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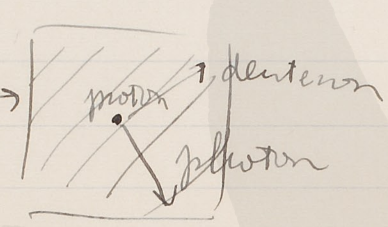
$\dot{x} = \left(p_x + \frac{e}{c} A_x\right)$

DATE Oct, 21, 1936.
NO. 1

Cross Sections of Capture of the Neutrons by the Proton and of the Photoelectric Effect of the Deuteron.

1) neutron $\nu \rightarrow$



$$\sigma_c = \frac{2\pi}{\hbar}\frac{\rho_2}{v}\left|V_{12}\right|^2$$

$$\rho_2 = \frac{8\pi\nu^2}{hc^3}$$

$$\frac{e}{2c}\{\vec{A}(\vec{r}_2)\vec{p}(\vec{r}_2) + \vec{p}(\vec{r}_2)\vec{A}(\vec{r}_2)\}$$

$$V_{12} = \iint \tilde{\psi}_1(\vec{r}_1, \vec{r}_2)\, \frac{e}{c}\vec{A}\,p(\vec{r}_2)\,\vec{p}_2\,\psi_2(\vec{r}_1\vec{r}_2)\, dv_1 dv_2$$

$$\vec{A} = \sum_n \{\vec{A}_n e^{2\pi i(\frac{\nu}{c}(\vec{n}\vec{r}_2) - \nu t)} + \cancel{\vec{A}_n^{(-)} e^{-2\pi i(\cdot,\cdot)}}\}$$

$$\cancel{\vec{A}_n^{(+)}\vec{n} = 0 \qquad \vec{A}_n^{(-)}\vec{n} = 0.}$$

$$\vec{A}_n\vec{n} = 0 \qquad \vec{A}_n = \tilde{\vec{A}}_n.$$

$$\vec{E} = -\frac{1}{c}\dot{\vec{A}} = \frac{2\pi\nu i}{c}\sum \vec{A}_n e^{\cdots}$$

$$\vec{H} = \frac{2\pi\nu i}{c}\sum[\vec{n}\vec{A}_n]e^{\cdots}$$

$$\boxed{\begin{array}{l}\frac{1}{2}(\vec{r}_1+\vec{r}_2) = \vec{R}\\ \vec{r}_1 - \vec{r}_2 = \vec{r}\end{array}}$$

$$\frac{1}{8\pi}\int\{\vec{E}^2 + \vec{H}^2\}dv = \frac{\pi\nu^2}{c^2}\sum_n \vec{A}_n^2 = \sum \cancel{h\nu}\ 2\pi\hbar\nu.$$

$$\vec{A}_n\left|A_n\right| = \frac{2c}{\pi}\sqrt{\frac{\hbar}{\nu}}$$

$$\psi_1(\vec{r}_1\vec{r}_2) = e^{ikz_1} + \cdots = e^{i(kZ + k\frac{z}{2})} + \cdots \text{ for } r > a$$

$$\cancel{\psi_2(\vec{r}_1\vec{r}_2) = e^{i}} = e^{i(kZ)}\,\psi_1(\vec{r})$$

$$\vec{A}_n = 2c\sqrt{\frac{\hbar}{\nu}}\cdot\vec{e}_n.$$

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$\vec{k} + \vec{k}_2' + \frac{2\pi\nu}{c}\vec{n}$

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$\vec{A}\vec{p}\Psi =$

$\vec{p}_2 \vec{A}\Psi = \vec{A}_2 \vec{p}_2 \psi_2 + (\vec{p}_2 \cdot \vec{A}_2 \psi_2)$

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$\alpha = \frac{(MW)^{\frac{1}{2}}}{\hbar}$. $\overline{r}$

$\psi_2(\vec{r}_1 \vec{r}_2) = e^{i(\vec{k}\vec{R})} \psi_D(r)$ $\quad \psi_D(r) = Ce^{-\alpha r}/r$ for $r > a$.

$\vec{p}_2 = -i\hbar\left(\frac{\partial}{2\partial \vec{R}} - \frac{\partial}{\partial \vec{r}}\right)$

$\vec{e}_{\vec{n}}\vec{p}_2 \psi_2(\vec{r}_1\vec{r}_2) = \vec{e}_{\vec{n}} \cdot (-i\hbar)\left\{\frac{i\vec{k}'}{2} + \alpha\frac{\vec{r}}{r}\right\}$ for $r > a$

$-\vec{k} + \vec{k}' + \frac{2\pi\nu}{c}\vec{n} = 0.$

$+\frac{\vec{r}}{r^2}$

$= \vec{e}_{\vec{n}}(-i\hbar)\left\{\frac{i\vec{k}}{2} - \frac{i2\pi\nu}{c}\vec{n} + \alpha\frac{\vec{r}}{r}\right\}$

k^2 $\quad = \vec{e}_{\vec{n}}(-i\hbar)\left\{\frac{i\vec{k}}{2} + \alpha\frac{\vec{r}}{r}\right\}.$

$2\pi\hbar\nu = \frac{Mv^2}{2} = M\left(\frac{v}{2}\right)^2 + W$ $\quad \frac{4M}{\hbar^2}$

~~$2\pi M\nu =$~~

$8\pi\frac{M\nu}{\hbar} = k^2 + 4\alpha^2$ $\quad \frac{2\pi\nu M}{\hbar} = \left(\frac{k}{2}\right)^2 + \alpha^2$

$\vec{e}_{\vec{n}} = \vec{1}_x$ $\quad : -i\hbar\left(\alpha\frac{x}{r} + \frac{x}{r^2}\right)$

$\vec{1}_y$ $\quad : -i\hbar\left(\alpha\frac{y}{r} + \frac{y}{r^2}\right)$

1_z $\quad : -i\hbar\left(\frac{ik}{2} + \alpha\frac{z}{r}\right) - \frac{z}{r^2})$

$|V_{12}|^2 = \underbrace{2e\sqrt{\frac{\hbar}{\nu}}\cdot\hbar}_{0,\,0\,\alpha} \int dv\, e^{-\frac{ikz}{2}}\left\{\frac{ik}{2} + \alpha\frac{z}{r}\right\} Ce^{-\alpha r}.$

$\sigma_c = \frac{2\pi}{\hbar}\frac{4\pi^2\nu^2}{v\hbar c^3}\frac{4e^2}{3}\frac{\hbar^3}{\nu}\left|\int dv\, e^{-\frac{ikz}{2}}\left\{\frac{ik}{2} + \alpha\frac{z}{r}\right\} Ce^{-\alpha r}\right|^2$

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$$\sqrt{\frac{\pi}{kr}}\cdot J_{\frac{3}{2}}\left(\frac{kr}{2}\right) = \frac{2}{kr}\left(\frac{\sin\frac{kr}{2}}{\frac{kr}{2}} - \cos\frac{kr}{2}\right)$$

$$i\, r \sin\frac{kr}{2} = i\, I\left(r\, e^{+\frac{ikr}{2}}\right)$$

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$$\text{or}\quad \sigma_c = \frac{32\pi e^2 \hbar\nu}{3\nu c^3}\left\{x\, \frac{4\pi^2}{c^2}\, x\right\}\iint \sin\theta\, d\theta\, r^2 dr\, e^{-\frac{ikz}{2}}\left\{\frac{ik}{2}+\alpha\frac{z}{r}\right\} e^{-\alpha r}\Big/ r^2$$

$$e^{-\frac{ikz}{2}} = \frac{\sin\frac{kr}{2}}{\frac{kr}{2}} - 3i\left(\frac{\pi}{kr}\right)^{\frac{1}{2}} J_{\frac{3}{2}}\left(\frac{kr}{2}\right)\cos\theta$$

$$+\ \cdots$$

$$\int_{-1}^{1} dx\cdot \int r^2 dr\cdot \frac{\sin\frac{kr}{2}}{\frac{kr}{2}}\cdot\left(\frac{ik}{2}\right)\cdot e^{-\alpha r}$$

$$= 2i\, I_m \int r\, e^{\frac{ikr}{2}-\alpha r}\, dr$$

$$= \cancel{2i\, I_m \frac{\quad}{\left(\frac{ik}{2}-\alpha\right)^2}}$$

$$-i\int_{-1}^{1} 3x^2 dx \int \alpha r^2 dr\, \frac{2}{kr}\left(\frac{\sin\frac{kr}{2}}{\frac{kr}{2}} - \cos\frac{kr}{2}\right) e^{-\alpha r}$$

$$= 2i\cdot\left\{ I_m \frac{4\alpha}{k^2}\int e^{\frac{ikr}{2}-\alpha r}\, dr\right.$$

$$\left. - R_e\, \frac{2\alpha}{k}\int r\, e^{\frac{ikr}{2}-\alpha r}\, dr\right\}$$

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$$\operatorname{Im}\int e^{\frac{ikr}{2}-\alpha r}\,dr = \operatorname{Im}\frac{-1}{\frac{ik}{2}-\alpha} = \frac{\frac{k}{2}}{\left(\frac{k}{2}\right)^2+\alpha^2}$$

$$\int r e^{\frac{ikr}{2}-\alpha r}\,dr = \frac{1}{\left(\frac{ik}{2}-\alpha\right)^2} = \frac{\alpha^2-\frac{k^2}{4}+ik\alpha}{\left\{\left(\frac{k}{2}\right)^2+\alpha^2\right\}^2}$$

$$\iint \cdot = 2i\left\{\frac{k\alpha}{\{\alpha^2+(\frac{k}{2})^2\}^2} \mp \frac{4\alpha}{k^2}\frac{k}{2}\cdot\frac{1}{\{\alpha^2+(\frac{k}{2})^2\}}\right.$$

$$\left. + \frac{2\alpha}{k}\frac{\alpha^2-\frac{k^2}{4}}{\{\quad\}^2}\right\} \qquad , \cancel{k}\ \frac{\alpha k}{2}$$

$$= 2i\,\frac{k\alpha \mp \frac{2\alpha}{\cancel{k}k}\{\alpha^2+(\frac{k}{2})^2\} + \frac{2\alpha}{k}\{\alpha^2 - (\frac{k}{2})^2\}}{\{\alpha^2+(\frac{k}{2})^2\}^2} = 0$$

$$= \cancel{2i\,\frac{\cancel{2\alpha k}\,\frac{4\alpha}{k}\{\alpha}{\{\alpha^2+(\frac{k}{2})^2\}^2}}$$

$$\cancel{r}\cdot\sin\theta\, d\theta\, r\,dr\, e^{-\frac{ikz}{2}}\frac{\cos\theta}{r}e^{-}$$

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