A Preliminary Theory of the Proton-Electron Mass Ratio

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Abstract

The experimental value of the proton-electron mass ratio is

$$\frac{m_p}{m_e} \sim 1836.15267343(11).$$

A recent investigation by the author revealed that the dimensionless number could be extremely well approximated by the simple closed-form expression:

$$\sqrt[4]{11366719876399} \sim 1836.15267343109087.$$

That such an accurate value could be generated by such a simple formula inspired me to try to account for this fact.

A Preliminary Theory of the Proton-Electron Mass Ratio

Suppose the proton and neutron are isotropic radiators (whether it be gravitons, photons or virtual particles/photons, who knows?). If the power of a transmitter T_x is denoted by P_t and if an isotropic radiator (transmitter which will radiate energy uniformly in all directions) then the power density at a distance R from the transmitter is equal to the radiated power divided by the surface area $4\pi R^2$ of an imaginary sphere of radius R, i.e., the power density at range R from an isotropic radiator is

$$= P_t/4\pi R^2 \quad \text{Watt/m}^2.$$

The target intercepts a portion of the incident energy and re-radiates it in all directions. It is only the power density re-radiated in the direction of the original transmitter (echo) that is of interest. The signal cross-section of the target determines the power density returned to the transmitter for a particular power density incident on the target. It is denoted by σ. The reradiated power returning back at the transmitter (now the receiver) is:

$$\frac{P_r}{\sigma_r} = \frac{P_t \sigma_t}{4\pi R^2 \cdot 4\pi R^2}.$$

The cross-section has units of area, but it can be misleading to associate the cross-section directly with the objects physical size. The cross-section is more dependent on shape than size.

Simple algebraic manipulation leads to:

$$R = \sqrt[4]{\frac{P_t}{P_r} \frac{\sigma_t \sigma_r}{(4\pi)^2}}$$

Now for an ansatz. Suppose that the distance from the proton to the electron $R_{p,e}$ does not equal the distance from the electron to the proton $R_{e,p}$ and that that discrepancy somehow accounts for the mass ratio, i.e.,

$$\frac{R_{p,e}}{R_{e,p}} = \sqrt[4]{\frac{P_{t,p}}{P_{r,p}} \cdot \frac{P_{r,e}}{P_{t,e}}} \stackrel{?}{=} \frac{m_p}{m_e}$$

If that were the case, the proton-electron mass ratio would be accounted for if it could be proven that

$$\frac{P_{t,p}}{P_{r,p}} \cdot \frac{P_{r,e}}{P_{t,e}} = 11,366,719,876,399$$

and this would essentially be the discovery of a new constant of nature.