On the Interaction of Ele mentary Particles. I. Hideki YUKAWA. Proceeding

The potential of force corresponding to "Platzwechsel" between the neutron and the proton in Heisenberg's theory of the nucleus was assumed to be of the form $\pm g^2 \frac{e^{-\lambda r}}{r}$, which is the static solution of the wave equation

$$\left\{ \Delta - \frac{1}{c^2}\frac{\partial^2}{\partial t^2} - \lambda^2 \right\} U = 0$$

The magnitudes of two constants g and λ were estimated by comparison with experiments. The properties of the quantum accompanying the field of force were discussed and the following conclusions were reached: It has the proper mass about hundred times as large as the electron mass and has the elementary charge either +e or −e, obeying Bose's statistics.

The problem of β-disintegration was treated on the assumption that the light particle can jump from a neutrino state of negative energy to an electron state of positive energy by absorbing a quantum with charge -e. The result was essentially the same with that of Fermi, who treated the problem by assuming the direct coupling of heavy and light particles. The interaction of the quantum with the light particle should be far smaller than that with the heavy particle to account for the small probability of β-disintegration as well as the large binding energy of the nucleus.

The reason why such quanta, if they exist, have never been observed was discussed and ascribed to the large proper mass.

Author.

The potential of force corresponding to "Platzwechsel" between the neutron and the proton in Heisenberge's theory of the nucleus was assumed to be of the form $+g\frac{e^{-\lambda r}}{r}$ or $-g\frac{e^{-\lambda r}}{r}$, which is the static solution of the wave equation

$$\left(\Delta - \frac{1}{c^2}\frac{\partial^2}{\partial t^2} - \lambda^2\right) U = 0 .$$

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