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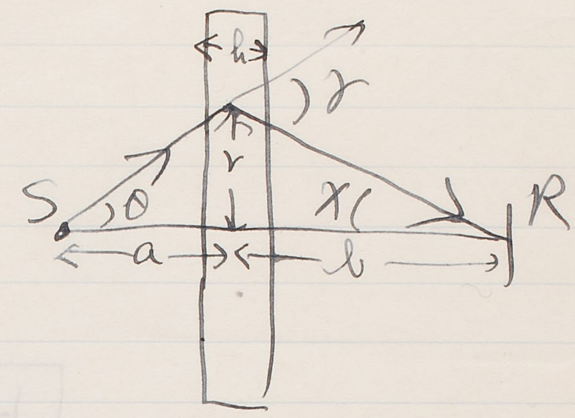

$$N_0 \cdot \frac{2\pi r\,dr\cos\theta}{a^2+r^2} \cdot \frac{h \cdot 2\cos\gamma}{\lambda_0 \cos\theta} \cdot \frac{S\cos\chi}{b^2+r^2}$$

$$= N_0 \cdot \frac{4\pi S h}{\lambda_0} \cdot \frac{b(ab-r^2)\,r\,dr}{(a^2+r^2)^{\frac{3}{2}}(b^2+r^2)^2}$$

$$r = \frac{\left\{(a+b)^2 + 4ab\frac{1-\frac{E}{E_0}}{\frac{E}{E_0}}\right\}^{\frac{1}{2}} - (a+b)}{2\frac{\sqrt{1-\frac{E}{E_0}}}{\sqrt{\frac{E}{E_0}}}}$$

$$= \frac{\left\{4ab + (a-b)^2\frac{E}{E_0}\right\}^{\frac{1}{2}} - (a+b)\sqrt{\frac{E}{E_0}}}{2\sqrt{1-\frac{E}{E_0}}}$$

$$\cos\chi = \frac{b}{(b^2+r^2)^{\frac{1}{2}}}$$

$$k = \tan\gamma = \frac{\tan\theta + \tan\chi}{1-\tan\theta\tan\chi} = \frac{r(a+b)}{ab-r^2}$$

$$ab - r^2 = \frac{r(a+b)}{k} = \frac{\sqrt{\frac{E}{E_0}}\,r(a+b)}{\sqrt{1-\frac{E}{E_0}}}$$

$$\cos\gamma = \frac{1}{\sqrt{1+\tan^2\gamma}} = \frac{ab-r^2}{\sqrt{(ab-r)^2 + r^2(a+b)^2}} = \frac{ab-r^2}{(a^2+r^2)^{\frac{1}{2}}(b^2+r^2)^{\frac{1}{2}}}$$

$$dr = \frac{1}{2k}\left\{\frac{\cancel{4k}\,4k\,ab}{\sqrt{\quad}} - \frac{\sqrt{\quad''} - (a+b)_0}{k}\right\}dk$$

$$\cancel{\tan\gamma^2}\ \cancel{k = \ldots 1-}$$

$$k r^2 + (a+b)r - kab = 0$$

$$r = \frac{\sqrt{(a+b)^2 + 4k^2ab} - (a+b)}{2k}$$

$$= \frac{4k^2ab - (a+b)^2 + (a+b)\sqrt{\quad''}}{2k^2\sqrt{\quad''}}\,dk$$

$$k = \frac{\sqrt{1-\frac{E}{E_0}}}{\sqrt{\frac{E}{E_0}}}$$

$$= \frac{(a+b)}{k\sqrt{\quad''}}\,r\,dk =$$

$$dk = \frac{\sqrt{\frac{E}{E_0}}\cdot\frac{-d\frac{E}{E_0}}{2\sqrt{\quad''}} - \frac{\sqrt{\quad}\,d\frac{E}{E_0}}{2\sqrt{\frac{E}{E_0}}}}{\frac{E}{E_0}}$$

$$= \frac{(a+b)r}{k\sqrt{(a+b)^2+4k^2ab}}\,\frac{\frac{dE}{E_0}}{2\sqrt{\frac{E}{E_0}}^{\,3}\sqrt{1-\frac{E}{E_0}}}$$

$$= \frac{\frac{dE}{E_0}}{2\sqrt{\frac{E}{E_0}}^{\,3}\sqrt{1-\frac{E}{E_0}}} = \frac{\frac{dE}{E_0}\left(\frac{E}{E_0} + 1 - \frac{E}{E_0}\right)}{2\sqrt{\frac{E}{E_0}}^{\,3}\sqrt{1-\frac{E}{E_0}}}$$

$$= \frac{(a+b)r}{\sqrt{\quad}}\cdot\frac{\frac{dE}{E_0}}{2\left(1-\frac{E}{E_0}\right)}$$

$$k = \frac{\sqrt{1-\frac{E}{E_0}}}{\sqrt{\frac{E}{E_0}}}$$

$$\frac{\left(\frac{E}{E_0}\right)^{\frac{1}{2}}}{\left(1-\frac{E}{E_0}\right)^{\frac{3}{2}}\sqrt{(a+b)^2+4ab\,\frac{1-\frac{E}{E_0}}{\frac{E}{E_0}}}}$$

$$= \frac{1}{(\quad)^{\frac{3}{2}}\sqrt{4ab+(a-b)^2\frac{E}{E_0}}}$$

$$r = \frac{\sqrt{(a+b)^2+4ab\,k^2}-(a+b)}{2k}$$

$$= \frac{-(a+b)\left(\frac{E}{E_0}\right)^{\frac{1}{2}}}{2\sqrt{1-\frac{E}{E_0}}}$$

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$$N_0 \frac{4\pi s h}{\lambda_0} \cdot \frac{\cancel{b(ab-r^2)4b}\,(a+b)^2 r^3}{2\left(1-\frac{E}{E_0}\right)\sqrt{(a+b)^2+4k^2ab}\,(a^2+r^2)^{\frac{3}{2}}(b^2+r^2)^2} \quad \frac{dE}{E_0}$$

$\frac{E}{E_0} \ll 1.$ $\quad \cancel{k} \; r = \cancel{2}\sqrt{ab}.$

$$\frac{dE}{2E_0} \cancel{2(1-\ldots)} \frac{b(a+b)^2 a^{\frac{3}{2}} b^{\frac{3}{2}}}{2a^{\frac{1}{2}}b^{\frac{1}{2}}\cancel{(a+b)}k} \quad \frac{1}{a^{\frac{3}{2}}(a+b)^{\frac{3}{2}}} \quad \frac{1}{b^2(a+b)^2} \frac{1 \cancel{\sqrt{1-\frac{E}{E_0}}}}{\sqrt{\frac{E}{E_0}}}$$

$$= \frac{dE}{4E_0} \cancel{\sqrt{\frac{E}{E_0}}} \cdot \frac{1}{a^{\frac{1}{2}}(a+b)^{\frac{3}{2}}}$$

$a=b$: $\quad N_0\; r = \dfrac{\sqrt{\cancel{(a+b)^2}\,4a^2+4a^2\dfrac{1-\frac{E}{E_0}}{\frac{E}{E_0}}} - \cancel{2a(b)}}{2\dfrac{\sqrt{1-\frac{E}{E_0}}}{\sqrt{\frac{E}{E_0}}}}$

$$\frac{a^2+r^2}{2a} = a^2\left(\frac{1-\frac{E}{E_0}+1-2\sqrt{\frac{E}{E_0}}+}{1-\frac{E}{E_0}}\right) = \frac{1-\sqrt{\frac{E}{E_0}}}{\cancel{2}\sqrt{1-\frac{E}{E_0}}}\,a$$

$$N_0 \frac{4\pi s h}{\lambda_0} \frac{\cancel{a}\,\cancel{\frac{E}{E_0}}}{2\left(1-\frac{E}{E_0}\right)^{\frac{3}{2}}} \frac{4a^2 \cdot a^3\left(1-\sqrt{\frac{E}{E_0}}\right)^3}{\cdot 2a\,\left(1-\frac{E}{E_0}\right)^{\frac{3}{2}}} \frac{\left(1-\frac{E}{E_0}\right)^{\frac{7}{2}}}{a^7\left(1-\sqrt{\frac{E}{E_0}}\right)^{\frac{7}{2}} 2^{\frac{7}{2}}} \frac{dE}{E_0}$$

$$= N_0 \frac{4\pi s h}{\lambda_0} \cdot \frac{1}{2^{3/2}} \cdot \frac{\frac{E}{E_0}}{a^2} \cdot \frac{\left(1-\frac{E}{E_0}\right)^{\frac{1}{2}}}{\left(1-\sqrt{\frac{E}{E_0}}\right)^{\frac{1}{2}}} \quad \frac{dE}{E_0}$$

$$= \quad " \quad \left(\frac{1+\sqrt{\frac{E}{E_0}}}{\cancel{1-\sqrt{\frac{E}{E_0}}}}\right)^{\frac{1}{2}} \cancel{\frac{E}{E_0}} \frac{dE}{E_0}$$

$$N_0 \cdot \frac{2\pi r\,dr\cos\theta}{(a^2+r^2)} \cdot \frac{h}{\lambda_0\cos\theta}\,\frac{2\cos\gamma\cdot\sin\cos\chi}{(b^2+r^2)}$$

$$= \frac{N_0 h}{\lambda_0} \cdot \frac{\cancel{4\pi}\,S\cdot r^2 b\cdot}{(a^2+r^2)(b^2+r^2)^{\frac{3}{2}}}\cos\gamma\,dr.$$

$$\tan\gamma = \frac{r(a+b)}{ab-r^2}$$

$$\tan\gamma\, r^2 + (a+b)r - \tan\gamma\, ab = 0$$

$$\{\tan\gamma\cdot 2r + (a+b)\}dr = \frac{\frac{ab-r^2}{r^2-ab}}{\cos^2\gamma}\,d\gamma.$$

$$\cos\gamma\,dr = \frac{ab-r^2-ab}{\cos\gamma\,(2r\tan\gamma+a+b)}\,d\gamma$$

$$= \frac{r(a+b)}{\sin\gamma\cdot(2r\tan\gamma+a+b)}$$

$$= \frac{N_0 h}{\lambda_0}\frac{4\pi S\; r^2 b(a+b)}{(a^2+r^2)(b^2+r^2)^{\frac{3}{2}}}\;\frac{d\gamma}{\sin\gamma\,(2r\tan\gamma+a+b)}$$

$$\gamma\to 0,\quad r = \frac{ab}{a+b}\quad \tan\gamma = \sin\gamma.$$

$$\cos\gamma = \sqrt{\frac{E}{E_0}} \quad d\gamma = \frac{\frac{dE}{2E_0}}{\sqrt{\;}}\quad \sin\gamma\,d\gamma =$$

$$\doteqdot \frac{N_0 h}{\lambda_0}\,\frac{4\pi S\; b(a+b)}{a^2 b^3}\,\frac{a^2b^2}{(a+b)^2}\,\frac{\sin\gamma\,d\gamma}{\cos^2\gamma\;(a+b)}$$

$$= \frac{N_0 h}{\lambda_0}\,\frac{4\pi S}{(a+b)^2}\,\frac{dE}{2E_0}$$

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$a + \frac{b-a}{2}\frac{E}{E_0} - \sqrt{\frac{E}{E_0}}$

$$f(x) = \frac{a^{\frac{1}{2}} b\left(y - \frac{a+b}{2}x\right)}{\left(a + \frac{b-a}{2}x^2 - xy\right)\left(b - \frac{b-a}{2}x^2 - xy\right)^{\frac{3}{2}}}$$

$(1-x^2)^{\frac{1}{2}} = z$,　　$y = \left\{ab + \left(\frac{a-b}{2}\right)^2(1-z^2)\right\}^{\frac{1}{2}}$

$= \cancel{a^{\frac{1}{2}}b.(}$　　$= \left\{\left(\frac{a+b}{2}\right)^2 - \left(\frac{a-b}{2}\right)^2 z^2\right\}^{\frac{1}{2}} \to \frac{a+b}{2}$ for $z=0$.

$$= \frac{a^{\frac{1}{2}} b.\left\{y - \frac{a+b}{2}(1-z^2)^{\frac{1}{2}}\right\}}{\left\{a + \frac{b-a}{2}(1-z^2) - (1-z^2)^{\frac{1}{2}}y\right\}\left\{b - \frac{b-a}{2}(1-z^2) - (1-z^2)^{\frac{1}{2}}y\right\}^{\frac{3}{2}}}$$

$z \to 0$

$$= \frac{a^{\frac{1}{2}} b\left\{\frac{ab}{a+b} z^2\right\}}{\left\{\frac{a+b}{2} - \frac{b-a}{2}z^2 - \left(1 - \frac{z^2}{2}\right)\left(\left(\frac{a+b}{2}\right)^2 - \frac{1}{4}\frac{(a-b)^2}{(a+b)}z^2\right)\right\}}$$

$-\frac{b-a}{2} + \frac{a+b}{4} + \frac{1}{4}\frac{(a-b)^2}{a+b}$

$\parallel$

$\frac{(a-b)^2 + (a+b)^2 + 2(a+b)(a-b)}{4(a+b)} = \frac{b^2}{a+b}$.

$\{(a-b)+(a+b)\}^2$

$$= \frac{a^{\frac{1}{2}} b.\ \frac{ab}{a+b} z^2}{\left(\frac{a^2}{a+b} z^2\right)\left(\frac{b^2}{a+b} z^2\right)^{\frac{3}{2}}} = \frac{(a+b)^{\frac{3}{2}}}{a^{\frac{1}{2}}.b\ \ z^3}$$

$$= \cancel{\frac{\quad}{a}}\quad \frac{1}{ab}\ \frac{\frac{dE}{E_0}}{\sqrt{1 - \frac{E}{E_0}}} \to$$

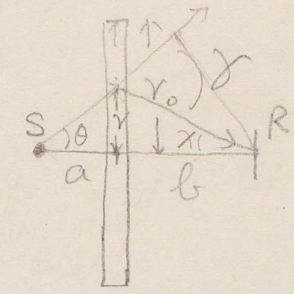
$$\frac{N_0 \cancel{2\pi} r\, dr \cos\theta}{(a^2+r^2)} \cdot \frac{2h\cos\chi\, s \cos\chi}{\lambda_0 \cos\theta (b^2+r^2)}$$

$$\cos\chi = \frac{b}{\sqrt{b^2+r^2}}$$

$2h\cos\gamma.$

$\cos^{*}\gamma\, d\gamma$

$2\frac{dE}{E_0}$



$$= \frac{N_0\, \cancel{4\pi} h\, r\, s}{(a^2+r^2)\lambda_0} \frac{b}{(b^2+r^2)^{\frac{3}{2}}} \quad \cancel{\frac{d\theta}{\cos\delta}}$$

$$\tan^{*}\gamma = \frac{\boxed{}}{\sqrt{1+\cos^2\gamma}} = \frac{\sqrt{1-\frac{E}{E_0}}}{\sqrt{\frac{E}{E_0}}}$$

$$r = a\tan\theta$$
$$= b\tan\chi$$

$$\times \frac{a+b}{ab+r^2} \frac{\cos\gamma\, d\gamma}{\sin^2\gamma} r^2$$

$$\tan\gamma = \frac{\tan\theta + \tan\chi}{1-\tan\theta\tan\chi}$$

$$= \frac{N_0\, 4\pi h s\, \cancel{b}(a+b)}{\lambda_0} \frac{\left(\frac{E}{E_0}\right)^{\frac{1}{2}} \frac{dE}{E_0}}{\left(1-\frac{E}{E_0}\right)^{\frac{3}{2}}}$$

$$= \frac{\frac{r}{a}+\frac{r}{b}}{1-\frac{r}{a}\frac{r}{b}}$$

$$\times \frac{r^3}{(a^2+r^2)(b^2+r^2)^{\frac{3}{2}}}$$

$$\cos\gamma\, dr = \cos^3\gamma\, \cancel{d\gamma}$$

$$\frac{dr}{\cos\gamma} \frac{a+b}{ab+r^2} \cdot \frac{r^2}{\tan\gamma} = \frac{r(a+b)}{ab-r^2}$$

$$\frac{d\gamma}{\cos^2\gamma} = \left\{\frac{a+b}{ab-r^2} + \frac{(a+b)2r^2}{(ab-r^2)^2}\right\} dr$$

$$= \frac{N_0\, 4\pi s h}{\lambda_0}$$

$$\frac{1}{(ab-r^2)^2} \quad \frac{\tan^2\gamma}{(a+b)^2 r^2}$$

$$-2(a+b)\sqrt{\frac{E}{E_0}}\sqrt{\cdots}$$

$$4\left(1-\frac{E}{E_0}\right).$$

$$= \frac{a+b}{(ab-r^2)^2}\{ab+r^2\}\, dr$$

$$a^2+r^2 = \frac{a^2+4ab+(a-b)^2\frac{E}{E_0} + (a+b)^2\frac{E}{E_0}}{4\left(1-\frac{E}{E_0}\right)}$$

$$\tan\gamma\, r^2 + (a+b)r - \tan\gamma\, ab = 0$$

$$= \frac{\sin^2\gamma}{\cos^2\gamma} \frac{(ab+r^2)}{(a+b)}\, dr$$

$$r = \frac{-(a+b)+\sqrt{(a+b)^2 + \cancel{4\tan^2\gamma}\, ab}}{2\tan\gamma}$$

$$= \frac{4a(a+b) + 2(b^2-a^2)\frac{E}{E_0} - 2(a+b)\sqrt{\frac{E}{E_0}}\sqrt{\cdots}}{4\left(1-\frac{E}{E_0}\right)}$$

$$= \frac{-(a+b)\cos\gamma \pm \sqrt{(a+b)^2\cos^2\gamma + 4ab\sin^2\gamma}}{2\sin\gamma}$$

$$= \frac{\sqrt{(a+b)^2\frac{E}{E_0} + 4ab\left(1-\frac{E}{E_0}\right)} - (a+b)\sqrt{\frac{E}{E_0}}}{2\sqrt{1-\frac{E}{E_0}}}$$

$$= \frac{(a+b)\left\{2a + (b-a)\frac{E}{E_0} - \sqrt{\frac{E}{E_0}}\boxed{\quad\cdots\quad}\right\}}{2\left(1-\frac{E}{E_0}\right)}$$

$$= \frac{\sqrt{\cancel{4ab}\, (a-b)^2\frac{E}{E_0}} - (a+b)\sqrt{\frac{E}{E_0}}}{2\sqrt{1-\frac{E}{E_0}}}$$

$$b^2+r^2 = \frac{(a+b)\left\{2b + (a-b)\frac{E}{E_0} - \sqrt{\frac{E}{E_0}}\sqrt{\cdots}\right\}}{2\left(1-\frac{E}{E_0}\right)}$$

$$\frac{\sqrt{2}^3 \cdot 2}{2} = \sqrt{2}^3$$

$$\frac{N_0 4\pi h s}{\lambda_0}\left(\frac{E}{E_0}\right)^{\frac{1}{2}}\frac{dE}{E_0}\left(1-\frac{E}{E_0}\right)^{\frac{1}{2}}\frac{2^{\frac{3}{2}}b}{(a+b)^{\frac{3}{2}}}\frac{\sqrt{}-(a+b)\sqrt{\frac{E}{E_0}}}{\{\quad\quad //\quad\quad\}^{\frac{3}{2}}}$$

$\sqrt{K}$

$$\frac{N_0 4\pi h s}{\lambda_0}\left(\frac{E}{E_0}\right)^{\frac{1}{2}}\frac{dE}{E_0}\left(1-\frac{E}{E_0}\right)^{\frac{1}{2}}\frac{2^{\frac{3}{2}}b}{(a+b)^{\frac{3}{2}}}\frac{\sqrt{4ab+(a-b)^2\frac{E}{E_0}}-(a+b)\sqrt{\frac{E}{E_0}}}{\left\{2a+(b-a)\frac{E}{E_0}-\sqrt{\frac{E}{E_0}}\boxed{K}\right\}}$$

$2ab$

$$\left\{2b+(a-b)\frac{E}{E_0}-\sqrt{\frac{E}{E_0}}\sqrt{K}\right\}^{\frac{3}{2}}$$

$2ab$

$E \ll E_0$

$$\frac{N_0 4\pi h s}{\lambda_0}\left(\frac{E}{E_0}\right)^{\frac{1}{2}}\frac{dE}{E_0}\frac{2^{\frac{3}{2}}b}{(a+b)^{\frac{3}{2}}}\frac{\sqrt{4ab}}{2a\ (2b)^{\frac{3}{2}}}$$

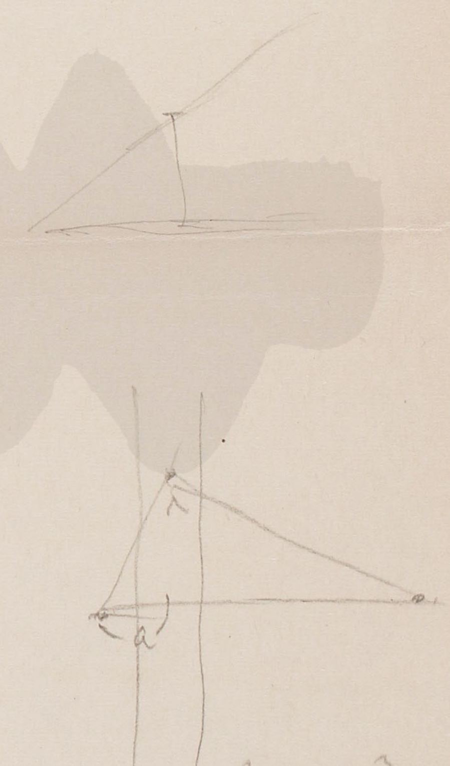
$$=\frac{N_0 4\pi h s}{\lambda_0}\left(\frac{E}{E_0}\right)^{\frac{1}{2}}\frac{dE}{E_0}\frac{1}{(a+b)^{\frac{3}{2}}\cdot \cancel{2}a^{\frac{1}{2}}}$$

$$\parallel$$

$$2^{\frac{3}{2}}\cdot a^2$$

$a=b.$

$$=\frac{4\pi h s}{\lambda_0}N_0\left(\frac{E}{E_0}\right)^{\frac{1}{2}}\frac{dE}{E_0}\frac{2^{\frac{1}{2}}}{(2a)^2}$$



$$\frac{4\pi h s}{\lambda_0}N_0\int_0^{E}\frac{2^{\frac{1}{2}}}{(2a)^2},\quad\int_0^{E}\left(\frac{E}{E_0}\right)^{\frac{1}{2}}\frac{dE}{E_0}$$

$$\parallel$$

$$\boxed{\frac{2}{3}\left(\frac{E}{E_0}\right)^{\frac{3}{2}}}$$

$$\int_{E_1=E-\frac{1}{2}\Delta E}^{E_2=E+\frac{1}{2}\Delta E}\frac{E}{E_0}=\frac{2}{3}\left\{\left(\frac{E_2}{E_0}\right)^{\frac{3}{2}}-\left(\frac{E_1}{E_0}\right)^{\frac{3}{2}}\right\}$$

$$=\frac{2}{3}\frac{E_2}{E_0}$$

$$=\frac{2}{3}\left\{\left(\frac{E}{E_0}+\frac{\Delta E}{2E_0}\right)^{\frac{3}{2}}-\right\}$$

$$=\cancel{\ }\left(\frac{E}{E_0}\right)^{\frac{3}{2}}\frac{\Delta E}{\cancel{\ }E_0}$$

$$=\frac{E^{\frac{1}{2}}dE}{E_0^{\frac{3}{2}}}\ \frac{\Delta E}{\cancel{\ }E}$$

$$\left(1+\frac{\Delta E}{2E}\right)^{\frac{3}{2}}-\left(\quad\right)$$