~~Reflection~~
Scattering and Absorption
by Plate ~~not~~ Containing
Hydrogen

By ~~Elementary~~ calculations similar to those which were performed in preceding sections ~~can~~ be estimated, irrespective of the breadth of the band,

~~We can obtain the average energy of the resonance group of slow neutrons can~~

~~Thus~~ one can estimate the ~~resonance~~ energy ~~resonance energy~~ of neutrons of the resonance group of slow neutrons which activate a certain detector, by from the ~~ratio of~~ rate of ~~change increment~~ increment of activation ~~by increasing the~~ as ~~to that~~ screen with ~~increment~~ of the thickness ~~the thick~~ thin plates of the ~~plate scatterer~~ containing hydrogen, provided that ~~the primary~~ the direction of neutrons ~~impinges~~ is normal ~~ly~~ to the plate and ~~the velocity~~ have uniform velocity.

~~Roughly~~ the same conclusion will be reached if the neutron source is surrounded by a sphere containing hydrogen, provided that ~~its~~ ~~and~~ their thin ~~dire~~ shell ~~its long radius~~ with its thickness normal ~~to the plate~~, is large compared ~~the velocity of the primary neutrons~~ ~~$\tan\theta =$~~

The ratio, ~~becomes large~~ increases as the resonance energy decreases, as can be easily predicted.

Further, if ~~the~~ ~~the in~~ the inclinations θ_1 and θ_2 ~~fixed~~ small value of ~~are~~ are ~~determined~~ measured for two bands with mean energies E_1 and E_2 respectively, ~~their ratio can be~~ we ~~obtain from the~~ the ratio of energies can determine ~~the~~ approximately ~~relation~~ by the relation

$$\frac{E_1}{E_2} = \exp\left(\frac{\tan\theta_2}{\tan\theta_1}\right).$$

a

§6. Dependence of Number of scattered Neutrons on Energy and Thickness.

~~Energy Distribution~~ and its Dependence on Thickness.

heavy nucleus と 1回 及び 2回 の scattering を受けて出て来る

§5. ~~Summary and~~ Numerical Results and Concluding Remark

From above results ~~can be we can obtain at once~~ the energy distribution of neutrons can be obtained at once. Namely, the ~~number of~~ fraction, ~~no of neutrons which~~ which ~~is trans~~ passes through with energy between E and $E+dE$ becomes

$$P(E,h)dE \cong \frac{dE}{E_0}\cdot\frac{h}{\lambda_0}\left\{1+O\left(\frac{h}{\lambda}\right)\right\} \qquad (18)'(23)$$

for ~~energy~~ $\frac{E_0}{4} < E < E_0$, where E_0 is the energy of the incident neutrons and

$$\frac{\lambda}{h} = \frac{E}{E_c}$$

$$P(E,h)dE \cong \frac{dE}{E_0}\cdot\frac{h}{\lambda_0}\left\{\left(\frac{\lambda_0 E}{h E_0}\right)^{\frac{1}{2}} + \frac{1}{2}\log\left(\frac{E_c}{E}\right) + \frac{1}{2}\frac{\lambda}{\lambda''} + \frac{h}{4\lambda''_0}\log\frac{\lambda_0}{h}\right\} \qquad (24)$$

for $E < E_c$, where E_c $(\ll E_0)$ is the critical energy given by

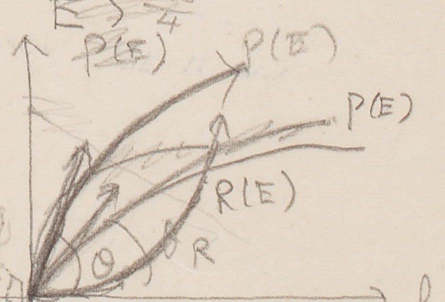
$$\frac{E_c}{E_0} = \left(\frac{h}{\lambda_0}\right)^2,$$

Similarly, the ~~table~~ fraction, which is deflected, becomes

$$R(E,h)dE \cong \frac{dE}{E_0}\,\frac{h}{\lambda_0}\,\frac{h}{\lambda_0'}\left[\left(\frac{E_0}{2E}\right)^{\frac{1}{2}}+1+\frac{1}{2}\log\frac{\lambda_0}{h}\left(1-\frac{E}{E_0}\right)^{\frac{1}{2}}\right]$$

$E > \frac{E_0}{4}$ (25)

Fig 2.



Similar calculations wre

Similar calculations were made in the supplement [Proc. Phys.-Math. Soc. Japan, III, 18 (1936), 128-130.] according to the modified theory of Konopinski and Uhlenbeck.

As well known, the layer of either certain elements absorbs a large part of neutrons in a certain group of neutrons, and only a small part reflects or transmits. This is interpreted as the result of smallness of prob. of scattering compared with that of capture with γ-ray emission. The coefficient of reflection for normal incidence on the thick plate can be determined by elementary calculation and the result is

$$\frac{1}{2}(1-\log 2)\frac{\sigma_s}{\sigma_c} \cong 0.15\frac{\sigma_s}{\sigma_c}$$

If we assume the layer to form a very thick plate, where $\frac{1}{\lambda} = \frac{1}{\lambda_c} + \frac{1}{\lambda_s}$, $\frac{1}{\lambda_c} = n\sigma_c$, $\frac{1}{\lambda_s} = n\sigma_s$, provided that the atomic cross section σ_s for elastic scattering is small compared with capture cross section σ_c.

$$\int_{\theta=\frac{\pi}{2}}^{\pi}\int_0^{\infty} e^{-\frac{z}{\lambda\cos\theta}}\frac{\sin\theta\, d\theta}{2}\frac{dz}{\lambda_s\cos\theta}\, e^{+\frac{z}{\lambda\cos\theta}} = \int_{\frac{\pi}{2}}^{\pi}\frac{\sin\theta\, d\theta}{2\lambda_s\cos\theta\left(\frac{1}{\lambda}-\frac{1}{\lambda\cos\theta}\right)} = \frac{\lambda}{\lambda_s}\int_0^1\frac{x\,dx}{1+x} = \frac{\lambda}{2\lambda_s}(1-\log 2) = 0.15\frac{\sigma_s}{\sigma_c}$$

[illegible]

it vanishes, if we put t t at the beginning.

Thus the density matrix for empty space vanishes everywhere in the modified theory in contrast to the usual theory, so that it is clear that they can not be identified by mere relabeling of eigenfunctions. Whether this is trivial or not will be left to the judgement of the referee.

for $-\frac{E_0}{4} < E < E_0$

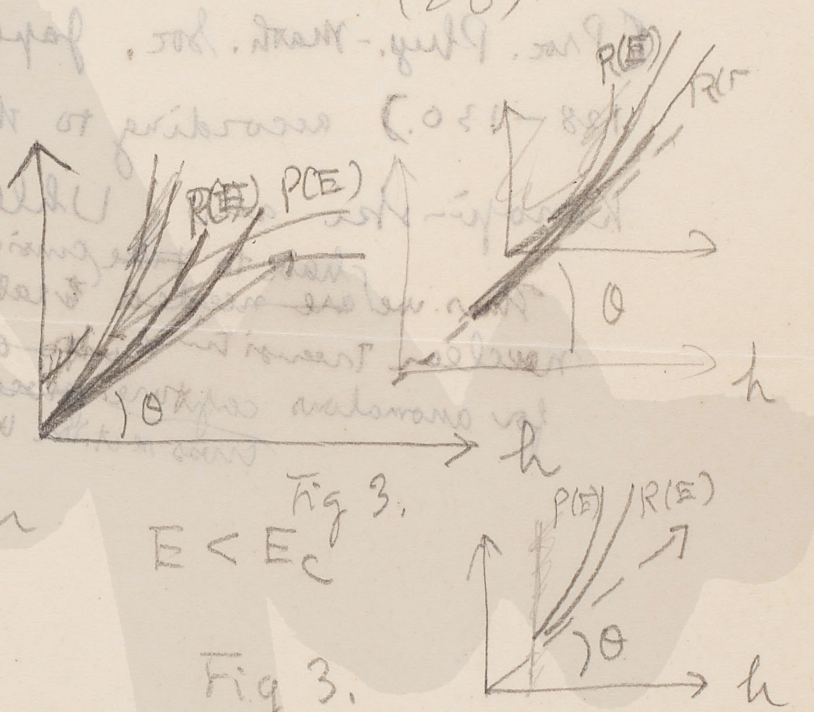
and ~~R~~

$$R(E,h)dE \simeq \frac{dE}{E_0}\frac{h}{\lambda_0'}\left\{\frac{1}{2}\log\left(\frac{E_0}{E}\right)+\frac{1}{2}\frac{\lambda_0}{\lambda_0'}\right.$$

$$\left.+\frac{h}{4\lambda_0''}\log\frac{\lambda_0}{h}\right\} \quad (26)$$

for $E < E_c$

~~These formula~~



The curves in Fig. 2 and Fig. 3. ~~shows the behaviour~~ the dependence ~~on h~~ of $P(E,h)$ and $R(E,h)$ on h in the neighborhood of $h=0$ for the fixed value of E.

Fig 3. $E < E_c$

Fig 3. $E < E_c = E_0\left(\frac{h}{\lambda_0}\right)^2$

The inclination of these curves at $h=0$ can be determined at once from (23), (24), (25) and (26).

For example, the angle θ in Fig. 3 is given by

$$\tan\theta \cong \frac{1}{2\lambda_0'}\frac{1}{2}\log\left(\frac{E_c}{E}\right) = \frac{n'\sigma(\nu_0)}{2}\log\left(\frac{E_c}{E}\right)$$

for E ~~≪~~ E_c, where $\sigma(\nu_0)$ resonance

Thus one can estimate the energy of ~~resonance of~~

Fig.4

On the Theory of the -Disintegration and the Allied Phenomenon.

Hideki Yukawa and

Similar calculations were made in the Supplement [Proc. Phys.-Math. Soc. Japan, III, 18 (1936), 128–130.] according to the modified theory of Konopinski and Uhlenbeck.

Thus we have to consider rather complicated nuclear transitions to account for anomalous capture cross section of slow neutrons