

The Mass of the Proton and the Mass of the Electron

by

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According to the principles of Observer Physics mass is a subjectively generated phenomenon and does not exist as an objective reality. In other words, you can not measure the mass of any object unless you put a resistance against it. What you end up measuring as mass is just a reflection of your own resistance.

On the other hand, we observe that phenomena come in quantized packets. Therefore we find that objects consisting of a certain number of energy quanta often behave as if they had so many quanta of mass when we apply a resistance to them. Subatomic particles such as protons and electrons come in such quantized packets, so we conventionally speak of them as having a certain quantized "mass". That just means that such particles reflect resistance in consistent ways in this universe.

One of the challenges of physics has been to explain how the proton and the electron happen to have the particular masses that they have. Observer Physics has developed a theory of how these fundamental particles can exist as stable phenomena. The theory also explains how they happen to have the masses that we associate with them. In this article I briefly present a description of the masses of the proton and the electron. In other articles I consider their deep structures.

Some Preliminaries

Before presenting the masses of the proton and electron I first will discuss some preliminaries concerning the unconventional notations that I use. No physical phenomenon exists of and by itself. All phenomena and their properties are conditioned as relationships among a simple set of fundamental physical phenomena. In other words, our conventional definitions are always circular. We define one property in terms of a relationship between two or more other properties. No property exists by itself. The "meaning" of these properties and phenomena derives solely from the viewpoint from which the observer observes them. Different properties reflect different viewpoints. All the viewpoints involve looking at the same thing from different angles. Thus the universe is a Unitary Reality made of conditioned components.

The Objective World and the Subjective Mind

Our reality is made up from the coexistence of two interconnected realms, the

Objective World and the Subjective Mind. We describe these realms in terms of their constant properties. A constant property is a property that, when viewed a certain way, appears to be constant. That is, it does not change in space or time. Each property has to be defined in terms of at least two other properties, so we can not reach any final definition of what these things are. However, they refer to experiences that a person may test to his own satisfaction. Anyone living in the universe that we jointly co-create and share as a reality will share these experiences. In other universes these properties and their relationships are not necessarily the same. They may not even exist.

We can describe our objective World in terms of the following five physical constants. These are all recognized standards measured in terms of arbitrary units: kg, m, s, J.

$H = (\hbar) = \text{Planck's constant} = 1.054 \times 10^{-34} \text{ J}\cdot\text{s}$.

$e = \text{the fundamental quantum of electric charge} = 1.602 \times 10^{-19} \text{ C or (kg/s)}$.

$c = \text{the speed of light in a vacuum} = 2.9979 \times 10^8 \text{ m/s}$.

$G = \text{the gravitational constant} = 6.672 \times 10^{-11} \text{ m}^3/\text{s}^2 \text{ kg}$.

$\epsilon_0 = (\text{epsilon sub zero}) = \text{the permittivity of a vacuum} = 8.854 \times 10^{-12} \text{ kg/m}^3$.

We can derive all other physical constants from these primary ones. The key element in the objective world is TIME. This means energy and mass. Of course, some may prefer to take other constants as fundamental and derive this list from them, so this list is a bit arbitrary. But it serves our purpose for this article.

We can describe the subjective Mind in terms of geometry. The key element of geometry (and hence the Mind) is SPACE. Space also plays a role in the physical constants. For example, the velocity of light is a ratio of space to time. So the physical World is actually an extension of the Mind into an additional dimension of time. Geometry (Mind) exists in a timeless world of pure space. Such an empty space in its simplest form is Euclidean. A vacuum follows the laws of Euclidean geometry. All types of geometry are variations of Euclidean geometry. Geometry is the spatial way of doing mathematics, the precise language (thinking) of the Mind.

Geometry fundamentally consists of points, lines, and circles viewed from different perspectives. Points, lines, and circles are all the same thing viewed from different perspectives. However, we will identify certain universal constants in geometry. Since these constants are not all established conventionally, I will comment on each. Here is the list. I call these constants the Seven Dwarves.

$$Ru = 1 \text{ m.}$$

$$\% = 3.16227766... \text{ m.}$$

$$P = (\pi) = 3.14159... \text{ (a pure number ratio)}$$

$$Oo = 6.28318... \text{ m} = 2 P Ru.$$

$$Ao = 3.14159 \text{ m}^2 = P Ru^2.$$

$$As = 12.56636... \text{ m}^2 = 4 P Ru^2.$$

$$Ss = 4.1887867 \text{ m}^3 = 1.333... P Ru^3.$$

I call Ru the Radial Unit. Theoretically this Unit can have any size, but when geometry (Mind) interacts with physics (World), there is a specific constant length in space that is fundamental to the connection between Mind and World. This happens to be almost exactly 1 meter. Oddly enough the meter is the scale at which we live. Two people interacting face to face on average will be about one meter apart. So this spatial interval seems also to be a biological constant. We will see how the Radial Unit definitely emerges as the constant spatial unit connected to the proton.

The % symbol in my notation stands for a constant that I call the Dimensional Shift Operator. If Ru is 1 meter, then %² is 10 Ru². You see how this number shifts up exactly an order of magnitude from Ru when we square it. It seems arbitrary that we are using meters and a base ten number system. Oddly the proton contains a constant 1 meter unit, and the relationship between Planck's constant and the velocity of light interact commonly in physics equations to give exactly a power of the Dimensional Shift Operator. Our metric system shows this most clearly.

$$* \quad (H c) = (3.162 \times 10^{-26} \text{ kg m}^3 / \text{s}^2) = (\%)(10^{-26} \text{ J}).$$

In other words the common expression (H c) stands for % times ten to the minus twenty-sixth Joules. Energy (here written as Joules) is a way of expressing time, and % is purely a spatial interval. This love triangle of H, c, and % (unified by Ru = 1 m) marks a very deep connection between space and time in the physical World.

The other symbols of geometry listed above represent the Circumference of a unit circle (Oo), the Area of a unit circle (Ao), the Area of a unit sphere (As), and the volume of a unit sphere (Ss). In each case we use the Ru to define our unit radius. This connects our abstract geometry of the Mind to our physical World. The following Newton-Force Unit shows another interesting role that (%) plays in physics.

$$* \quad Fn = (4 P eo) (\% c)^2 = 10^8 \text{ Newtons.}$$

The Mass of the Proton

Now we are ready to look at the mass of the proton. The proton (i.e. neutron) is the fundamental building block of the universe. It is stable, but contains a number of components. The electron is actually just one of the components of the proton. Sometimes the electron seems to run around independently, but the two are never really separated except by relative distances in space and time. These temporal and spatial separations determine the phenomena that we experience as the universe.

The proton/neutron mass is an expression of the relation between electric charge, the speed of light, the ratio pi, and the Radial Unit. The formula is as follows:

$$M_p = (e/c)(P \text{ Ru}) = 1.67897 \times 10^{-27} \text{ kg. (Mass of neutron: } 1.674955 \times 10^{-27} \text{ kg)}$$

That is all there is to it. Protons tend to cluster into pairs and form hydrogen. This gives us the factor (2 P Ru), which is simply (Oo), the fundamental quantum orbit. The expression (e/c) is the ratio of the charge quantum to the velocity of light. This formula tells us that the proton tends to form hydrogen gas. It also tells us that the proton is made of photons. It also tells us that a photon of light in a mode called charge creates a force (Fp). The photon moves at the velocity of light. But the charge represents a warping of the photon path in space/time.

$$* \quad F_p = (e \ c) = 4.806 \times 10^{-11} \text{ N.}$$

$$* \quad F_p \text{ (Oo)} = 2 \ M_p \ c^2.$$

The proton force times the Unit Circumference gives us the rest energy of a pair of protons (a hydrogen molecule). So we simply rearrange the formula to get the rest mass of hydrogen.

$$* \quad 2 \ M_p = F \text{ (Oo)} / c^2 = (2 \ P \ \text{Ru}) \ (e / c).$$

We can cancel out the 2's to get the rest mass of a single proton (neutron). We should note here that taking Ru as 1 meter is an approximation. The actual value of Ru is very slightly less (about 2.4 mm) than 1 meter. However, it is so close that I think we should consider using Ru as our meter stick, since it is the physical constant for our universe that connects our Mind to our stable physical World of experience.

Velocity is an observable. But charge is more mysterious. We can also observe effects of charges, and Millikan measured individual charges in his oil-drop

experiment and found them to be quantized at a constant value of (e).

According to Observer Physics charge comes from a viewpoint shift by the observer. The observer twists his viewpoint and this creates the illusion that a photon is spinning around in a circle rather than going straight ahead through space. Recall that space is a purely mental phenomenon. Theoretically it takes no effort to do such a twist in the mind. But it does take time. This time appears to us as an expenditure of energy and generates the sensation of a physical force. Not wanting to take responsibility for the twisted viewpoint, we say that the photon is whirling in a vortex. Since our physics has not yet advanced to the point of even recognizing the vortex motion of photons, we simply say that we have a stable subatomic particle called the proton or a molecule of hydrogen gas. As a rough approximation that is OK.

The Mass of the Electron

Now we come to the mass of the electron. This is a bit more complex. It seems odd that the electron is a component of the proton and yet it has a more complex mathematical structure than the proton. This has to do with its interaction.

The electron has the same quantum charge as the proton, but a much smaller mass. It is about 1836 times smaller. We would expect the electron to have the same basic vortex structure as the proton, and indeed it does. For starters we observe the following relation:

$$* \quad m_e c^2 = (e c) (k).$$

Here (k) represents some unknown radial distance. Actually it is not unknown. We know it has to be about 1836 times shorter than (P Ru) since the proton-to-electron mass ratio is around 1836. So we know right off the bat that (approximately):

$$* \quad m_e = (e/c) (k) = (e/c) (P Ru / 1836).$$

$$* \quad (k) = (P Ru) / 1836 = .0017111 \text{ m.} \quad (\text{approx. val.})$$

The electron always interacts with photons via the fine structure coupling constant (a). Niels Bohr derived this pure number constant from a fundamental set of physical constants. We mentioned the combinations (4 P eo) and (Hc) earlier in this article.

$$* \quad (a)^{-1} = 4 P e o H c / e^2 = 137. \quad (\text{Approximate value})$$

$$* \quad (a) = (\% F p^2) / (10^{-26} N^2 \text{ m}) = 137^{-1}. \quad (\text{See the protons hidden in there?})$$

In any case the factor (a) gets us pretty close to our ratio and it logically makes sense that we will have (a) appear for each component of an electron interaction. Hence we will have (a)² show up when two electrons interact electromagnetically.

$$* \quad (k) = P R u a / 13.4.$$

We get very close when we notice that 13.4 is ten times the ratio $4/3 = 1.333\dots$. Of course that reminds us of the volume of our Unit Sphere: $1.333\dots P R u^3$. This makes sense since the electron behaves like an energy cloud that fills the space around a proton. The size of the cloud depends on the "rest" energy of the electron (its ground state) plus any additional energy it may have. The cloud's shape gets distorted in many atoms due to complex interactions. A single proton is the simplest possible state. Let's put in our Unit Volume and then balance the units and shift magnitude.

$$* \quad S s P \% ^2 / A o ^2 = 13.333\dots m.$$

$$* \quad (k) = (P R u a) (A o ^2 / S s P \% ^2) = (R u a A o ^2 / S s \% ^2) = .001711292.$$

We are now very close to the desired proton/electron "mass" ratio.

$$* \quad P S s \% ^2 / a A o ^2 = 1826.666\dots m.$$

We edge it up just a tad and balance out the units with the following important ratio:

$$* \quad \% / A o = 1.006585\dots m^{-1}.$$

$$* \quad (P S s / a) (\% / A o)^3 = 1838.69$$

We invert this factor and our formula for the electron becomes an elegant object of contemplation.

$$* \quad M e = (e/c) (R u a / S s) (A o / \%)^3 = 9.1197 \times 10^{-31} \text{ kg.}$$

$$* \quad M p = (e/c) (P R u). = 1.67 \times 10^{-27} \text{ kg.}$$

With our logical argument we have gotten so close to the measured mass of the electron that this formula is not likely to be chance. Since $F_p = (e c)$, we also get the following rest energies for the electron and proton/neutron.

$$* \quad M e c^2 = (F_p) (R u a / S s) (A o / \%)^3.$$

$$* \quad M p c^2 = (F_p) (P R u).$$

In the **Observer Physics** papers (ch. 8:18-19) I show that the motivation for R_u is that it represents the magnetic component of the proton. The magnetic field \mathbf{B} is measured in Teslas ($1 \text{ T} = 10^4 \text{ G} = 1 \text{ Wb/m}^2$). So a Weber is basically a unit of area in square meters.

$$* \quad 1 \text{ T} = 1 \text{ Wb/m}^2.$$

My approach is to establish a magnetic constant ($b = 1 \text{ meter}$) set up by the proton, the basic unit of solid matter.

$$* \quad b^2 = 1 \text{ Wb.}$$

$$* \quad M_p = P e b / c.$$

Here (b) represents the unit of magnetism of the proton, just as (e) represents the unit of charge of the proton. The unit (b) is in meters, and the unit (e) is in Coulombs or kilograms per second. So ($b e$) is a momentum. The ($b e$) momentum differs from the light-speed momentum of a proton by the proportion π .

$$* \quad (e o)(m o)(c^2) = 1.$$

This is the famous Maxwell Relation that shows the unity of electricity and magnetism. We can multiply our proton formula by this Maxwell Relation and then reorganize the components.

$$* \quad M_p c^3 = P e b / e o m o.$$

$$* \quad (M_p c^2) = (P / c) (e / e o) (b / m o).$$

This elegantly shows the "rest energy" of a proton in terms of light moving in a vortex to generate electric and magnetic components relative to the respective permittivity and permeability of a vacuum. The value $b = R_u = 1 \text{ meter}$ and the derivation of the weber unit (Wb) come up in the definition of the Ampere, the unit of electric current. In other words we define current indirectly by the magnetic effects it induces.

$$* \quad 1 \text{ A} = 2 \times 10^{-7} \text{ N} / 1 \text{ m.}$$

$$* \quad 1 \text{ b} = 2 \times 10^{-7} \text{ N} / 1 \text{ A.}$$

When two parallel current-carrying very thin wires separated by a vacuum gap of (b)

= 1 meter generate a magnetic force per (b) on each wire of 2×10^{-7} newtons, we define that current as one Ampere. The total area involved in this determination is thus $(b)^2 = 1 \text{ Wb}$. One (b) is for the separation of the parallel wires, and the other (b) is for distance along the wires. This means we have one square meter of area involved in the determination of 1 Ampere of current.

If we have a single free proton moving in a plane and subject to a magnetic field perpendicular to the plane of its motion, the proton assumes a circular motion. As long as the magnetic field \mathbf{B} is constant and homogeneous, the motion will continue in a circle with a constant radius. The formula for this radius R is:

$$* \quad R = M_p v / q \mathbf{B}.$$

If we set $v = c$ and $R = R_u$, (and of course $q = e$) then we get the following interesting relation.

$$* \quad R_u = M_p c / e \mathbf{B}.$$

$$* \quad M_p = (e / c)(\mathbf{B} R_u).$$

The value of \mathbf{B} , the strength of the magnetic field, then turns out to be pi in Teslas. The value of R_u is the constant radius value that appears when a proton is moving at light speed and the magnetic field is pi in Teslas. The radius of 1 meter is the magnetic constant (b) for the proton. Or we can say that $(\mathbf{B} R_u = P \text{ Wb/m.})$