Collision of Neutron & Proton (3)

$$\frac{d^2\psi}{dr^2} + \frac{2}{r}\frac{d\psi}{dr} + \left\{ \frac{M_p E}{\hbar^2} \mp \frac{M_p g^2 e^{-\lambda r}}{\hbar^2 r} - \frac{l(l+1)}{r^2} \right\} \cdot \psi = 0$$

$\lambda r = x \quad r\psi = y$

$$\frac{d^2y}{dx^2} + \left(A \mp B\frac{e^{-x}}{x} - \frac{C}{x^2}\right) y = 0$$

$$\delta \int_0^\infty \left\{ \frac{d\tilde{y}}{dx}\frac{dy}{dx} - \left(A \mp B\frac{e^{-x}}{x} - \frac{C}{x^2}\right)\tilde{y}y \right\} dx = 0$$

$$y = e^{i\kappa x}(ae^{-\mu_0 x} + be^{-\mu x}) + e^{-i\kappa x}(ce^{-\mu_0 x} + de^{-\mu x})$$

$$\left|\left\{ i\kappa(a e^{-\mu_0 x} + be^{-\mu x}) \underbrace{+ b\mu e^{-\mu x}}_{+ (a\mu_0 e^{-\mu_0 x}} \right\}\right|^2$$

$$y = \sin \kappa x + a(1-e^{-\mu x})\cos \kappa x$$

$x \to \infty \qquad a = \tan \varepsilon$

$$y = \frac{1}{\cos\varepsilon}\sin(\kappa x + \varepsilon)$$

$$y = \sin(\kappa x + \varepsilon) - e^{-\mu x}\sin\varepsilon$$

~~Photoel.~~ γ-ray Disintegration
Capture of Neutron by Nucleus

$$J(r) = g^2 \frac{e^{-\lambda r}}{r}$$ なる type の exchange force の存在の下に

neutron が nucleus に capture される process の prob を計算する.

1) Proton との recombination
2) Deuteron の γ-ray absorption.

$$\psi_1 = e^{-\kappa r_1} \qquad \iiint e^{ikz} \boxed{\frac{4\pi g^2}{\lambda^2}} e^{-\kappa r} r^2 dr d\theta d\varphi$$

$$\psi_2 = e^{ikz_1}$$

=

H. Bethe v R. Peierls, Photoelectric Disintegration of the Diplon (Int. Conf. on Physics London, October 1934)

Selbstenergie

G. Wataghin, Zs. f. Phys. 88, 92, 1934
92, (7-8), 547, 1934.

V. Weisskopf, 89, 27, 1934.
90, 817, 1934.

W. Heisenberg, 90, 209, 1934.

Watagin によると、radiation と electron の Wechselwirkungsenergie は

$$H_1 = eV_1 + e(\vec{\alpha}\vec{U}_1)$$

$$V_1 = c\left(\frac{8\pi}{\Omega}\right)^{1/2} \sum G_s \nu_s e^{i\left(\frac{1}{\hbar}(\vec{k}_s\vec{r}) - \nu_s t\right)}$$

$$\vec{U}_1 = \quad \text{,,} \quad \sum \text{,,} \; \vec{u}_s \quad \text{,,}$$

$$G_s = e^{-\frac{1}{2mE_0}\left[(\vec{p}_s - \vec{p})^2 - \left(\frac{E_s - E}{c}\right)^2\right]}$$

$$\vec{p}_s = \vec{k}_s$$

$$E_0 = \frac{mc^2}{\alpha}$$

$$4\pi U = \sqrt{1+\vec{D}^2+\vec{B}^2+[\ldots]^2}$$

$$dU = \vec{E}\,d\vec{D} + \vec{H}\,d\vec{B}$$

$$4\pi\vec{S} = \frac{1}{2}[(\vec{D}\times\vec{B}) - (\vec{B}\times\vec{D})]$$

$$[B_k, \bar{B}_l] = [D_k, \bar{D}_l] = 0$$

$$[D_k, \bar{B}_k] = [B_k, \bar{D}_k] = 0\ldots$$

$$[D_1, \bar{B}_2] = -[B_1, \bar{D}_2] = 4\pi\frac{\partial}{\partial z}\delta(r-\bar{r})$$

$$i\alpha[D_1, \bar{B}_2] = (D_1\bar{B}_2 - \bar{B}_2 D_1), \text{ etc}$$

$$(\epsilon = 1, \quad c = 1; \ \epsilon_0 = 1; \ b = 1,$$
$$h = 137, \quad 1 = \frac{1}{\alpha})$$

$$\frac{\partial F}{\partial t} = -[W, F]$$

$$\frac{\partial F}{\partial x} = [p_x, F]$$

$$W = \int U\,dv,$$

$$\vec{p} = \int \vec{S}\,dv \qquad \begin{aligned}&(4\pi U - \vec{D}^2 - \vec{B}^2)\\ &\times(2\times1)(4\pi U + \vec{D}^2 + \vec{B}^2)\\ &= (4\pi\vec{S})^2\end{aligned}$$

$$4\pi U = \beta(1+\vec{D}^2+\vec{B}^2) + \vec{\alpha}\,4\pi\vec{S} - 1.$$

$$(4\pi U)^2 = (1+\vec{D}^2+\vec{B}^2)^2 + (4\pi\vec{S})^2$$
$$\cancel{-2\beta(1+\vec{D}^2+\vec{B}^2) + \vec{\alpha}\,4\pi\vec{S}) + 1}$$
$$(+1)$$
$$\cancel{= (\vec{D}^2+\vec{B}^2)^2 + 2(1-\beta)(1+\vec{D}^2+\vec{B}^2) + 2\vec{\alpha}}$$