

Support for the Validity of the New, Smaller Radius of the Proton

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Abstract:

A simple algebraic derivation using the Planck constant for a photon and the mass/energy of a proton suggests that the new smaller measurement of the proton radius is accurate.

The newly measured, smaller proton radius of $0.84087 (39) \times 10^{-15}$ m is significantly smaller than the long-held value of 0.8768×10^{-15} m (4/13/13-Randolph Pohl, Max Planck Institute for Quantum Optics). Consequently, a great deal of debate has arisen trying to either explain this value or discredit it.

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.

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

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

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

$$r = \frac{h}{2\pi mc} \quad \begin{array}{l} m \text{ is mass of proton} = 1.672621777 \times 10^{-27} \text{ kg} \\ c \text{ is speed of light} = 2.99792458 \times 10^8 \text{ m.s}^{-1} \\ h \text{ is Planck constant} = 6.62606957 \times 10^{-34} \text{ kg.m}^2.\text{s}^{-2} \end{array}$$

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

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

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

This derivation, which uses the Planck relation for a photon, suggests that the actual geometry of a proton may be strongly related to the structure of photons. The wavelength (or effective radius of curvature) is inversely proportional to energy. Use of the mass-energy of a proton provides a radius of curvature that is one fourth the size of the new proton radius. If this energy were to be distributed equally among four, intertwined, overlapping, photon-like structures, each would result in a four-fold increase in radius, yielding the newly measured proton radius.

Currently, no model of the proton internal structure suggests the presence of four identical features within the proton. Hopefully, this calculation may trigger a new line of reasoning about the internal geometry of the proton. Some of my recent calculations show potentially promising results in this direction.