Determination of Proton and Neutron Radii

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Abstract: 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)

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In note we calculate Proton and Neutron radii[1,2]

The Newtonian gravitation formula has the following form:

$$F = -G\frac{M_1 M_2}{R^2} \tag{1}$$

We assume

$$G = K_0 \rho_1 \rho_2 \tag{2}$$

Where ρ_1 and ρ_2 denote the densities of both M_1 and M_2 separately. Using the Cavendish experiment we determine K_0. In (2) $G = 6.7 \times 10^{-8}$ cm^3/g sec^2 and the density of lead $\rho_1 = \rho_2 = 11.37 g/cm^3$. From (2) we have

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

Thus, K_0 is new gravitational constant.

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

$$\gamma_p = \left(\frac{9K_0 m_p^2}{16\pi^2 G_s} \right)^{1/6} \tag{4}$$

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

$$\frac{\text{strong interaction}}{\text{gravitational interaction}} = \frac{G_s}{G} = 10^{38} \tag{5}$$

where $G_s = 6.7 \times 10^{30}$ cm^3/g sec^2. We know the proton mass $m_p = 1.67 \times 10^{-24}$ g.

From (4) we obtain the proton radius

$$\gamma_p = 1.5 \times 10^{-15} \text{ cm} = 0.015 \text{ fm} \tag{6}$$

In the same way we have the neutron radius

$$\gamma_n = 1.5 \times 10^{-15} \text{ cm} = 0.015 \text{ fm} \tag{7}$$

Pohl, et al, measure the proton size 0.03 fm[4].

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