

Mathematics and Empirical Evidence can Reveal Truths

If Physicists Eliminate Theorists' Tricks

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Introduction: Mathematics is the science of cataloguing and using shortcuts that permit achieving sums while avoiding or minimizing counting. By itself mathematics has no existence. What is meant by this is that there is no such thing as a pure number. A number represents a sum of something. For example, the number one is one of something or it is a sound without meaning. The science of physics uses mathematics as its tool for analyzing and describing its mechanical interpretation of the operation of the universe. Physics counts meters and seconds. They are the units of empirical evidence. They are the representatives of the properties of empirical evidence.

The empirical evidence is always patterns in changes of velocities of objects with respect to time. It is called acceleration and its units are meters per second². The early representation of a physics equation is Newton's $f=ma$. The empirical evidence is represented by the letter a standing for acceleration. The cause of acceleration is represented by the letter f standing for force. Resistance to force is the letter m standing for mass. The units of acceleration are naturally indefinable units. There are no previously existing units by which either meters or seconds can be defined. A defined unit is one that is defined in terms of pre-existing units. A defined property is one that is defined in terms of previously existing properties.

The challenge back then for physicists was how to define both mass and force in terms of the only two pre-existing units of meters and seconds. It was not known how to do this and the conclusion was that either force or mass would have to be declared to be an additional indefinable property. Mass was chosen and it was assigned the indefinable units of kilograms. Force and its units were then definable in terms of mass and acceleration and their units.

This act was the first error of theoretical physics. By that act the meaning of the equation was no longer dependent upon empirical evidence. By that act fundamental disunity was made a permanent part of $f=ma$. By that act all higher level theory affected by mass includes that disunity. The lost fundamental unity cannot be regained until mass is made a defined property with direct dependence upon empirical evidence for its interpretation and use.

Tricks by Lack of Definitions: It is the empirical evidence of physics that introduces properties to us and provides the means for defining their units. It is the empirical evidence that provides the patterns for math equations to model. The mathematics brings only the shortcuts for counting. Still the math is a necessary and valuable tool to aid in communicating what

empirical evidence is showing us. However, the mathematics is vulnerable to interference by theorists for which the arbitrary indefinable status of mass is the first such example. That which makes mass' interpretation artificial next affects the definition of force because the definition of force includes mass. Then follows the definition of energy in terms of mass, acceleration and distance. Then later when it is said that mass is energy reality has been replaced by theory. Reality is found in a definition of mass that results solely from that which its empirical evidence communicates to us. That communicative process is carried out by photons which deliver increments of information about changes of velocity of individual particles of matter. There is not a thimbleful of 'energy' in a lab anywhere. Yet 'energy' is often spoken of as if it were a mechanical version of a Creator.

In the case of thermodynamics, there is another artificially indefinable property. It is temperature. Both temperature and its units of degrees are indefinable. This is the reason that physicist cannot explain what temperature is. The sidestepping practice of saying it is a measure of this or that other property cannot undo the negative consequences of introducing additional fundamental disunity into the physics equations of thermodynamics. Physicists need to know now what temperature is.

The reason that Clausius' entropy cannot be explained is because temperature is not explained. Further sidestepping occurs during discussions of entropy. Clausius' is passed over in favor of Boltzmann's definition of an invented entropy that is not the same thing as what Clausius discovered. Returning temperature to its empirical form, by defining it in the same terms as its empirical evidence is expressed, makes clear immediately what Clausius' entropy is. The empirical definition of mass leads quickly to empirical units for temperature.

Temperature's empirical units are meters per second, the units of velocity. However, those units are reduced forms of its full expression of empirical units. The full expression of its units is those of acceleration times distance divided by the units of acceleration times time. In other words, the units of meters in temperature's numerator are the reduced form of empirical units of energy. Temperature is energy divided by time. It is the mathematical expression for the rate of exchange of energy between molecules. Temperature is the rate of exchange of energy between molecules. Learning what is temperature is the key to solving thermodynamic puzzles.

Clausius' entropy is energy divided by temperature. The empirical units reduce to units of seconds for Clausius' entropy. Clausius' entropy, as revealed by direct dependence upon empirical evidence, is the time required for unused heat to be transferred to the low temperature heat sink quasi-statically.

The last artificial indefinable property that is in need of establishing a direct connection to its empirical roots is electric charge. Electric charge is defined in terms of current while current is defined in terms of electric charge. This circular reasoning along with the theorist decision to guess that two unknown properties appearing in Coulomb's force equation were the sources of electric force make learning the empirical units of 'electric charge' especially difficult.

The method needed to discover the empirical identity of 'electric charge' is to look for the magnitude of its universal fundamental constant value to reappear during the development of other replacement equations. It happens that that value is hiding in plain sight. It is the magnitude of the time required for light to travel the radius of the hydrogen atom. That radius is approximately 5.0×10^{-11} meters. If it is taken to be 4.8×10^{-11} meters, then the time required for light to travel that distance is 1.602×10^{-19} seconds. In order to give support to this claim, I will use that universally constant value of time in derivations of replacement equations for electromagnetic theory. Polarity will not be included in the work that follows. Polarity turns out to be a property of mass. It has to do with whether or not the speed of light is increasing or decreasing. It is not the case that the speed of light always increases with distance from matter.

Empirical Replacements for Maxwell's Equations: It is known that:

$$f = q\xi$$

Allowing that 'electric charge' is a universal constant measure of time, it can be rewritten 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:

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

Our concept of electric field is actually 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:

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

Returning to the equation:

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

I will substitute for f :

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

Making the substitution:

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

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

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

This is an equation that I will be using. The remaining two equations are:

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

And:

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

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. The observer has a velocity between zero and the speed of light, and is moving in the same direction as the photons. I will next derive replacement equations for Maxwell's equations.

Empirical Definition 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 conventionally defined as:

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

I will use this equation as it applies to a force caused by a single charged particle. I substitute:

$$q = dt_c$$

The fundamental quantity of electric charge is the time required for light to travel the radius of the hydrogen atom:

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

Electric Field Varying With Distance: I proceed to derive electromagnetic equations analogous to the Maxwell equations. Since force can in general be expressed as:

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

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

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

Taking the derivative with respect to an increment of distance equal to the radius of the hydrogen atom:

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

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 show 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 can be explained. Clearly it must have a specific magnitude. This magnitude can easily be calculated:

$$v_p = \mu v_c$$

Substituting the appropriate values:

$$v_p = \left(12.6 \times 10^{-7} \frac{\text{newton} \cdot \text{second}^2}{\text{coulomb}^2} \right) \left(2.998 \times 10^8 \frac{\text{meters}}{\text{second}} \right)$$

Substituting empirical units and reducing them down to units of velocity:

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

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. The new definition of mass reveals a single cause for all physical effects. That cause is the variation on the speed of light. What has been shown is that there is a physical relationship between the speed of light and the speed of sound.

Interpreting Electric Permittivity: The solution for magnetic permeability allows for a solution of electrical permittivity. It is known:

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

Or:

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

Solving for electrical permittivity:

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

I have an identity for magnetic permeability of:

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

Substituting:

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

Yielding:

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

Electrical permittivity is inversely proportional to the product of the speed of light and a speed approximately that of sound. It can be shown that for solids it is the speed of sound.

Relativity's Trick: The general theory of relativity presents space-time to us as a real property. There is no empirical evidence to substantiate this claim. All empirical evidence consists of patterns in changes of velocities of objects. Neither space nor time nor space-time has ever been shown to have velocities or to have experienced changes of velocities. Here is a reason why this tension between theory and empirical evidence exists.

The reality is that theorists are not stopped by the unknown. They imagine substitutes for the unknown. They make guesses about the existence of properties that are not revealed to us by empirical evidence. With regard to length contraction and time dilation transforms, the existence of length contraction of objects is empirically supported. The existence of time undergoing expansion is not empirically supported.

Empirical evidence does support the slowing of rates of activity. None of those rates of activity, in so far as empirical evidence reveals, involve time as a property available to us for experimentation. No lab contains a sample of time upon which physicists may conduct experiments. The letter t in physics equations has never stood in for the property of time. It has always stood for cycles of activity of objects. The units of time have always been in the form of cycles of activity of objects. The actual property undergoing change is that property that makes the activity possible. It is light that makes the activity possible. It is light that undergoes a change. The change that occurs to light is the variation of its speed, increasing with distance from matter.

I will calculate the increase in gravitational potential energy E_{gp} from the perspective of the local observer, I must hold the speed of light constant yet the equation will still include the effect of the acceleration of light through the effect of gravity. The acceleration due to gravity is equal but opposite to the acceleration of light. The calculation requires holding the magnitude of v_c constant and equal to v_{cmax} , which is equal to C , at the same time that I am including an effect of the acceleration of light. From the point of view of the local observer, these two values are not linked. The calculation is:

$$E_{GP} = \int_0^{v_{cmax}} m v_{cmax} dv_c = m v_{cmax}^2 = m C^2$$

This result shows Einstein's rest energy is the gravitational potential energy of the object from the perspective of the local observer. A local observer is one who travels with the object to its final location.

Einstein's requirement to hold the speed of light constant results 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 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 adopted time dilation in place of a variable speed of light. Time dilation causes those equations that include it to yield results from the remote observer perspective. In other words, each term that includes gamma will necessarily be from the remote observer's viewpoint. It will not appear in terms pertaining to a local observer. A local observer does not see time dilation occurring for himself.

The remedy is to join mathematics together with empirical evidence in a dependency so strong that theorists can't interfere with it. Guessing, even by professionals, is a temporary convenience or it is a fault. Prove it or remove it. There is a third temporary position: Admit that it is a placeholder so that all, without personal attacks or censorship or banning, may work toward removing it.

Conclusion: The equations of physics currently exhibit many theorists' tricks, more than have received attention in this essay. These tricks are responsible for lack of fundamental unity and for misunderstandings about the nature of the universe. Theorists don't believe that their tricks are tricks. If they did recognize that the intrusion of the products of their imaginations into physics equations takes us further and further away from knowing the nature of the universe, then they would also have to recognize that the guessing and inventing that makes up much of theoretical physics is what needs to be removed from physics equations. The remedy for fixing physics is to return the equations of physics back to their empirical forms. When the equations are in their empirical forms, then the mathematics of those equations can reveal empirical truths.