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# 1.0 Abstract

What determines the mass of particles like the muon and tauon? No, reasonable, mainstream model, has been predictive the mass of particles. Michael John Sarnowski's empirical equations for the proton and electron use an equation that shows that a resonant frequency created by a resonance between bremsstrahlung and Cherenkov like radiation and the ratio of orbital energy ratios.(1) In those two papers the masses of the electron and proton are due one of the solutions the resonances. In addition a small fraction of the proton mass is due to relativistic effects of most of the electron, a small fraction of the electron is due to relativistic effects of the second solution to the mass equation of the proton. In "Evidence for Granular Granulated Spacetime it is shown that charge is directly dependent on the mass ratio of the electron to neutron and the proton to the neutron(2). These empirical equations are accurate to the CODATA values for the mass ratios of the electron to the neutron and the proton to the neutron. Also this equations are also predictive for the value for elementary charge. The following paper shows that the mass ratios of the muon to the neutron and the tauon to the neutron can be calculated from both solutions to resonant equation of a Cherenkov like radiation and Bremsstrahlung type radiation. These mass ratios are also accurate to the CODATA values for these two particles and are likely predictive of more accurate measurements of these particles in the future.

What is unique for the muon-neutron and tauon-neutron is that the mass ratios of the use the same resonance and use one of the solutions for the resonance of the proton to the neutron mass ratio. The consistent use of resonances, consistent use of mass ratios to the neutron, and consistent interdependence of the mass ratios of particles indicates that the developing model is consistent and hints at underlying structure to space-time.

When a charged particle travels faster than light, it emits Cherenkov radiation. When a charged particle is accelerated it emits a braking radiation called Bremsstrahlung. Inside an electron are the many configurations of the constituent particles. It is proposed here, and likely proposed by others that there may be some equivalent process that there is a constant acceleration of charged particles or superluminal movement of charged particles that causes the mass of the electron or other particles.

It is proposed that the ratios of the masses of particles to the mass of the neutron is related to ratio of the Bremsstrahlung to the Bremsstrahlung where velocity is parallel to acceleration.

This paper is an attempt of an explanation and derivation for the equation that very closely, within the known Codata 2014 mass ratio of both the muon and tauon to the neutron. An equation is developed below that uses the coupling dependence and Cherenkov radiation angles summing the radiation angles from $0$ to $\frac{pi}{2}$ angles, assuming an ideal case of a non-dispersive medium (where phase and group velocity are the same(4), and integrating through what may appear to be multiple levels of dimensions. This is a continuation of Sarnowski's Sphere Theory for the construction of the universe.

## 2.0 Equations

In an MIT course the Cherenkov radiation satisfied both a resonance and dispersion relation (3)

This is the following equation in their analysis.

$$Cos\theta = \frac{1}{v\beta} \quad [1]$$

Where $\theta$ is the possible emission solution angles, $\nu$ is relative permittivity, and $\beta$ is velocity divided by the speed of light. If $\nu = 1$, which is a possibility inside the nucleons.

$$Cos\theta = \frac{1}{\beta} \quad [2]$$

Note: In this case the velocity is greater than the speed of light. This is true of Cherenkov radiation.

If we look at the following google book (4) and equation 232 we find that $\theta$ must be divided by two to keep the sum of the angular momentums equal. Therefore we have

$\frac{Cos\theta}{2} =$ Possible emission solution angles. [3]

If we integrate the possible emission solution angles $\frac{Cos\theta}{2}$ from $0$ to $\frac{\pi}{2}$ but do this as the Cherenkov type radiation of the nucleons goes through 9 physical dimensions we than have the following equation.

$$\int_0^{pi/2} (\frac{Cos\theta}{2})^9 d\theta \quad [4]$$

If we set equation 4 equal to $p(1-p)$ we obtain the following

$$p(1-p) = \int_0^{pi/2} (\frac{Cos\theta}{2})^9 d\theta \quad [5]$$

And if we substitute $p$ as follows, we get

$$p = \beta^2 = \frac{v^2}{c^2} \quad [6]$$

We can substitute equation 6 into equation 5 and obtain the following.

$$\beta^2(1-\beta^2)=\int_0^{pi/2}(\frac{Cos\theta}{2})^9 d\theta \qquad [7]$$

Or

$$\frac{v^2}{c^2}(1-\frac{v^2}{c^2})=\int_0^{pi/2}(\frac{Cos\theta}{2})^9 d\theta . \qquad [8]$$

It is not known why setting equation [5] should be set equal to $\frac{p(1-p)}{2}$. The value of $\frac{1}{2}$ could be due to the Cherenkov nucleon type radiation going through a cuboctahedron angles of 60 degrees or the summing of the scalar number of 3 equal forces in the x, y, and z direction.

How do we obtain the relationship of $p(1-p)$

Let's propose that the value p is a ratio. Here we show that $p$ may be the ratio of the mass of the electron to the neutron. Let's propose that this ratio may come about by calculating the ratio of the Bremsstrahlung type radiation of the Electron to the Neutron. It is called Bremsstrahlung type radiation since it would be a radiation of photons that are absorbed back into the nucleons which would actually not get emitted outside of the constituent particles. If we look at the most established for Bremsstrahlung Radiation, we have the following.

$$P=\frac{q^2\gamma^6}{6\pi\grave{o}c}(\dot{\beta}^2*(1-\beta^2)-(\vec{\beta}\times\dot{\vec{\beta}})^2) \qquad [9]$$

If we look at the case where the acceleration is parallel with the velocity, then

$$P_{parallel}=\frac{q^2\gamma^6}{6\pi\grave{o}c}\dot{\beta}^2_{parallel} \qquad [9.1]$$

When we divide Equation 9 by Equation 9.1 we obtain

$$\frac{P}{P_{parallel}}=\frac{\dot{\beta}^2*(1-\beta^2)-(\vec{\beta}\times\dot{\vec{\beta}})^2}{\dot{\beta}^2_{parallel}} \qquad [9.2]$$

Lets propose that this equation contains some special situations.

1) For $\dot{\beta}^2$ is equal to $\frac{\frac{Mp}{Mn}\beta^2}{2}$ for exponential deceleration.
2) $\dot{\beta}^2_{parallel}=1$ [9.3]
3) $(\vec{\beta}\times\dot{\vec{\beta}})=0$ [9.4]
4)

Then equation 9.2 becomes the following

$$\frac{P}{P_{parallel}} = \frac{Mp}{Mn}\frac{(\beta^2)(1-\beta^2)}{2} \quad [9.5]$$

We can then set this equal to the Cherenkov Radiation through 9 dimensions as proposed below.

We can then change the equation 5

$$p(1-p) = \int_0^{pi/2} (\frac{Cos\theta}{2})^9 d\theta \quad [5]$$

to

$$\frac{Mp}{Mn}\frac{(\beta^2)(1-\beta^2)}{2} = \int_0^{pi/2} (\frac{Cos\theta}{2})^9 d\theta \quad [9.6]$$

It is possible that there are other factors. We could multiply the left hand side of the equation to an orbital energy level as shown in equation 11

$$\frac{Mp}{Mn}\frac{(\beta^2)(1-\beta^2)}{2} = \frac{\lambda_\infty}{\lambda_{muontau}}\int_0^{pi/2} (\frac{Cos\theta}{2})^9 d\theta \quad [9.7]$$

Where $\frac{\lambda_\infty}{\lambda_{muontau}}$ is defined below.

The Energy levels for the Bohr hydrogen atom is as follows.

$\frac{1}{\lambda_x} = R_\infty(\frac{1}{n_1^2} - \frac{1}{n_2^2})$ where $R_\infty = \frac{m_e q^4}{8\epsilon_0^2 h^3 c}$ and where $n_1$ and $n_2$ are any two different positive integers (1, 2, 3, ...), and $\lambda$ is the wavelength (in vacuum) of the emitted or absorbed light.

We will called $\lambda_\infty$ for the infinity orbital and $\lambda_{muontau}$ for the muontau. It is not possible to measure these levels, but we can see if these wavelengths follow a pattern for the masses of particles.

It is proposed that the ratio of the mass of the muon and tau particle to the neutron, and of course other particles is related to the ratio the energy levels of a similar process to the Bohr hydrogen, but at a deeper level. It is not expected that $R_\infty$ is not the same number for this deeper level, but this number does not need to be known since we will be taking ratios of the wavelengths and the $R_\infty$ ratio will become one. For the muon and tau to neutron orbital energy ratio the following equation is proposed.

$$\frac{\lambda_\infty}{\lambda_{muontau}} = \frac{R_\infty(\frac{1}{n_{1muontau}^2} - \frac{1}{n_{2muontau}^2})}{R_\infty(\frac{1}{n_{1\infty}^2} - \frac{1}{n_{2\infty}^2})} \quad [9.8]$$

The following values are substituted in. $n_{1muontau} = 2$, $n_{2muontau} = 4$, $n_{1\infty} = 1$, $n_{2\infty} = \infty$ which yields

$$\frac{\lambda_\infty}{\lambda_{muontau}} = \frac{R_\infty(\frac{1}{2^2} - \frac{1}{4^2})}{R_\infty(\frac{1}{1^2} - \frac{1}{\infty^2})} = \frac{3}{16} \quad [9.9]$$

Whatever the value of, $R_\infty$, at the next level of dimensions, it cancels with the ratio in equations 9.8 and 9.9

Equation 9.7 becomes Equation 9.10 with the equation 9.9 substitution

$$\frac{Mp}{Mn}\frac{(\beta^2)(1-\beta^2)}{2} = \frac{3}{16}\int_0^{pi/2}(\frac{Cos\theta}{2})^9 d\theta \quad [9.10]$$

This equation yields the following possible values for $\beta^2$

$\beta^2 = MTy = 0.000298118170815717 and MTx = 0.99970188182918$ If we take the first value

It appears from the following equations that the mass of the muon and tau is due to a combination of resonance from the proton resonance solution and from the muon tau resonance solution.

The relativistic correction

$$Lm = \frac{1}{\sqrt{1-(\frac{\pi MTy}{9})^2}} = 1.0000000054. \quad [9.11]$$

Equation for Muon-Neutron Mass ratio

Equation 9.12

$$\frac{Mu}{Mn} = 1 - Lm * Px + \frac{Mx}{9} = 1 - 1.0000000054 * 0.998623461644084 + \frac{0.99970188182917}{9} = .1124545198$$

Which compares to 2014 Codata of

| muon-neutron mass ratio $m_\mu / m_n$ | |
|---|---|
| Value | 0.112 454 5167 |
| Standard uncertainty | 0.000 000 0025 |
| Relative standard uncertainty | 2.2 x $10^{-8}$ |
| Concise form | 0.112 454 5167(25) |

Equation for Tauon-Neutron Mass ratio

Equation [9.13]

$$\frac{Mt}{Mn} = (2*(1-Lm*Px) + \frac{17*Tx}{9} = 2*(1-1.0000000054*0.998623461644084) + \frac{17*0.99970188182917}{9}$$

$\frac{Mt}{Mn} = 1.8910789$ Within one sigma of Codata 1.89111 and within0.99998

Which compares to 2014 Codata of

| tau-neutron mass ratio $m_\tau / m_n$ | |
|---|---|
| Value | 1.891 11 |
| Standard uncertainty | 0.000 17 |
| Relative standard uncertainty | 9.0 x $10^{-5}$ |
| Concise form | 1.891 11(17) |

Please note that the value used for $\frac{Mp}{Mn} = 0.99862346166$ from

$\frac{p(1-p)}{\sqrt{3}} = \int_0^{pi/2} (\frac{Cos\theta}{2})^9 d\theta$. The reason for this substitution is that the values of the electron and proton mass are intertwined. Please see An Electro Magnetic Resonance in 9 Dimensions that gives Mass Ratio of Proton to Neutron(5)

3.) Discussion

First please note the complementary equation 9.12 and 9.13 for the muon-neutron mass ratio and tauon-neutron mass ratio. That this would happen by coincidence is not likely. It adds to the credibility that the equation [9.10], although empirical, is mirroring the actual derivation for these respective mass ratios of muon-neutron mass ratio and tauon-neutron.
We see that Bremsstrahlung and Cherenkov type of radiation from the nucleons could offer some explanation for the mass of the muon. We also see that the equation use of integrating radiation angles to the ninth power, which may be an indication of the 9 physical dimension of string theory. More work needs to be done to determine why this particular equation for the electron neutron mass ratio and can this type of equation be applied to other particles of mass.

In Sarnowski's Sphere Theory it is not strings, but rotating spheres and imperfections that may be creating these stable resonances that give properties to our universe. This paper doesn't show the universe is granulated, but does show it is possible that Cherenkov type radiation and Bremsstrahlung radiation in the nucleon, could help account for the particular mass of particles.

Although these equations are empirical the origin of the masses of particles are elusive. It is hoped that these empirical equations will lead to mainstream mechanical model of the universe.

4.) Prediction

It is predicted from these empirical equations that the Muon-Neutron mass ratio, when published by CODATA, when the values are more accurate, will be

$$\frac{Mu}{Mn} = 0.1124545198$$

It is predicted from these empirical equations that the Tauon-Neutron mass ratio, when published by CODATA, when the values are more accurate, will be

$$\frac{Mt}{Mn} = 1.8910789$$

<u>Reference</u>

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