Determination of Proton and Neutron Radii

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In note we calculate Proton and Neutron radii[1,2]
The Newtonian gravitation formula has the following form.

\[ F = -G \frac{M_1 M_2}{R^2} \]  

(1)

We assume

\[ G = K_0 \rho_1 \rho_2 \]  

(2)

Where \( \rho_1 \) and \( \rho_2 \) denote the densities of both \( M_1 \) and \( M_2 \) separately. Using the Cavendish experiment we determine \( K_0 \). In (2) \( G = 6.7 \times 10^{-8} \text{ cm}^3/\text{g sec}^2 \) and the density of lead \( \rho_1 = \rho_2 = 11.37 \text{ g/cm}^3 \). From (2) we have

\[ K_0 = 5.2 \times 10^{-10} \text{ cm}^9/\text{g}^3 \text{ sec}^2 \]  

(3)

Thus, \( K_0 \) is a new gravitational constant.

By using (2) we determine the proton radius \( \gamma_p \). From (2) we have

\[ \gamma_p = \left( \frac{9K_0 m_p^2}{16\pi G_s} \right)^{1/6} \]  

(4)

In the nucleus the strong interaction prevails. We have [3].

\[ \frac{\text{strong interaction}}{\text{gravitational interaction}} = \frac{G_s}{G} = 10^{38} \]  

(5)

where \( G_s = 6.7 \times 10^{30} \text{ cm}^3/\text{g sec}^2 \). We know the proton mass \( m_p = 1.67 \times 10^{-24} \text{ g} \). From (4) we obtain the proton radius

\[ \gamma_p = 1.5 \times 10^{-15} \text{ cm} = 1.5 \text{ jn} \]  

(6)

In the same way we have the neutron radius

\[ \gamma_n = 1.5 \times 10^{-15} \text{ cm} = 1.5 \text{ jn} \]  

(7)
Pohl, et al. obtain the size of proton in [4].

References