measure an electron as having a much smaller mass than that of a proton.

Mass is the inverse of an acceleration. It is convenient, when working with the accelerations that represent the masses of the electron and proton, to identify them as:

$$a_{me} = \frac{1}{m_e}$$

And:

$$a_{mp} = \frac{1}{m_p}$$

I will sometimes refer to these accelerations as inverse mass. For an electron I can say:

$$a_{me} = \frac{1}{9.108x10^{-13}\,\frac{sec^2}{meter}} = 1.1x10^{30}\,\frac{meters}{sec^2}$$

And for a proton:

$$a_{mp} = \frac{1}{1.672x10^{-27}\,\frac{sec^2}{meter}} = 5.98x10^{26}\,\frac{meters}{sec^2}$$

These are both tremendous magnitudes of acceleration. However, since the magnitudes of mass are independent of distance, I will assume, as a first approximation, that these accelerations occur basically during one fundamental increment of time. In other words, the acceleration applies only to a single photon hypothetically having one end touching the center of a particle. The interpretation of this is that: Mass is the inverse of the acceleration of light due to the light-field of the particle over the length of what I will call the first-photon length.

I can use this acceleration, or inverse mass, along with the fundamental increment of time to calculate the length of a photon that, theoretically, has one end touching the center of a particle. The length of this first-photon is a function of its acceleration. For an electron this length is:

$$dx_{ce} = \frac{dt_c^2}{m_e} = a_{me}dt_c^2 = \frac{d^2x_{ce}}{dt_c^2}dt_c^2$$

Substituting the appropriate values:

$$dx_{ce} = a_{me}dt_c^2 = \left(1.1x10^{30}\frac{meters}{sec}\right)(1.602x10^{-19}sec)^2$$

Yielding the first photon length for an electron as:

$$dx_{ce} = 2.82x10^{-8}meters$$

Repeating this procedure for the proton:

$$dx_{cp} = a_{mp}dt_c^2 = \left(5.98x10^{26}\frac{meters}{sec^2}\right)(1.602x10^{-19}sec)^2$$

Yielding:

$$dx_{cp} = 1.54x10^{-11}meters$$

Within the hydrogen atom, the first level electron and the proton nucleus are considered separated by the length of a single photon. Both particles combine their light-field strengths and cause this photon length to be determined by the relative strengths of their light-fields. I will use this concept of first photon lengths for each of these particles to calculate the approximate length of the hydrogen atom first-photon length.

The proton light-field strength is assumed to be greater than the electron light-field strength by the ratio of the proton mass to the electron mass. I will include this effect when calculating for the photon length of the hydrogen atom. To do this, I multiply the first-photon length of the proton by the ratio of the masses. I then average the adjusted proton first-photon length with the electron first-photon length. The formula I can use is:

$$dx_{cH1} = \frac{dx_{ce} + \frac{m_p}{m_e} dx_{cp}}{\frac{m_p}{m_e} + 1}$$

Substituting the values:

$$dx_{cH1} = \frac{2.82x10^{-8}meters + (1.8356x10^{3})(1.54x10^{-11}meters)}{1.8366x10^{3}}$$

Yielding:

$$dx_{cH1} \cong 3.1x10^{-11}meters$$

This is an approximation for what this theory would predict for the radius of the hydrogen atom. The actual measured value is approximately $2/5$ larger than my answer. One possible reason is that I made my calculation from the perspective of the remote observer.

I have treated the speed of light as a variable. The electron and proton have different values for their individual speeds of light. Their combined effect gives a third value for the average speed of light inside the hydrogen atom. The speed of light as predicted by the electron at one photon length is:

$$v_{ce} = a_{me} dt_c \left(1.1x10^{30} \frac{meters}{sec^2}\right)(1.602x10^{-19}sec) = 1.76x10^{11} \frac{meters}{sec}$$

The speed of light as predicted by the proton at one photon length is:

$$v_{cp} = a_{mp} dt_c = \left(5.98x10^{26} \frac{meters}{sec^2}\right)(1.602x10^{-19}sec) = 9.58x10^{7} \frac{meters}{sec}$$

I presume that the proton speed of light has a greater effect than does the electron speed of light. I do this because of the much larger mass of the proton compared to that of the electron. I allow for this increased effect by multiplying the proton speed of light by the ratio of its mass to the mass of the electron. Combining the values into an average:

$$v_{cH} = \frac{v_{ce} + \frac{m_p}{m_e} v_{cp}}{\frac{m_p}{m_e} + 1} = \frac{\left(1.76x10^{11} \frac{meters}{sec}\right) + (1.8356x10^{3})\left(9.6x10^{7} \frac{meters}{sec}\right)}{1.8366x10^{3}}$$

Yielding:

$$v_{cH} = 1.92x10^{8}\frac{meters}{sec}$$

These results reveal the velocity of light predicted by the proton to be approximately equal to $1/3\ C$ (even more accurate is C/π), and the velocity of light predicted for the hydrogen atom to be approximately $2/3\ C$ (also here $2C/\pi$ is more accurate). Since the local velocity of light inside the atom is approximately $2/3\ C$, then a local observer would measure the radius of the atom to be larger by approximately $1/3$ over that of the remote observer. The local measurement of radius of the hydrogen atom is:

$$dx_{cH1L} = dx_{cH1}\frac{3}{2} = (3.1x10^{-11}meters)\frac{3}{2} = 4.7x10^{-11}meters$$

Or:

$$dx_{cH1L} = dx_{cH1}\frac{\pi}{2} = (3.1x10^{-11}meters)\frac{\pi}{2} = 4.87x10^{-11}meters$$

These answers are the approximate size of the radius of a hydrogen atom. The values are both good approximations when it is remembered that they were derived using the idea of mass being the inverse of the acceleration of light due to the particle in question.

The reason I offer the local perspective as being the most representative measure of the atom is that all phenomena by which we measure this radius occur on a local basis. We are measuring the result of a local encounter. For example, the energy of the first level electron can predict a radius length only from the local perspective. This is because the calculation does not take into account any relativity type effect upon the measurement of length. The results obtained depend upon the speed of light always being equal to C. The speed of light is a constant only on the local level.

Universal Gravitational Constant

Newton's formula for the force of gravity contains the proportionality constant G. Since there is no fundamental force of gravity then what physical phenomenon does G represent? The answer can be gained from a close inspection of the force formula. Newton's formula for the force of gravity contains expressions for two separate masses:

$$f = \frac{Gm_1m_2}{r^2}$$

This is significant because his fundamental force formula contains an expression that has only one term for mass:

$$f = ma$$

There is an important clue in this difference between the formulas. There is awkwardness between these two formulas that should not persist. This point can be demonstrated by altering the second formula:

$$f = \frac{dE}{dx} = \frac{mv_p dv_p}{dx} = ma$$

The point is that Newton's force formula for gravity should be easily manipulated into all of the forms shown above. What is specifically not clear is how to show:

$$\frac{Gm_1m_2}{r^2} = \frac{mv_p dv_p}{dx}$$

What I wish to show is that one is theoretically derivable from the other. To be more accurate, there is a connection in this new theory; however, it leads to a new perspective on the nature of force.

Two new clues are available to help decipher this riddle of the force of gravity. One clue is that the units of G are velocity to the $4th$ power. The second clue is that force is dimensionless. The new theoretical tool which this makes available is that force times force or force divided by force is still force. In other words, a single force can be the product or quotient of any number of other forces. The units still match because there are no units.

The new units of the universal gravitational constant inserted into the force of gravity formula allow me to move easily between the different fundamental forms of a force equation. First I recognize that an incremental change in velocity has units of velocity. This means I can anticipate that:

$$G = v_1 dv_1 v_2 dv_2$$

If this is true, then, I can write:

$$f = \frac{Gm_1m_2}{r^2} = \frac{v_1 dv_1 v_2 dv_2 m_1 m_2}{r^2}$$

Yielding:

$$f = \left(\frac{m_1 v_1 dv_1}{r}\right)\left(\frac{m_2 v_2 dv_2}{r}\right)$$

And since:

$$r = n_r dx_c$$

Then:

$$f = \frac{1}{n_r^2}\left(\frac{m_1 v_1 dv_1}{dx_c}\right)\left(\frac{m_2 v_2 dv_2}{dx_c}\right)$$

Rewriting this into a general form:

$$f = \frac{1}{n_r^2}\frac{dE_1}{dx}\frac{dE_2}{dx} = \frac{1}{n_r^2} f_1 f_2$$

When the radial quantum number is equal to one then:

$$f = f_1 f_2$$

This suggests that Newton's basic formula for force of gravity consists of the product of two other measures of force. I will shortly give a physical interpretation for these two forces. For now I develop further mathematical representation for the force of gravity. Acceleration can be expressed as:

$$a = v\frac{dv}{dx}$$

I substitute this into the force formula given a few steps above:

$$f = \frac{1}{n_r^2} m_1 a_1 \, m_2 a_2$$

Comparing this to Newton's force of gravity formula, I convert the formula above into:

$$f = (a_1 a_2)\frac{m_1 m_2}{n_r^2} = (a_1 a_2 \, dx_c^2)\frac{m_1 m_2}{n_r^2 \, dx_c^2} = (a_1 a_2 \, dx_c^2)\frac{m_1 m_2}{r^2}$$

I then conclude that:

$$G = a_1 a_2 \, dx_c^2$$

What is this acceleration that helps to form the value of G? I can reasonably anticipate our macroscopic concept of gravity is formed from quantum values of a primary value of gravitational force. What I mean is: Two particles of matter, either protons or neutrons, would experience the first quantum level of gravity at a distance of one photon length.

This is what I will anticipate to represent the first quantum level of gravity. As a first approximation I don't include an electron as one of the particles because they are almost insignificant in our macroscopic measurements of gravity.

In order to test this hypothesis I solve for the acceleration contained in G. Since I am thinking in terms of two identical particles, their accelerations are equal and I can write:

$$a_G = \left(\frac{G}{dx_c^2}\right)^{\frac{1}{2}} = \left[\frac{6.673x10^{-11}\dfrac{meters^4}{sec^4}}{(5.0x10^{-11}meters)^2}\right]^{\frac{1}{2}}$$

Yielding:

$$a_G = 1.6x10^5 \frac{meters}{sec^2}$$

I need to compare this result with the acceleration predicted by using Newton's gravitational force formula:

$$f = \frac{Gm_1m_2}{r^2} = \frac{\left(6.673x10^{-11}\dfrac{meters^4}{sec^4}\right)(1.672x10^{-27}kgm)^2}{(5.0x10^{-11}meters)^2}$$

The acceleration of one of the protons is:

$$a = \frac{f}{m_p} = \frac{7.5x10^{-44}newtons}{1.672x10^{-27}kgm} = 4.5x10^{-17}\frac{meters}{sec^2}$$

Comparing this result to the acceleration obtained using G it appears there is no connection. However, there is a connection if I make a comparison using force instead of acceleration. The force on a proton using the acceleration I obtained from G is:

$$f = m_p a_G = (1.672x10^{-27}kgm)\left(1.6x10^5\frac{meters}{sec^2}\right)$$

Yielding:

$$f = 2.7x10^{-22}\ newtons$$

I observe this force to be the square root of the value of force obtained using Newton's formula. The units of Newton's formula would make this into a real dilemma. However, recognizing that, in this theory, force has no units removes this dilemma. One force can be the square root of another force. What needs to be explained is: What can be the physical interpretation of the product of two forces?

The answer to this question comes from recognizing that there are two ways to measure the acceleration of the two protons. A remote stationary observer would measure each proton as having equal accelerations with respect to the observer. A local observer located on one of the protons would measure an acceleration of one proton with respect to the other proton. This observer's measure of acceleration would be different from that obtained by the stationary observer. The path of the theoretical connection between the two is to use force.

For the stationary observer there is a different value of force with which to work. He uses a value of force that will predict a proton's acceleration with respect to him. This is not the same value of force that must be used to measure the acceleration of one proton with respect to the other proton. For the local observer:

$$f_L = m_p a_L$$

For the remote observer:

$$f_R = m_p a_R$$

I now use as a guide the formula derived above which shows Newton's force of gravity to be the product of two other forces. In other words, I assume the value of the remotely measured force to be the square of the locally measured force. The mathematical expression of this is:

$$f_R = f_L^2$$

Or:

$$m_p a_R = m_p^2 a_L^2$$

Newton's formula gave me the remote value of acceleration. Now I solve for the local measure of acceleration:

$$a_L = \left(\frac{m_p a_R}{m_p^2}\right)^{\frac{1}{2}} = \left(\frac{a_R}{m_p}\right)^{\frac{1}{2}} = \left(\frac{4.5x10^{-17}\frac{meters}{sec^2}}{1.672x10^{-27}kgm}\right)^{\frac{1}{2}}$$

Yielding:

$$a_L = 1.6x10^5\frac{meters}{sec^2}$$

This is the measure of acceleration I obtained using G. I conclude that the mathematical expression of G is:

$$G = a_{pL}^2\, dx_c^2$$

The interpretation for this result is: The fundamental gravitational constant is the square of the local acceleration due to gravity of one proton toward another proton multiplied by the square of the distance between them. The distance is the length of one photon.

There is an appearance of an artificial aspect of this result. Since the acceleration due to gravity is formally defined using the fundamental gravitational constant, then the equation can seem to be defining G with an expression that ultimately contains G. This is not the case. The reason is that the acceleration due to gravity in this theory is due to the variation of the speed of light.

The variation of the speed of light is the fundamental given from which all effects are derived. Therefore, the phrase, the local acceleration due to gravity, is to be understood as the local acceleration of light. When read this way, the equation actually defines G in terms of the variation of the speed of light.

Particle Polarity

The empirical evidence of electrical type effects demonstrates that there is a cause of polarity and it is connected to particles of matter. Electrons will voluntarily move toward protons. Electrons will voluntarily move away from other electrons. The effect named polarity, as with all effects, must be caused by the primary cause. The primary cause is the variation of the speed of light.

I have already used, for the purposes of defining the size of the hydrogen atom, the idea that electrons cause a positive exceleration of light and protons cause a negative exceleration of light. There is, therefore, a natural polarity of the change of velocity of light. This is the starting point to begin theorizing the polarity of electrical effects.

The speed of light is under the control of particles of matter. The theoretical model of the light-field, which I have used only for convenience, is superfluous. Since particles of matter are already defined, there is nothing else needed. The particles of matter are the form of existence of the primary cause that I have called light-fields. In an analogous manner, it can be argued that there is no universal background of emptiness. The integrated extensions of particles are the definition of space.

Although particles can theoretically be said to be infinite, the effect we measure as the mass of a particle is detectable almost solely within the length of a single photon. Beyond this distance, the particle's effect becomes greatly diminished as evidenced by the difference of magnitude between electrical force and gravitational force.

What have been known as charged particles are high and low points in the continuum of space or, as space can more accurately be defined, are high and low peaks in the continuum of the control of the speed of light. They are high and low points in the speed of light. Their overlapping effects are what I have defined as the background light-field. I will use this visual aid again here. The background light-field is a relatively constant speed of light. Its variations are measured as the effect we call gravity.

I picture electrons as the high peaks and protons as the low peaks with respect to the background light-field. Since electrons and protons are attracted toward each other, I anticipate that there is something about the polarities of their excelerations of light that causes this attraction. If this is the case, then it implies that the variation of the speed of light is one of two fundamental aspects of the universe.

There are, it seems to me, two causes of change in the universe. There is, of course, the variation of the speed of light. The first aspect is that there are permanent sources of a change of velocity of light. These sources are called particles, and they guarantee there will always be variations in the speed of light.

The second aspect is that light acts to neutralize variations in its speed. The movement of an electron toward a proton accomplishes a minimization of their individual effects upon the speed of light. In other words, their opposing effects increasingly overlap and tend to counteract each other. It is as if the speed of light needs to try to be a constant.

The existence of individual electrons and protons disrupts this goal. The combining of electrons with protons is an approach toward this goal. Also, the movement of one electron away from another electron has the same effect. I define a positive electrical polarity for matter if the speed of light increases with distance from the particle. The polarity is negative when the speed of light decreases with distance from the particle.

The effects we have known as electrical repulsion and electrical attraction are the result of these two opposite polarities causing particles to move in a manner that tends to neutralize changes of the speed of light.

Photon Electromagnetism

I have treated the electromagnetic properties of photons as if they were represented by a two dimensional tilt. This is a gross simplification for what would actually occur. The photon is assumed to be perfectly pliable in order that it is able to accurately record any history of changes in velocity. The idea is to account for all force effects by using unique shapes for the photon.

The photon is assumed to be very thin. This does not foreclose on the possibility that the thickness of the photon may change. I am only considering at this time the linear shape and orientation of the photon. It can be pictured as a short piece of soft wire which will accept any three dimensional shape. A photon can be bent into various forms. These forms include all practical possibilities. Also it is assumed that some force effects can be accounted for by only twisting the photon. Any variations of twists can be included into the shape of the photon. In principle a photon could be shaped like a corkscrew or could contain sharp bends.

All of these possible variations of bends and twists result from overlapping light-fields, or particles, which are changing their velocities with respect to each other. The photon acquires a recorded history of the changes in light speed that it has encountered. It also is sharing a portion of its historical record with the light-fields it encounters. It acquires and transfers energy. For the photon and light-field to interact, the light-field must have a gradient. If a photon traveled through a flat light-field, there would be no interaction.

Every possible kind of change of velocity can be recorded onto the photon in this manner. Sometimes there may be only very subtle differences between photons. One phenomenon that might be accounted for in this manner is when two spectral lines are found where only one is expected. It is this phenomenon that originated the idea of electron spin. While there clearly must be some difference between the two electrons, they would also have experienced very similar histories of changes in velocity. They have a very close relationship.

Perhaps the great similarities and the minor difference will be accounted for by defining two resulting photons with exact shapes but being mirror images of each other. Whether it is mirror image or some other kind of symmetry, the photons could share almost all of the same spectral properties while differing only by being reversed in some single manner.

Gravity

All effects are the result of a change in the speed of light. Therefore, there must be a relationship between the effect we call gravity and that which we call electromagnetism. It has been assumed in modern physics, as a fundamental given, that the magnitudes of electric charge of an electron and proton are the same. Certainly within the limits of accuracy of measurements, empirical evidence indicates they can be treated as being identical. However, caution should be exercised in reaching an absolute conclusion. If we cannot measure absolutely, then we do not know absolutely.

It is known there are force effects differing so greatly in magnitude that one can completely mask the other. For example, gravity is completely masked by electrical force because their effects differ in magnitude by approximately forty powers of ten. It is risky to close out new possibilities by insisting that the magnitudes of the electric charge of the electron and proton are exactly equal.

Force results from the variation of the speed of light. There are two aspects of this variation. One is the continuous variation of the speed of light. Another is the discontinuous variation. The first is the light-fields we call particles of matter. The second is the increment of change in the speed of light stored in photons. Electrical force is explained by attributing positive and negative excelerations of light to different particles of matter. Where, then, does the effect of gravity come into play?

This theory says that gravity is also caused by the variation of the speed of light. Freely falling bodies of matter change their velocity as a function of the changing velocity of light. The simplest expression of this effect is to say the accelerations of light and of matter are equivalent.

Even though I use exceleration and acceleration to explain the effect of force, they are not themselves the same thing. They are different types of measurement of the same event. For the purpose of explaining the physical basis of gravity, I will use the measurement of exceleration. The usefulness of the concept of exceleration is due to its being a measurement of change of velocity with respect to distance.

Since all effects of force are the result of the interaction of photons with particles, then it can be instructive to visualize what occurs over the incremental distance of particle change of velocity. All such distances are smaller, usually much smaller, than the length of a photon. However, distance is always involved and, therefore, intervening circumstances are not constant. In other words, effects theoretically constant at a point in space are usually not constant in observable events because distance is involved.

When measuring the effect called gravity, increments of distances are involved across which the speed of light is varying. This variation of the speed of light reveals itself in a change of energy of a passing photon. If a point in space is used to observe the passing of a photon, then during the passing of the photon the changing speed of light will cause the energy of the photon to vary. If the photon is moving into an area where the speed of light is increasing, then the length of the photon is increasing and its degree of tilt is decreasing. In other words, the stored electrical force of the photon is decreasing in magnitude. It is this change in the magnitude of electrical force which is the origin of the effect we call gravity.

Another useful way of visualizing the cause of gravity is to picture two photons moving through a changing light-field in opposite directions and moving very near to the same point. The two photons have their leading ends about to cross approximately the same point. Even if the photons received their initial stored force under identical circumstance, they will cause two different magnitudes of effects. It is the difference in magnitude of photon energy that is the origin of the effect called gravity.

It is assumed that at any particular point in space where electrical force is considered to be neutral, that there are actually vast numbers of electrically charged photons moving in all directions, and their average electrical effect can be considered to be zero. There is, in this theory, the prediction that observable things are not truly neutral and there is a measurable resultant effect.

I consider the case where two photons are approaching a point from opposite directions and in the neighborhood of a charged particle. Even though at a given point the effects of the photons might cancel out, this cannot be the case for the total effect of the photons upon the charged particle. A background light-field gradient makes neutrality beyond the point impossible. The effect between photons and matter does not occur at a point. The effect is felt over the detectable extension of the light-field of the particle. The particle will then be caused to move in response to the photon made stronger by the light-field gradient. This response to the stronger photon is the cause of the effect we call gravity.

There is another useful way to visualize what is occurring. It is assumed that one proton sends out simultaneous identical photons to a remote isolated electron and an equally remote isolated proton. The receiving electron and proton are exactly the same magnitude of distance away from the first proton. It is assumed that this distance is such that both receiving particles are measurably affected by the light-field of the first proton, but are not measurably affected by each other. It is also assumed that the first proton is fixed in space. The electron will interact with the photon and as a result the electron will move toward the first proton. The second proton will interact with its photon and will move away from the first proton.

Even if the energies of the two photons were identical, their resultant electrical effects would not be the same. Since each receiving particle is moving during the time it takes to receive the total energy of its photon, different changes of distance with respect to the light-field of the stationary proton would change the total amount of energy delivered by its photon. The electron would move more closely toward the stationary proton. Its deeper penetration into the light-field of the stationary particle would cause it to receive more energy than would the second proton. It is this difference in total received change of energy which is the origin of the effect we call gravity.

In all these examples the cause of gravity is the same thing. It is the change in the speed of light over the incremental change of distance the particle travels while absorbing a photon's energy. In other words, it is the change of length of a photon and the corresponding change in the tilt of the photon during the fundamental increment of time. If there are two hydrogen atoms in proximity to each other, and only their own respective light-fields have gradients, then they will be attracted toward each other by a force proportional to their two masses.

Each atom is almost electrically neutral except for the resultant light-field gradient, which causes gravity. Their resultant gradients make each atom appear a very little bit like they are positively charged. If electric charge were true then all atoms would repel each other. Since there is only the change of the speed of light, then the examples given above may indicate why atoms are attracted to each other.

The reason is that the electrons are attracted toward each opposite atom more strongly than the protons are repelled. This stronger attraction results from the electrons moving in the direction of a stronger light-field gradient. The protons are repelled much more slightly into the direction of a weaker gradient. This means that two photons, interacting with the two kinds of particles and which are identical at the initial time of impact, will have their energies changed slightly in opposite directions of magnitude during the period of interaction.

The change in magnitude of energy for each photon will be half of that of the total change of potential energy of the light-field. This is an approximation that can be made based upon a linear interpretation of the change in energy. The change is zero at the beginning and reaches the maximum value at the end of the interaction. Treating the problem linearly means the total change of energy transferred to the particle is one half the change in potential energy.

Each particle receives one half the change in potential energy for the direction it is moving. Since the changes in potential energy are different for each, then it is one half of the difference between the potential energies that propels one atom toward the other. This is just an approximation. Since the gradient of the light-field is not changing in a linear manner, then we can expect the difference in potential energies to be very slightly higher than when it is calculated linearly. The force of gravity then should become stronger as the atoms become closer.

Gravity is pictured as being generated by the imperfect neutrality of the electron and proton of the hydrogen atom. Therefore, gravity exists only outside the hydrogen atom. What is then the case for more complex atoms? Do they have gravity inside the atom? The answer lies in an understanding of neutrons. This understanding will show that neutrons also generate the gravity effect. There is, therefore, gravity inside all atoms containing neutrons.

Newton's formula for the force of gravity treats it as if it were exactly inversely proportional to the distance of separation squared. This assumes the universal gravitational constant to be truly a constant. Since this constant is a function of the change in the speed of light, it is not really a constant. It is decreasing with distance the same as is the speed of light. For example, Mercury should experience stronger gravitational pull than expected based upon a universal gravitational constant measured with respect to earth.

It is interesting to observe this new interpretation of the effect called gravity as leading to both contraction and expansion properties of the universe. It follows from the work here that gravity results from the formation of atoms. That is, particles of opposite polarity join together to form atoms that are very nearly electrically neutral. When atoms are interacting with one another they respond in the manner described above. This is true also for electrons interacting with atoms.

On the other hand, individual protons would experience reverse gravity. An isolated proton caught in a gravitational field will move away from the source of gravity. Such protons would tend to isolate themselves from all positively charged or neutralized matter. They would have a repulsive effect against that kind of matter. This means isolated protons would push the universe apart while atomic matter attracts other atomic matter. Loose electrons would try to capture the isolated protons turning them into atomic matter that would move to join other atomic matter. However, when energetic photons knock an electron sufficiently far away, the proton will seek to move back into isolation.

A New Equivalence Principle

There is a claim by Einstein that because a person in free fall experiences no sense of being under the influence of a force there is then for him no force of gravity. He is merely doing a very natural thing as explained by the general theory of relativity. In general relativity the force of gravity does not need to be explained any more than does the experience of moving at a constant velocity with no resistance.

This claim, if correct, gives gravity a different nature than all other forces. Since gravity actually has the same nature as all other forces then Einstein's claim must be wrong. The error he made, in simplest terms, was to ascribe something to gravity that belongs to all acceleration. In principle, any *body* undergoing pure acceleration will feel nothing. The cause of the acceleration is not a factor if the acceleration is pure and complete in its application.

There is certainly something felt during most accelerations so what is it? What is felt is distortion and compression. If a body is pushed on one side only, it will undergo compression. If a body is pushed at one small part only, it will undergo both compression and distortion. We feel the effects of changes in the distance between our molecules and atoms. We feel nothing if all particles in our body suddenly accelerate in perfect unison. During free fall due to gravity this situation is very closely approximated.

What then is to be said of the principle of equivalence? Let us examine a common example cited in support of this principle. The example is of a sequestered scientist inside a windowless room. The point stressed is that there is no way for the scientist to determine whether he is feeling the effect of gravity or the effect of acceleration. Since the scientist cannot devise a test to determine why he remains standing on the floor, the conclusion is made that gravity and acceleration are the same phenomenon. In other words, if we can't tell the difference then there is no difference.

There is a revealing connection between this example and the importance of first properly understanding force. This connection is: An analysis of force tells us there is a difference between the effect of gravity and the effect of acceleration. In the case of gravity we know there are two forces at work on the scientist. Gravity exerts a force on him trying to pull him downward. The floor of the room is exerting a second and separate force pushing upward against him. There are two equal but opposite forces at work. These two forces cause compression and distortion.

In the case of acceleration there is only one force at work on the scientist. This force is the floor pushing him upward. Therefore, the difference between the two situations is a difference in the number of forces at work. The fact that the scientist cannot distinguish between the two cases does not prove gravity and acceleration are the same thing. All he needs is a window to prove they are different.

What we do learn is that we cannot distinguish between different combinations of force so long as they add up to the same effect. In these two cases the effect felt is not acceleration. It is almost identical compression and distortion to the scientist's body. Therefore, it is force that is suggested to be of a common nature. The equivalence principle belongs to all force.

Nuclear Physics

Nuclear physics is the crucial next step to take in this theory. I am not at this time offering a formal introductory analysis of nuclear reactions. I need to take more time to comprehend the current fundamental understanding and empirical evidences of nuclear physics. All theory involves conjecture. I hope that, up to this point, I have provided a theory with strong substance and little conjecture. From this point on there is mostly conjecture. Before proceeding I want to stress that all we know from empirical evidence is the mechanical universe is gauged by changes in velocity.

Perhaps particles such as neutrinos exist and perhaps they don't. There are many other mysterious particles that are believed to exist. My own approach to the problem of identifying which particles do exist and which do not is first to acknowledge that we know only that there are nuances to empirically measured changes in velocity. We should try to explain these nuances. However, empirically speaking, they will always remain just changes in velocity. The tendency to identify new particles or new dimensions as the causes of these nuances is risky. It’s analogous to the risks encountered in field theory.

Once we decide we have found a new particle or a new force field, we are tempted to stop our search. We do not feel a need to look further unless new empirical evidence provides a nuance that seems to challenge our belief. Since our only source of information about the universe is photons carrying increments of changes of velocity, all of our interpretations of this information are strictly beliefs. Beliefs can change.

We should use helpful ideas, but we should not rest upon them. This can sometimes be hard to do. I point out to the reader I have practiced this resistance myself as demonstrated in this book. I found myself forced time and again to discard accepted hard-core ideas. One instance, during which I felt particularly uncomfortable, was accepting the realization that there is no such thing as electric charge. Once I understood this and forced myself to search for a new meaning behind the empirical number we identify as the magnitude of electric charge, I was able to find a new and, I believe, better theoretical answer.

As we look deeper into atomic reactions, I suggest we resist assuming new primary causes. Or, at least let us avoid insisting that those we must invent are real. It is essential for a unified theory to move seamlessly between all areas of physical phenomena. For the reader who finds merit in this theory thus far, here is a point where you can move beyond my work. I will make some suggestions as to how I would approach interpreting nuclear reactions.

First, I would begin with as few particles of matter as possible. The two I would choose to begin with are the electron and positron. Also, there are some theoretical tools to carry along. All effects must be traceable to variations in the speed of light. For example, the strong nuclear force might be evidence that when fundamental particles are very close together, the slope of their combined light-fields may reverse itself for a small distance between them.

One other tool to try using is to assume, first, that photons must be involved. For photons to be involved in nuclear reactions, their length must be caused to shrink drastically. They would have to be at least as small as the size of a proton. Such small photons require that the local speed of light be proportionately reduced.

A tool that can always be counted upon to work in all circumstances is what I have called the fundamental increment of time. It is always an absolute constant. The discussions that follow are not part of a rigorous presentation of theory. They are intended to be suggestive of ideas that may be useful for extending this theory.

Neutrons

Neutrons are defined as being electrically neutral. This definition is not logically maintainable. The neutrality of a neutron cannot unquestionably be interpreted as electrical neutrality. The reason is that one neutron cannot pass through another neutron or any other particle of matter. It also cannot be the case that neutrons can bang against each other because they are tiny balls of matter. There is no evidence at all that there is anything material about matter. The concept of materiality is a theoretical invention reflecting macroscopic interpretations.

Field theory and materiality are incompatible. In this theory it has been argued a particle of matter consists only of a light-field. It is assumed here that neutrons also consist of a light-field or a combination of light-fields. It has also been argued there can be no effect of force without the catalysts called photons. Therefore, I further assume the interaction of neutrons with other particles through photons. If this is all true, then neutrons cannot be completely electrically neutral. Neutrons, like all matter, exhibit the property of gravity. Gravity is electrical in origin. It is an extremely subtle electrical effect.

Since a neutron can cause the effect of gravity, then neutrons cannot be completely electrically neutral. This is consistent with my fundamental postulation that all effects are the result of the variation of the speed of light. If the variation of the speed of light is the cause for all effects, this requires there cannot be absolute neutrality. Absolute neutrality, i.e. a constant speed of light, would result in no effects.

Neutrons must also be defined using the variation of the speed of light. Simplicity suggests a neutron might be formed from the combination of a proton light-field and an electron light-field. This combination would allow for the appearance of electrical neutrality while accounting for the effect of gravity. Empirical evidence supports this approach. When a neutron disintegrates it separates itself into an electron and a proton. It is then reasonable to assume that if it separates into an electron and proton, then it probably consisted of the combination of an electron and proton or at least of their possible constituents.

In fact, the similarity of gravitational effects between a hydrogen atom and a neutron suggests some probable physical similarity between the two. It is assumed this similarity consists of an electron orbiting a proton. How can an electron orbit a proton at such a close distance? What is required is that the two light-fields combine in such a way so as to shrink the size of a photon down to less than the size of a neutron.

This means the local speed of light inside a neutron is sufficiently lowered to allow this amount of shrinkage to occur. To an outside observer, who defines the speed of light as a universal constant, the effects of the very low speed of light would be interpreted as being due to objects of very large mass.

Formation of Atoms

The acceleration of light raises the question of a polarity for mass. It is assumed that the acceleration of light due to a particle can be positive or negative. I define a positive polarity for mass if the speed of light increases with distance from the particle. The polarity is negative when the speed of light decreases with distance from the particle.

I will assume, since the source of a positive acceleration of light attracts the source of a negative acceleration of light, that there is a natural goal or speed which light is directed to achieve. I will further assume this goal or speed to be constant. That is to say, the acceleration source moves in a direction that will accomplish the most diminishing effect upon the acceleration of light.

The proton moves toward the electron and vice versa because opposite accelerations of the speed of light tend to cancel each other out. Particles, which are the source of the imbalance of the speed of light, try to move in directions tending to cancel out the imbalance they cause. There are important limitations on the ability of particles to achieve some balance in the speed of light. I will give two of them here.

One is, the particles do not move toward or away from each other just because of the gradients of their light-fields. They can only react to the intermediaries of light, the photons. The existence of light-fields does not cause any direct action between particles. If it weren't for the existence of photons, particles would have no means for revealing their existence to one another. Particles need photons as the catalysts to enable them to move.

The photons are the catalysts because they carry acceleration with them. The amount of this increment of acceleration will not normally be the precise amount that would allow for a secure balancing of effects to occur. The particles accelerate in response to the history of motion of other particles. The timing is late, and the acceleration is not the correct amount needed at that late instant of time.

Photons gain their increments of acceleration from the motion of the particles. Acceleration is being passed back and forth. This exchange of acceleration back and forth between photons and particles will not let either of them achieve a lasting balance. Usually there will not be a balance achieved between the light-fields. The normal condition is that the only balance that can occur often enough to allow for a predictable universe is the balance of acceleration between photons and particles. When this kind of balance is achieved, atoms form. Even more than this, perhaps protons and the like also form in an analogous manner.

Protons

Empirical evidence used to support quark theory shows protons not to be primary particles but to consist of other more primary particles. Since quark theory depends upon the existence of electric charge, then there is a need for a new theory concerning the structure of the proton. Electric charge does not exist. Therefore, quark theory must be wrong.

It would seem to be the case that, since a proton measures to have an apparent electric charge equal but opposite to that of an electron, there is a connection between a positron and a proton. If we could work with only electrons and positrons to build the universe, this would be an attractive alternative to current quark theory.

I speculate, at this point, that a proton consists of two positrons and one electron circling each other at distances less than the empirical size of a proton. While this idea will not be further developed here, it is interesting to also speculate that a neutron might then consist of two electrons and two positrons tightly bound together by photons under conditions where the speed of light is greatly reduced.

The key to understanding unexpected variations of the masses involved is to recognize that each mass is dependent upon the relative speed of each particle. If combined masses are larger than expected, it is because the particles are moving at speeds that significantly lower the local speed of light within confined spaces that are very much smaller than the size of an atom.

The difference in the masses of combined particles, from their expected values, is the key to solving for their higher speeds. The speeds of the constituent particles must be higher in order that the speed of light be slower. The speed of light must be slower in order that the length of local photons becomes smaller. The substantial lowering of the local speed of light is required for photons to be small enough to mediate interactions on such a small scale of size.

Quark Theory and the Speed of Light

In quark theory, electric charge is divided between sub particles by fractions of three. In this new theory, electric charge is the fundamental increment of time. This increment of time cannot be divided. It is the fundamental constant of the universe. There must then be a different divisible quantity that is responsible for the apparent success of quark theory. Since all the quarks have been found it could seem incredible to suggest they do not exist. However, as pointed out in the very beginning of this work, nothing has ever been empirically observed except velocity and change of velocity. Each quark represents a specific pattern in change of velocity. It could be the case that the patterns result from different causes that fit the same patterns.

When we fit a theory to a known empirical pattern we should not take permanent comfort from the theory even if it does predict the next steps in the pattern. It is the pattern itself that is doing this. The theory does not add to the pattern. It only adds an interpretation to it. There is nothing which the theory can predict which was not already contained within the initial assumed foundation upon which the theory was developed.

Furthermore, our theories are restrictions on the truth. As we learn more, the limitations of our theories become apparent. The pattern, having become more complete, then requires a new theory. If electric charge is really the fundamental increment of time, then we need new theory for everything, including quark theory, using electric charge.

The work performed earlier, showing how the speed of light varies within the hydrogen atom, also shows a different quantity that may be inherently divided into fractions of three. This quantity is the only given in this new theory. The speed of light within the hydrogen atom is divided into fractions of three. The light-speed predicted by a lone proton is $1/3\ C$. The light-speed predicted by the combination of the electron and proton is $2/3\ C$.

This division of the speed of light within the hydrogen atom relates to atomic dimensions. How can it also be applied inside a proton or neutron? Sub particles are interacting with one another in a way that appears to form a larger particle such as a proton. It may be this division of the speed of light applies on the much smaller scale of sub particle interaction. Whatever the case is, sub particle properties must be derivable completely from the effects of the variation of the speed of light.

If a proton is made up of sub particles, then these sub particles must be interacting with each other by means of photons. Strong, very slow speed light-field strengths can shrink photon length dramatically. Using these super shrunken photons, sub proton particles could be expected to be orbiting one another at extremely small distances. Their interaction may occur at a reduced scale, but not necessarily with a change in character from the interactions at the larger scale where an electron and proton interact.

Creation of Matter

The creation of matter from pure energy is a routine physics experiment. This possibility was first predicted by Einstein's pinnacle formula which equates energy with mass times the speed of light squared. His equation and its interpretation are not accepted as being correct by this new theory. There does not appear to be any reason to expect that the light-field of a particle can be changed into a photon. There is equally no reason to expect that two photons colliding can change into a light-field. In any case, there is reason to try to use the minimum number of miracles.

Since there is no prediction for converting back and forth between energy and matter, then what is the possible explanation for the apparent success of this routine physics phenomenon? The explanation must lie within the atom. It is repeatedly shown that photons of sufficient energy can appear to convert themselves into new matter and antimatter when passing near the nucleus of an atom. It is reasonable to conclude that the matter and antimatter must have already been a part of the atom and its nucleus. This may be the reason why photons cannot be converted into matter in free space.

What can explain the reverse effect? When matter and antimatter collide, the matter disappears and energetic photons are produced in its place. From the perspective of this new theory, it would appear that if matter and antimatter join together and become undetectable then their individual effects upon the acceleration of light have neutralized each other. The resulting photons are the evidence of the changes of velocity undergone by the particles as they join together. The photons were not created by the collision. They are always in existence and the means by which change of velocity occurs. The energy they carry is always given to them by particles that have changed their velocity.

The particles also do not go out of existence. If we can no longer see them then it is because they are no longer changing their velocity on a scale that is perceptible. It does not automatically follow that the new matter which results would also have completely lost its ability to cause the effect we call gravity. In other words, the result of the joining of matter and antimatter is the disappearance only of a detectable effect upon the speed of light.

The energetic photons that are produced are simply evidence of the reaction between the two particles of matter. Nothing happens without photons being involved. The photons are carriers of changes in velocity. The photons are carriers of information. They are the record of what happened, and the immediate cause of what will happen.

If it is true that all empirically created particles of matter are actually already in existence within the atom and its nucleus, then this is one possibility for the apparent success of quark theory. If there are particles within particles, then the successful theory needs only to contain an accurate accounting of the observed patterns of changes of velocity.

Antimatter

A positron has the same mass but opposite electric polarity of an electron. In other words, a positron has the same magnitude of first photon acceleration but its speed increases instead of decreases with distance from the center. The light-field interpretation of a positron can be pictured as one that begins at the same magnitude of light speed as does an electron. The positron light-field, then, forms the mirror image of the electron light-field. Whereas the electron's light-speed decreases with distance, the positron's light speed increases with distance in a symmetrical manner. When these two light-fields are superimposed upon one another they would theoretically cancel each other's effects.

It is possible to give analogous explanations for other types of antimatter. Whatever the case proves to be, it must be compatible with the only primary cause existing within the universe. The variation of the speed of light is the primary cause and origin of all physical effects. Any presentation of any part of this theory will begin with this claim as its starting point. It will define particles only by their ability to cause a variation in the speed of light.

Complex particles would be defined as local combinations of simpler particles. This will include particles that may have only a very slight force of gravity effect. All force and its variation will be derived from the ability of photons to store increments of the variation of the speed of light. Neither matter nor photons will be converted or created.

It is indicated empirically that protons consist of combinations of more primary particles of matter. It is assumed, as a part of the investigation of the nature of matter and antimatter, that there may be only two primary particles. Even if there are more such particles, it is useful to begin with as few as possible and add others only when forced to do so. The two primary particles chosen for this purpose are the electron and positron. The attempt will then be made to form all other particles from combinations of these two. There is some empirical evidence for this possibly being the case. The creation of matter and antimatter occurs only very near to atomic nuclei.

It has been believed that the nucleus is included only to carry away extra momentum. It seems reasonable to assume the presence of a very strong interaction between the nucleus and any incoming energy just as would be expected if new matter did not appear. The result of that interaction could be the dislodging of nuclear particles.

In this theory it is not accepted that actual transformation of energy to matter occurs. Therefore, I look to the nucleus for the hiding place of positrons. The more complex forms of matter and antimatter may be constructed from varying combinations of electrons and positrons. The concept that photons may exist in an appropriate and proportionately smaller size makes this possible.

In other words, the speed of light is much slower within these very concentrated combinations of matter. A greatly lowered speed of light would give the appearance of interactions involving very high mass particles. The change of velocity of all objects is a function of the change of velocity of light.

Whatever the situation is, it is not assumed that Einstein's energy and mass relationship actually predicts the transformation of energy into matter. Mass and matter are not the same thing. If energy and mass are interpreted as being equivalent, then there is no justification for going beyond predicting that the mass of a photon increases with increasing energy, and that the mass of a particle of matter increases with increasing energy. In other words, it has not been shown that mass has a nature synonymous with the postulated material substrate called matter.

It is noted that: It is highly suspicious that the material nucleus is needed at all. As I have shown earlier, the calculation of extra momentum for a photon is an error. With this error corrected, there is no need for the presence of the nucleus unless the matter to be created is actually matter to be dislodged from the nucleus.

THE STRUCTURE OF THE UNIVERSE

Theorizing mechanically, the structure of the universe consists of the acceleration of light. The major details of this structure are particles of matter and photons of light. The particles of matter make up an immense number of microscopic sources of control over the speed of light. They control the speed and orientation of the photons. There are a far more immense number of photons than there are particles. All of these photons are under the control of the particles of matter. Conversely, all of the particles are under the control of the photons.

Natural Units of Measurement

Natural units are units not chosen for anthropocentric convenience. This new theory produces such units. They are those units of measurement belonging to the cause of all effects. That cause is the velocity of light. A natural unit of time is the period of time it takes for a photon to pass a given point. This is also the time it takes for light to travel from a nucleus of an atom to the first electron shell. The anthropocentric value of this period of time is $1.602x10^{-19}$ seconds. This is the natural unit of time, but it needs to be expressed as one natural unit of time. If this period of time is given a name such as photon-time (t_c), then the natural unit of time is one photon-time.

The natural unit of length is the local length of any photon $4.8x10^{-11}$ meters. Locally, this is the basis of all length measurements. The fact that this length varies from the remote perspective does not disqualify it from consideration. Locally it is a constant length everywhere just as the speed of light always appears to have the same local speed everywhere. The natural unit of length can be given the name one photon-length (l_c).

All natural units must be derived from the speed of light. This means the natural unit of mass must be drivable from the speed of light. This theory defines mass as the inverse of the acceleration of light. From the remote point of view, this acceleration is different for different particles. This fact is what characterizes each of them as unique types of particles. However, locally all particle masses are the same universal constant.

In the same manner that the speed of light always measures the same locally, so does its acceleration. This acceleration is calculated by dividing the speed of light by a unit of photon-time. In terms of units of seconds, this value is $1.602x10^{-19}$ *seconds*. Performing this division yields a value of acceleration of light of $1.87x10^{27}\ m/sec^2$. Taking the inverse yields the natural unit of mass as $5.3436x10^{-28}\ sec^2/m$ or kilograms.

If the natural unit of mass is given the name local-mass (m_l), then the natural, universal unit of mass is one m_l. How can this natural unit be used to measure masses that vary in value as they are measured from our remote perspective? This is done by using the inverse of the acceleration of light of a particle from our remote perspective. In this theory, this value is the mass, as we measure it, of any particle. The ratio of the remotely measured mass to the natural unit of mass gives a measurement of remote mass in terms of the natural unit of mass. From these three natural units all others may be derived.

Continuity and Discontinuity

Particles of matter and photons are mechanical representations of continuity and discontinuity. The particles of matter are the mechanical interpretation of the continuous nature of the universe. The photons are the mechanical interpretation of the discontinuous nature of the universe. These two natures are not mutually exclusive in the sense of wave-particle duality. It is not these two natures that represent reality. It is their interaction that forms the universe. They are always interacting. Their process of interaction is continuous and unlimited by time or distance.

The limited speed of photons is what introduces time into the universe. The truncated, variable length of photons provides the tick of the clock. Their lack of continuity causes uncertainty, imprecision and vagueness. However, when their numbers are great, such as on the macroscopic scale, these qualities are reduced almost to extinction.

Cosmic Background Radiation

The theory of relativity supports the concept of an expanding universe. Hubble's formula for red shift as a function of distance presents a picture of an expanding universe that is in agreement with relativity theory. Both of these are supportive of the idea of a big bang origin for the universe. The analysis of a big bang origin leads to the prediction of the cosmic background radiation. This radiation would have been created shortly after the big bang origin. It was released at the time atoms are thought to have formed. According to the big bang theory, the energy of this radiation would, over time, have greatly decreased as the universe expanded and cooled.

The frequency and temperature of this radiation as it should exist today is accurately predicted. Measurements have confirmed the existence of the background radiation. The background radiation is considered to be near positive proof of the big bang. Actually this discovery does not necessarily confirm the big bang. What it does confirm is that there was a time when atoms first formed. This confirmation is no shock to anyone's theory. The evidence that does appear to confirm a big bang origin is the red shift of light according to Hubble's formula.

There is, however, another interpretation in conformity with this new theory. This interpretation of the red shift of light is that the speed of light has increased over time. In other words, an accelerating speed of light would cause the energy of photons to decrease over time and distance. This effect is analogous to that which affects light moving away from the earth. What this idea suggests is that the universe may not be expanding now or ever. The origin of the universe could have occurred over an expanse of space that cannot be distinguished from infinity.

Perhaps the origin of the universe can be thought of as occurring when the velocity of light became non-zero over the entire universe. Placing a cautionary restriction on this, I will say over the entire known universe. This interpretation is consistent with the premise that all effects in the universe are the result of a single primary cause.

For this theory the single primary cause is always the variation of the speed of light. In the interest of keeping this theory simple, I assume the speed of light has changed over time, but only because the universe has been expanding. As the average density of matter has gone down, the speed of light would have risen.

So a major impact of this theory on the expansion of the universe is to allow for a significant portion of the red shift to be due to an increasing speed of light. This means the universe would be expanding at a lower rate than is currently thought. In other words, the universe is considerably older than the current big bang model would predict.

It is possible for red shift effects to be caused by the speed of light changing with time. These would also then come into play. They would be combined with the effects of a changing speed of light due to a decreasing average density of matter. I don't see a reason to try to introduce any time effects. However, since this possibility exists, the expansion red shift by itself does not prove the big bang theory.

Energy and Momentum

I have defined force as the ratio of two values of acceleration. I now expand this definition to include the concepts of continuity and discontinuity. Force is the local acceleration of the continuous nature of light divided by the local acceleration of the discontinuous nature of light. Force is necessarily invariant when it is considered to exist at a point. However, it is the effect of force that is of great interest to us. The effect of force is acceleration. Acceleration is the mechanical interpretation of change in the universe. When matter is accelerated it does so across a distance and during a period of time. The effect of force does not exist at a point.

It is useful to make an accounting of the effect of force, meaning the acceleration of matter, both across a measure of distance and during a period of time. The accounting of the effect of force across a distance we have named energy. Momentum is the name of the accounting of the effect of force over a period of time.

When a calculation of energy is used to interpret the effect of force across a distance it is necessarily dependent upon the length of a photon. When a calculation of momentum is used to interpret the effect of force over a period of time it is necessarily dependent upon the period of time for a photon to pass a given point. A dependency upon distance causes variance. A dependency upon time guarantees invariance.

For example, momentum is the measure of force applied over a period of time. Therefore, momentum is automatically invariant because time is invariant. In other words, the law of the conservation of momentum can always be defined in terms of mv. It doesn't matter whether the law is applied from the local or the remote perspective. The general form mv is always correct.

The length of a photon is variant. The measure of force applied across a distance will then also be variant. Energy is then necessarily variant. For example, gravitational potential energy measured remotely must be calculated using:

$$E = \frac{1}{2}mv_c^2$$

The same gravitational potential energy measured from the local perspective must be calculated using:

$$E = mv_c^2$$

Kinetic energy is also calculated differently depending upon its measurement being made either locally or remotely. As is well demonstrated, a remote observer who is measuring the effect of a constant force to accelerate an object will find that the effect of the force diminishes as the velocity of the object increases. However, a local observer, traveling with the object, will measure the effect of the force across a distance to be independent of the object's velocity.

The definition of energy as the accounting of the effect of force across a distance refutes the current belief that energy can be thought of as a physical substance. Currently energy is given a status tantamount to declaring it to be the primary substance of which the universe consists. This new theory argues that energy is not the substance from which the universe is constructed. Energy has no independent physical existence any more than does momentum.

Energy and momentum are on a similar footing because they are both measurements of the effect of force. They can both be either kinetic or potential. Where one exists the other exists. If one is to be considered more primary than the other, then momentum deserves the nod. Momentum is simpler in form and is invariant.

It can also be conjectured that momentum is more primary than energy from a combination of math and philosophy. Energy is force times distance. At the time before the universe formed there was no distance in existence. Therefore, it can be argued that energy cannot exist without distance already existing.

However, momentum is force times time. Before the universe came into existence, time could have already existed. Therefore, speaking mechanically, momentum could have existed prior to creation. I am not insisting this is true. I am pointing to the need to address the cause of the existence of force. What is the nature of force? Why does it exist? How does it exist? Of what does it truly consist that it can lead to recognizable life and intelligence?

For the sake of this argument, I am disregarding quantum mechanics' uncertainty or fuzziness. Quantum based reasoning leads to illogical conclusions such as something can come from nothing. For example a possible logical conclusion of quantum uncertainty at the moment of creation is that nothing is actually something, or, that a system of effervescent universes gave birth to ours. To the contrary, there is no primary wave nature in this theory, and, I am certain, it is safely postulated that something can only come from something. In the essays, I develop more fully the argument in favor of this position.

As far as the physics theory is concerned, there is a great deal more to be done. However, first the fundamentals must be made correct. No theory can be more correct than are the fundamentals from which it is derived. Completing the new set of fundamentals is the most challenging task. It requires original work and original work takes time.

The theory is still being developed and new additions are continuously being added. Its development seems to have a direction of its own. Its framework is built around a solid core of unity. This requires that all new additions must fit smoothly with all that has come before them. Compartmentalization is forbidden. The point is: There can be no theoretical shortcuts taken such as introducing new independent forces or other unique and unexplainable properties.

The first principle of this theory is: There is a single cause for the existence of the universe. This cause manifests itself in various ways that account for all effects. The cause does not divide itself down or separate its parts. It has no phase changes. It cannot contain or cause confusion. It is whole. It is constant. It is responsible. It is purposeful. It is successful. It is intelligent. It is everything revealed in the universe.

The Universe is under control. It has achieved great things. It has given rise to life and intelligence. A unified theory of physics must be able to demonstrate this control, and show at least the first step of how it leads to parts of itself that are capable of appreciating itself. That first step will be the *real* first step in understanding the operation of the universe.