Theoretical physics is not foundational

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To be foundational, theory must have established and maintained a direct dependence upon empirical evidence with the goal of learning that which empirical evidence is revealing to us. Three pervasive problems with theoretical physics are identified:

1. The failure to define mass.
2. Lack of attention to detail.
3. Accepting indirect empirical evidence as sufficient support for orthodoxy.
4. Lack of a foundational system of units.
5. Turning learning backwards.

1. The Failure to Define Mass.

Empirical evidence is our soul source of knowledge about the nature of the Universe. The formal practice of defining properties in physics is to express a property in terms of other properties with this special requirement: Those other properties must be properties that consist of the two properties of empirical evidence plus previously defined properties. This chain, linked on one end directly to empirical evidence, ensures that direct dependence upon empirical evidence will be maintained. This is directness is necessary in order to learn that which empirical evidence is attempting to reveal to us.

This chain was never formed because mass was never defined. We didn't learn what mass was at the time that it was introduced to us by empirical evidence. We can't learn it from any other source afterwards. It has to be learned at the time that it is introduced to us by its empirical evidence. It was not understood how to formally define both mass and force from f=ma. That did not happen and mass was declared to be a property that is so fundamental that it is indefinable. This decision enabled theorists to proceed to derive other physics equations. However, into all of those equations that include mass, there was the spread of lack of knowledge throughout the fundamentals of theoretical physics. It was the beginning of theory. The theory was that mass was indefinable. Physics began by being made a part of a theory; thereby instantly making physics into theoretical physics.

However, some things are undeniable and the lack of definition of mass is one of them. Normally if someone spots something like this and raises the issue, the professionals will come back with the challenge that not only does one need to first explain what is mass, but immediately thereafter, it must be shown that that explanation for mass works for all of known physics. This challenge is put forward by those who do not follow that same stringent criteria themselves. Mass is pervasive in physics equations. It is absolutely necessary that it be known what it is; otherwise, that lack of knowledge is spread widely throughout theory. One result is that we are offered a long list of indirect answers about what mass is, because the direct answers depend upon knowing what mass is.

The theorists make their list of knowledge about what is mass and fill some pages of their textbooks with it. But when the mathematics begins mass is re-introduced as a property that is so fundamental that it is indefinable. The reason for this duplicity appearing so soon in introductory physics is that mass is not defined. A physics definition is not theorist's opinion. It is not knowledge about what a property does. It is not an expression of a proportional relationship with other properties. A physics definition is a singular direct answer that is always valid. A physics definition of a property is a very specific kind of mathematical equation. A physics definition is an effort to make our knowledge of any property as directly dependent upon its empirical evidence as is possible. We learn what a property is from the empirical evidence that makes that property know to us.

Why do the equations work so well? Why have we not missed knowing what mass is? There reason is because the equations are those of theoretical physics and theory thrives on the unknown. The unknown becomes the target of theorists, and they aim their thoughts at the blanks that exist in physics equations about what might fill in sufficiently to keep the derivations of equations moving forward. The evidence that these substitutes exist is the acceptance of indirect evidence as being sufficient to justify adopting inventions of the mind as being real.

Such inventions cannot have direct empirical evidence. Theoretical progress requires that indirect empirical evidence be relied upon as if it were conformational. Presently all properties of mechanics are definable in terms of just three fundamental properties: Mass; length; and, what physics call 'time'. If physics had been developed by using only what is learned directly from empirical evidence, it would not have become theoretical physics, it would have become empirical physics.

Once theorists go back to f=ma and formally define mass in terms only of pre-existing properties, all mechanics properties become definable using just the two properties of empirical evidence. Going back to the beginning and defining mass does away with all theory that has become added on to physics equations.

The equation *f=ma* is the introduction of mass. The equation *f=dp/dt* is not the beginning equation. Physicists did not understand how one could define both mass and force in f=ma. It was understood that the properties of acceleration and its units were naturally indefinable. That is the case because they are the first properties of physics. There are no properties pre-existing them. There are no properties available by which length and time may be made defined.

The rigorous formal method of defining a physics property requires that the property be expresses as some combination of the two properties of empirical evidenced and any pre-defined properties. There were no pre-defined properties before the introduction of force and mass. This means that if one is going to accomplish that which must be done in order to start physics off on the foundation of direct empirical support, one must define both mass and force using a combination of only length and time. Furthermore, the units of both newton and kilograms must each be defined as some combination of the units of meters and seconds only. This can be done.

Solving for f/m=a demonstrates that the units of force divided by the units of mass must reduce to those of acceleration. Empirical evidence represented by the letter ‘a’ has provided us with sufficient information to decide how to define mass. The best choice is to accept mass as an inverse representation of some property that is undergoing acceleration. The great fundamental importance of mass in physics equations makes clear that the property that is inversely represented by mass is itself a most fundamental property. Force would then be defined as a ratio of two accelerations. The newton would be defined as a ratio of the units of acceleration. What makes this the best choice is that it is the one out of the few choices that provides for the reformulation of the equations of physics.

The units of mass tell us that we are being led to learning that there is a very fundamental property that has velocity and undergoes changes of velocity. What is the property? It is light. It is true that the speed of light always measures locally *C*. Locally means that the measuring equipment experiences the same environmental conditions as does the light for which its speed is being measured. Both the real effect of object length-contraction and the coordinated variation of its cause, the variation of speed of light, combine to give the locally measured result that the speed of light is *C*.

In addition to theoretical physics having failed to define mass, there is a second property that has always been undefined since its introduction. In the case of mass, it makes a difference to mechanics. When mass is properly defined mechanics is fixed. However, physics would still have the same ailment when it got to thermodynamics. Temperature has been and remains an undefined property ever since it was introduced. That unresolved problem, when physicist got to thermodynamics, would have caused fundamental unity to once again be immediately lost.

2. Lack of Attention to Detail.

What is the meaning of k in Coulomb's Law? I expect that Mainstream physics wouldn't know this answer and wouldn't want to hear about it either: The k in Coulomb's law is the most important term in the equation. Yes, it is the proportionality constant; and, yes, the cgs unit system sets it equal to 1 without losing any usefulness of the equation. And, it is the case that for all cases other than Coulomb's law in the MKS system, every other term has known important value especially electric charge.

What value could there be in a constant of proportionality that doesn't even exist for one common unit system? The answer lies in the fact that every other term in Coulomb's equation is previously known. They have their rules of measurement established using established standards and units. We know everything about them that matters for Coulomb's Law independently of Coulomb's equation.

What does this tell us about k? It tells us that Coulomb's law is formed because it has something new to offer beyond collecting the other terms together. They bring nothing new into the equation. The only place for new knowledge to enter Coulomb's Law is in the proportionality constant. That constant is found independently of those other terms. It has to be found experimentally.

That experiment puts the new knowledge that makes Coulomb's Law what it is, into the proportionality constant. That is the only number that is allowed to vary during the experiment. All other terms are held constant. Now what new knowledge comes into the equation through k? That answer must wait until k is truly made a pure constant of proportionality.

The reason is it not already that is because it has 4pi included as part of it. that 4pi belongs with r^2. The force predicted by Coulomb's Law varies indirectly with the surface of the sphere 4pir^2. Removing 4pi from k and placing it with r^2 gives us ko the true pure constant of proportionality. Now with no further derivation because these results can be easily verified, I share the result that ko=VsVc where Vs is the speed of sound in the medium in which the electric force is being measured. Vc is the speed of light. This information reaches even into electric permittivity *e*=1/(VsVc) and magnetic permeability *u*=Vs/Vc These results hold approximately for gases and accurately for solids.

3. Accepting indirect empirical evidence as sufficient support for orthodoxy.

An example is the idea of space-time. Time and space are both properties that are completely unavailable to us to affect them. There is no empirical evidence for either space or time either suffering effects caused by objects or causing effects upon objects. All evidence consists of objects leading to effects upon other objects. All physics measurements relate to object cyclic activity or to object length. There are no controlled specimens of either time or space located in any laboratory anywhere. There has been no experimentation directly upon the properties of space or time. The existence of relativity type of effects on objects is real, but the Relativity Theory claimed causes are not empirically supported.

The way in which this can be known is to recognize that there are no units of measurement for either one. The units of seconds are not units of a fundamental property of time. The units of meters are not units of a fundamental property of space. The units of seconds are a count of object cyclic activity. In other words, the units of seconds have to do with duration of object activity. The units of meters are a measure of object length. Space is not an object. There are no specimens of either space or time contained in any laboratory anywhere. Both are completely inaccessible to us for the purposes of measuring, or affecting them, or being affected by them. Absolute time and absolute space are possible and even probable.

The theory of Relativity is a theory of object ‘length-duration’. The properties of time and space have never been directly represented in any physics equation. The letter ‘t’ represents our substitute for the indefinable property of time. It represents the indefinable property of duration. Duration is a count of object cyclic activity. The letter ‘L’ if used, represents our substitute for the indefinable property of space. It represents a count of object length. Object length is an indefinable property.

For those who are not aware of this, Empirical evidence is communicated to us in terms of meters and seconds only. Furthermore, the units of empirical evidence are naturally indefinable. They are the only units that are naturally indefinable. They are indefinable because there are no units that pre-exist them; therefore, they cannot be expressed in terms of pre-existing units. This last explanation presents the requirement that must be fulfilled for definitions of units and of properties. A defined property is one that is expressed in terms of pre-existing properties.

4. Lack of a foundational system of units.

The units of empirical evidence are meters and seconds. The units of a defined mass are units of inverse acceleration. What is being achieved is that all units of all properties will now follow suit and be defined as a combination of the units of meters and seconds only. The units of force are those of acceleration divided by units of acceleration. Those units can cancel out leaving force unit free.

However, there are two ways of carrying units and they both have their uses. One is to carry along the full units. For force those would be the units of acceleration divided by units of acceleration. The other way of carrying along units is to reduce them. This is the easiest way to work with properties and their units. It can lead to the need to know what you are doing.

For example, the reduced units of temperature turn out to be meters/second. This certainly looks like a velocity; however, the reduced units for energy are meters. One who is used to working with reduced units will know that the units of temperature are representing energy/second. This result shows that temperature is the rate of transfer of energy between molecules. There are times when it is best to show the full units so that the meaning of the units can be clear. The units of force reduced down aren't clear. The full units of force make it clear that force is a ratio of accelerations.

As one works through the new system of empirical units, there are some surprises. Those surprises inform us about a new understanding of the nature of some properties. One example is that the units of the Universal Gravitational Constant are those of meters^4/seconds^4 looking like a velocity to the fourth power. However, the use of these units allows for the discovery that the Universal Gravitational Constant is actually the square of the gravitational force between two neutrons, as measured by an observer located on one of the neutrons, separated at a distance of the radius of the hydrogen atom locally measured as 4.8x10^-11 meters.

A second example concerns the universally constant magnitude of electric charge. First it is necessary to state that the Universe operates in an orderly manner. Operating in an orderly manner is evidence of being fundamentally unified. The Universe is fundamentally unified. However, the act of declaring mass to be an undefined property immediately removed fundamental unity from the equations of physics. Fundamental disunity became a part of all physics equations. Since we have defined mass and defined kilograms, fundamental unity has been restored to physics equations.

This makes for a very big change. Fundamental unity allows for just one cause for all effects. That one cause is the property that mass is inversely representing. It is the variation of the speed of light. All effects currently credited to one of the four fundamental forces are actually due to the variation of the speed of light. The reason for bringing this matter up in a discussion of units is because there is no place left for electric charge. Electromagnetic effects are caused by the variation of the speed of light. This would be a real dilemma if we knew what electric charge is.

We don't know what it is. One reason is because electric charge is an undefined property. Yes, there is a definition offered for its unit of coulomb. However, it doesn't tell us what electric charge is. A coulomb is a number of electric charges. It is the number of charges that pass through a section of a conductor in which there is a constant current of one ampere. The ampere is defined as that constant current when present in each of two parallel conductors of infinite length and one meter apart in empty space causes each conductor to experience a force of exactly 4pix10^-7 newtons/meter.

The definition of the coulomb offers a count of a number of electric charges, but, does not explain what is electric charge. We are left with the knowledge that the existence of electric charge was an idea. There were two unknown quantities in coulomb's law. It was guessed that they were the cause of electric force between two charged particles of matter. The identity of electric charge is unknown. The restoration of fundamental unity to the equations of physics allows for just one cause for all effects. The question needing answered is since there is no actual definition of electric charge we cannot work solely with units to find the true empirical units of electric charge.

The method used to discover the new identity of electric charge was to make use of the Universally constant magnitude of electric charge for an electron or proton. The equations of physics were developed without electric charge present. The idea was to watch for the magnitude to show up in the new equations. The place it showed up was as the period of time it takes for light to travel the radius, measured locally as 4.8x10^11 meters, of the hydrogen atom.

The identity of electric charge was found to be a Universally constant increment of time. It is the time that it takes for a photon to be absorbed during its interaction with a particle of matter. This increment of time was presented in my essay entry, The Absoluteness of Time, in the very first FQXi.org essay contest The Nature of Time. When used in the denominator of differential equations, it is the key to fundamentally unifying the properties of physics.

5. Turning Learning backwards

A quote from an anonymous physicist:

“Every single principle that we teach in intro college physics is based on only two principles: Conservation of momentum, and conservation of energy/mass. That’s it! All other ‘laws’ are based on those two principles – be it Newtonian mechanics, thermodynamics, E&M, etc… We can write the energy equations of the Lagrangian/Hamiltonian because of conservation of energy. Each conservation principle is based on some underlying symmetry of our physical world. Conservation of momentum is based on the isotropic symmetry of empty space, conservation of energy on the symmetry of time. So these are the FUNDAMENTAL assumptions that we build all of our understanding on (ignoring the CPT conservation rules).”

If theoretical physics had defined mass in terms of length and time only. If they had learned to define units using only those two units of empirical evidence, then they would have learned that action does not have units of newtons*meters*seconds. The proof goes to far afield here; however, the unit free reduced units of force used properly show that the correct units of action are newtons^2*meters*seconds. There are not two different forms of action: One being energy*seconds; The other being momentum*meters. There is only energy*momentum. The least action principle exists because both conservation of energy and momentum for the very same event holds.

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https://www.facebook.com/groups/NTPhysics/