Simple Equation for the Mass Radius of the Proton

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Abstract:

A simple derivation can provide the measured mass radius of the proton.

In 2014, I posted a simple equation for the newly measured shorter radius of the proton that was exceedingly close to the new measurements at that time. (Support for the Validity of the New, Smaller Radius of the Proton-viXra:1403.0073-submitted on 2014-03-10). A slight modification of my original formula now gives a very good value for the measured mass radius of the proton (Institute of Modern Physics of the Chinese Academy of Sciences-in Physical Review D on May 11, 2021).

Here is the original derivation of the proton radius.

A simple algebraic derivation using the Planck relation for a photon can show that this measurement of the proton radius is probably quite valid. The following derivation results in a value that is nearly identical to the new proton radius.

$$E = \frac{hc}{\lambda} \qquad \text{let } \lambda = 2\pi r$$

$$E = \frac{hc}{2\pi r} \qquad \text{substitute } E = mc^2$$

$$mc^2 = \frac{hc}{2\pi r} \qquad \text{solve for r}$$

$$r = \frac{h}{2\pi mc}$$

m is mass of proton = $1.672621777 \times 10^{-27}$ kg
c is speed of light = 2.99792458×10^{8} m.s^{-1}
h is Planck constant = $6.62606957 \times 10^{-34}$ kg.m^2.s^{-2}

$$r = 0.21030891 \times 10^{-15} \text{ m}$$

$$4r = 0.84124 \times 10^{-15} \text{ m}$$ which compares to:

$$r^* = 0.84087\ (39) \times 10^{-15} \text{ m}$$ (the new smaller measured proton radius)

By simply replacing the value of 4 in my equation with pi, a very good approximation of the proton mass radius can be obtained

$4r = 0.84124 \times 10^{-15}$ m becomes

$\pi r = 0.660705 \times 10^{-15}$ m which is a close match for:

r (mass) $= 0.67 \times 10^{-15}$ m The newly measured proton mass radius

My formula for the proton mass radius reduces to simply :

$$r = \frac{h}{2mc} \text{ or } \frac{hc}{2mc^2}$$

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