

The Absoluteness of Time

James A. Putnam

This essay presents a few examples of the theoretical use of absolute time. It points to a universal, constant value of a fundamental measure of time. It demonstrates the role that this exceptionally useful constant can play in achieving theoretical unity beginning with the fundamentals of physics theory. The constant time period is used in an analysis of the fine structure constant. New equations are derived to further clarify the nature of electromagnetic theory. The mathematics is algebraic manipulation of differential and incremental values. The analysis is on the level of introductory theory. The conclusion emphasizes an expanded role for absolute time in physics theory.

1. Introduction: Time is a companion to all activity. We are subjects living within the confines of time. It is a true fundamental property of the universe. It is not a physical substance that can be handled or an object that can be observed. The motion of matter does not generate it. It is not a theoretical construct or abstract concept. The nearest we approach to modeling time is to theoretically analyze methods of measuring durations of time. It is useful to study methods of measurement that reveal varying durations of time. However, it is also important to determine if there are exceptions whereby time can be measured in durations that are universally constant. There is one universal constant value of measurement of time introduced in this essay. The usefulness of this constant duration of time is demonstrated by introducing it into fundamental physics theory. A simple hydrogen atom model of an electron particle orbiting a proton is used.

2. The fine structure constant: The fine structure constant has a magnitude equivalent to the ratio of the speed of the electron in the first energy level of the hydrogen atom to the speed of light:

$$\alpha = \frac{v_p}{C} = \frac{\frac{dx_p}{dt}}{\frac{dx_c}{dt}} = \frac{dx_p}{dx_c}$$

The differential of distance traveled by light, a photon, is chosen equal to the radius of the hydrogen atom. The differential of distance for the electron is the distance traveled during an equal period of time. For atomic dimensions, these values are incremental Δ :

$$\alpha \cong \frac{\Delta x_p}{\Delta x_c}$$

The time required for light to travel the radius is:

$$\Delta t_c = \frac{\Delta x_c}{C} \cong \frac{5.0 \times 10^{-11} \text{ meters}}{2.998 \times 10^8 \frac{\text{meters}}{\text{second}}} = 1.668 \times 10^{-19} \text{ seconds}$$

The time it takes for the electron to travel one radian is:

$$\Delta t_p = \frac{\Delta t_c}{\alpha} = 137 \Delta t_c = \frac{1}{2\pi\omega}$$

Where ω is the orbital frequency of the electron. Solving for alpha:

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

We will return to this point. The fine structure constant has another definition that will be presented later. It will be demonstrated that the increment of time shown above contributes to our understanding of that definition.

3. A fundamental constant measure of time: The next step is to introduce time, in a radically new way, into fundamental physics theory. The previous analysis of the fine structure constant offers a clue on how one might proceed. It is only a clue and, this is only an essay; however, it will be used to derive new equations representing new interpretations for electromagnetic theory and the fine structure constant. The clue is that the time required for light to travel the approximate radius of the hydrogen atom is very close in magnitude to the magnitude of electron electric charge in the mks system of units. The magnitude of the electric charge is:

$$q = 1.602 \times 10^{-19} \text{ coulombs}$$

If the true magnitude of the time period is assumed to be equal to that of electric charge, then the size of the hydrogen radius is given as:

$$\Delta x_c = 4.8 \times 10^{-11} \text{ meters}$$

I will use this distance in the equations that follow. I will also replace electric charge with the period of time:

$$q = \Delta t_c = 1.602 \times 10^{-19} \text{ seconds}$$

The mysterious property in Coulomb's law is not interpreted here as the cause of electromagnetic effects. The new cause of electromagnetic effects, including polarity, is not included in this essay. The substitution introduces time into Coulomb's law. It is the theoretical effect of this change that is presented. The justification may appear weak, but it is not weaker than the decision to define electric charge. And, that decision had the disadvantage of necessitating new units that masked the problem mathematically.

4. New equations for electric and magnetic properties: The magnitude of electron electric charge is a fundamental constant; therefore, the corresponding period of time

replacing it is also a fundamental constant. The use of this simple model of the hydrogen atom allows me to perform some new derivations of electromagnetic theory. For convenience, I will credit the electromagnetic properties of the electron and proton to be due to a single photon. The photon is modeled as having a length equal to the radius of the hydrogen atom. This simple model provides a visual aid for the mathematics used in this essay. Coulomb's law for electric force is:

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

I substitute the increment of time in place of electric charge:

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

Force is also generally defined as:

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

For this example the incremental distance is the radius of the hydrogen atom. The subscript K denotes kinetic energy. The subscript c denotes properties pertaining to the photon. Substituting, adding the subscripts, and setting the two equations equal to each other:

$$\frac{\Delta E_K}{\Delta x_c} = \frac{\Delta t_c \Delta t_c}{4\pi\epsilon \Delta x_c^2}$$

Solving for permittivity:

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

Multiplying by unity:

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

Yielding:

$$\epsilon = \frac{1}{4\pi \frac{E_{Kc}}{\Delta x_c} C^2} = \frac{1}{4\pi f_{\xi H1} C^2}$$

The subscript $H1$ represents the first energy level of the hydrogen atom. The proportionality constant of Coulomb's law is:

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

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

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. It is known, for electromagnetic radiation, that electric permittivity and magnetic permeability are related by the formula:

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

This theoretical work is not in agreement with relativity theory. This is a Euclidian style analysis of a simple model of the hydrogen atom. The letter C will be replaced with a different symbol for speed. However, the magnitude of the speed of light, regardless of the symbol change, remains equal to C :

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

Solving for permeability:

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

I have derived:

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

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

Permeability is a function of the force felt by an electron in the first energy level of the hydrogen atom.

5. New electromagnetic field equations: In general, the electric field is defined by an equation that includes electric charge:

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

I will use this equation as it applies to a single particle. Maxwell's equations are normally written using differential values. In order to easily compare the resulting equations, I substitute the fundamental increment of time, but represent it as a differential value:

$$q = dt_c$$

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

Even with this radical substitution, the following equations have interpretations that rely only upon established properties. I will derive an equation analogous to one of Maxwell's. Force, in general, can be expressed as:

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

Substituting this definition into the electric field equation given above:

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

Taking the derivative with respect to the distance the photon would move during the fundamental increment of time and symbolizing it as a differential value:

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

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

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

I begin with:

$$dE = v_p dP$$

Multiplying the right side by unity:

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

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

Rearranging terms:

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

I next change the left side of this equation into the form shown on the right side of the equation for the electric field varying with distance. I first rewrite the above equation as:

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

Rearranging:

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

Multiplying by particle velocity:

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

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

Rearranging:

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

I submit that this equation is analogous to the Maxwell equation given above. In order to show this more clearly, I use the previously derived equation:

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

Substituting this into the equation above:

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

Rearranging:

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

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:

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

Of special interest, by analogy to Maxwell's equation, it is suggested that the physical basis for magnetic permeability is represented 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 is particle velocity. The appearance of particle velocity, as part of magnetic permeability, indicates its magnitude is fixed according to the measured permeability of the medium:

$$v_p = \mu v_c$$

Substituting the magnetic permeability of copper:

$$v_p = \left(1.2 \times 10^{-5} \frac{\text{newtons} \circ \text{sec} \circ \text{onds}^2}{\text{coulomb}^2} \right) \left(2.998 \times 10^8 \frac{\text{meters}}{\text{sec} \circ \text{ond}} \right) = 3.6 \times 10^3 \frac{\text{newtons} \circ \text{sec} \circ \text{onds} \circ \text{meters}}{\text{coulomb}^2}$$

Assigning the units of velocity:

$$v_p = 3.6 \times 10^3 \frac{\text{meters}}{\text{sec} \circ \text{ond}}$$

This appears to be the speed of sound in copper. Repeating the calculation for the magnetic permeability of glass:

$$v_p = \left(2.0 \times 10^{-5} \frac{\text{newtons} \circ \text{sec} \circ \text{onds}^2}{\text{coulomb}^2} \right) \left(2.998 \times 10^8 \frac{\text{meters}}{\text{sec} \circ \text{ond}} \right) = 6.0 \times 10^3 \frac{\text{meters}}{\text{sec} \circ \text{ond}}$$

This is the speed of sound in glass. I will shortly show that the end units for these equations are correct for this essay. I have already replaced the units of coulombs with seconds. I will also redefine the units of force. These calculations suggest that v_p is actually v_s the speed of sound. Magnetic permeability then becomes defined as:

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

It is known:

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

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

Solving for electrical permittivity:

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

Substituting the equation for magnetic permeability:

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

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

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

This result suggests electrical permittivity is inversely proportional to the product of the speed of light and the speed of sound. Returning to the equation:

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

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

Simplifying:

$$d\xi = v_s dH$$

Solving for v_s :

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

This equation says the speed of sound is the rate of change of the electric field with respect to the magnetic field. The force attracting the first energy level electron of the hydrogen atom is:

$$f = \frac{q^2}{4\pi\epsilon r_1^2} = \frac{\Delta t_c^2}{4\pi\epsilon \Delta x_c^2} = \frac{1}{4\pi\epsilon v_c^2}$$

I have derived:

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

Substituting:

$$f = \frac{v_s v_c}{4\pi v_c^2} = \frac{v_s}{4\pi v_c}$$

This equation shows that force has units that cancel out. This result, applied to the previously derived equations involving the speed of sound, makes the units of the equations match.

6. Additional analysis of fine structure constant: The definition of the fine structure constant contains constants that come from electromagnetic theory, relativity theory and quantum theory. I have previously redefined some of these constants. The formula defining the fine structure constant is:

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

Where: e is electron charge. Each expression on the right side with the exception of h , Planck's constant, has been redefined. For the purposes of this section, I will use Planck's constant as it would normally be used. I substitute the expressions from this new work for the constants contained in the equation. I return to the use of incremental symbols instead of differential symbols. The expression derived for k is:

$$k = f_{\text{EH1}} C^2 = \frac{E_{Kc}}{\Delta x_c} C^2 = \frac{E_{Kc}}{\Delta x_c} \frac{\Delta x_c^2}{\Delta t_c^2} = E_{Kc} \frac{\Delta x_c}{\Delta t_c^2}$$

The expression for e is:

$$e = \Delta t_c$$

Therefore:

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

The expression for the speed of light is:

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

The normal use of h is:

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

Substituting these identities into the equation for the fine structure constant:

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

Simplification yields:

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

This returns us to the point where it was previously stated we would return. The change in the identity of electric charge to one of a fundamental constant time period gave continuity to the analysis of the fine structure constant.

7. Conclusion: Time is not a cause of action. When action slows, for any reason, it does not represent time dilation. It represents that the cause is varying in intensity. Time is immune to human intervention. This is not the case for our mechanical measurements of time. The practice of monitoring cyclic action of material objects under varying environmental conditions tells us how the behavior of the objects varies. We may use this knowledge to affect their behavior. However, the increment of time, as measured by a photon, is immune to our interference. It is as much a universal constant as electric charge is proven to be. It has a specific physical meaning. The photon model presented indicates that: The fundamental constant increment of time is the time required for any photon, anywhere, at any time, to pass a given point. The theoretical examples provided indicate that: The fundamental increment of time can help to achieve theoretical unity beginning at the fundamental level and continuing into advanced theory. The changes to units are pervasive. Consider this consequence of force having units that cancel: Mass becomes the inverse of acceleration, indicating that: There is a fundamental, universal, property experiencing this acceleration. The absoluteness of time is the physics key to understanding the operation of the universe in a coherent, harmonious manner.