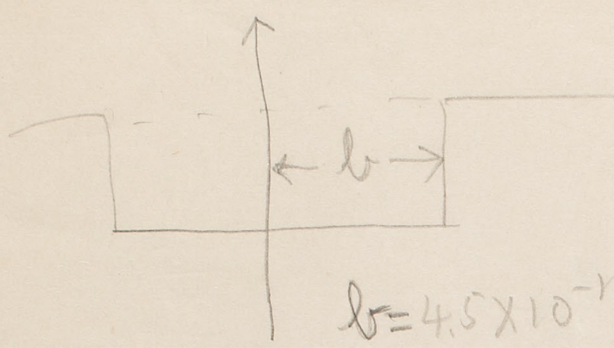
Excited state of ~~[illegible]~~ ^3H



$b = 4.5 \times 10^{-13}$ cm

$\Delta_s F ($

$$\Delta F + \frac{4M}{3\hbar^2}(E' - E_D - U_\pm)F = 0,$$

$$\Delta_3 F + \cancel{\ } \, \mathcal{U}(\varepsilon + u_\pm)F = 0.$$

$$\frac{4M}{3\hbar^2}(E' - E_D) = \varepsilon$$

$$F = \frac{f}{r}$$

$$-\frac{4M}{3\hbar^2}U_\pm = u_\pm$$

$$\frac{d^2 f}{dr^2} + (\varepsilon + u_\pm)f = 0.$$

$$f = Ce^{-\sqrt{\varepsilon}r} \quad r > b$$

$$f = \sin\sqrt{\varepsilon + u}\, r \quad r < b$$

$$Ce^{-\sqrt{\varepsilon}b} = \sin\sqrt{\varepsilon + u} \cdot b$$

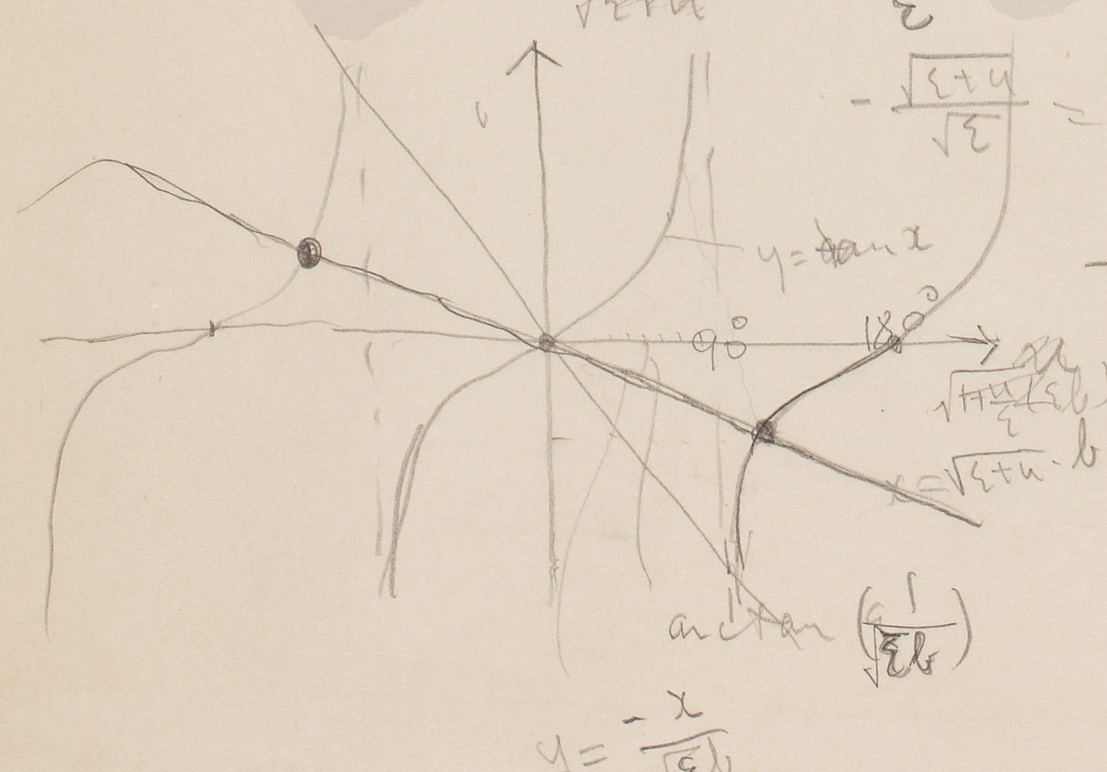
$$-C\sqrt{\varepsilon}e^{-\sqrt{\varepsilon}b} = \sqrt{\varepsilon + u}\cos\sqrt{\varepsilon + u}\, b$$

$$\frac{\sqrt{\varepsilon + u}}{\varepsilon} = \tan\sqrt{\varepsilon + u}\, b$$

$$-\frac{\sqrt{\varepsilon + u}}{\sqrt{\varepsilon}} = \tan\sqrt{\varepsilon + u}\, b$$

$$-\sqrt{1 + \frac{u}{\varepsilon}} = \tan\sqrt{1 + \frac{u}{\varepsilon}} \cdot (\sqrt{\varepsilon} b)$$

$$-\frac{\sqrt{1 + \frac{u}{\varepsilon}}\sqrt{\varepsilon}b}{\sqrt{\varepsilon}b} = \tan\sqrt{\ } \cdot \sqrt{\varepsilon} b)$$



$\sqrt{\varepsilon} b \ll 1$:　$\sqrt{\varepsilon + u}\, b \simeq \frac{\pi}{2}$　or　$\sqrt{u}\, b = \frac{\pi}{2}$.　$u = \frac{\pi}{2}\frac{1}{b^2}$,

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$$\varepsilon = \frac{4M}{3\hbar^2}(E + E_D) = \cancel{E_T} - \frac{4M}{3\hbar^2}(E_T - E_D)$$

$$= -\frac{4M}{3\hbar^2} \times (6.1 \times 10^6 eV)$$

1 MEV に相当する

$$\varepsilon_0 = \frac{4 \times 1.66 \times 10^{-24} \times 1.59 \times 10^{-6}}{3 \times (1.042)^2 \times 10^{-54}} cm^2 = \frac{4 \times 1.66 \times 1.59}{3 \times (1.042)^2} \times 10^{+24}$$

$= 3.241$

$\sqrt{\varepsilon_0} = 1.800 \times 10^{+12}$

10^{-24}

0.61206
0.22011
0.20140
1.02357
0.512856
2) 0.510714
0.255357

0.47712
0.017868
0.017868
0.512856

$$\frac{\sqrt{\varepsilon + u}}{\sqrt{\varepsilon}} = \tan \sqrt{\varepsilon + u}\, b$$

tan ~~E+~~ u 10^6eV を考えにしてはならない

$$\boxed{\sqrt{\frac{\varepsilon + u}{\varepsilon}} = \tan\left(\sqrt{\varepsilon + u}\; 0.81 \cancel{\times 10^{-13}}\right)}$$

1.8
4.5
90
72
8.1　$\times 10^{-13}$　$\times 10^{12}$

$\frac{1}{x} = \cot x$

13.8
6.1
6.1) 19.9 (3.26
18.3
1.60
1.22
380
366
14

19.9

13.8
6.1
6.1) 7.7 (1.26
6.1
1.60
1.22
380

1.265

0.649425
2) 1.298850

4.461
.81
446
3568
3.6126

FER

7.7
0.443245
2) 0.88649

$$\frac{180}{\pi} = 57.3$$

2.244
57.3
6732
15708
11220
128.38

2775
0.81
2775
22160
2.24775

$128°20'$
$51°40'$

$\frac{\varepsilon + u}{4}$

$$\sqrt{\frac{\varepsilon + u}{\varepsilon}} =$$

$0.81\sqrt{\varepsilon+u} = y.$　　$-\frac{y}{2.83} \equiv \tan y$

$\sqrt{\frac{\varepsilon+u}{\varepsilon}} = \frac{1}{\sqrt{\varepsilon}\times 0.81}\, y.$

6.1

$\tan y = \frac{-y}{2}$

$\|$

2.29

2.47
0.81
247
1976
$\boxed{2.00}$17

78533
39267
2470

131.5

$\tan y^{\circ} = \frac{y^{\circ}}{2\times 57.3}$

$= \frac{y^{\circ}}{114.6}$

131.5
48.5

0.88

$1.13 = \frac{131.5}{114.6}$

114.6) 131.5 (1.1
1146
1690
1146
544

α

$\boxed{\infty = \tan y}$

$0.81\sqrt{\varepsilon u} = \frac{\pi}{2}.$

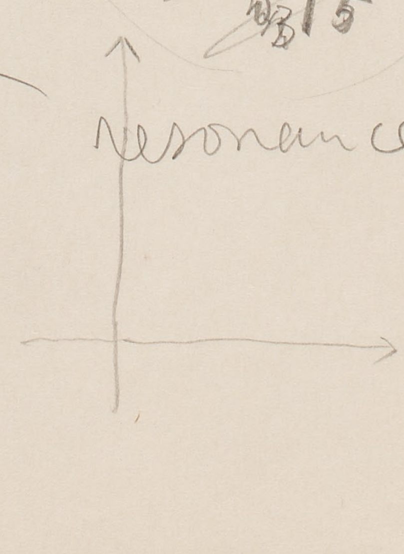
$u = \frac{\pi^2 \cancel{\times 0.81}}{(0.81)^2\times 4} = \frac{9.87 \cancel{\times 0.81}}{0.81\times 4}$

81
81
81
648
0.6561
4
2.6244) 9.87
786
2010

9.87
0.81
981
7896
4) 7.944

$\boxed{3.8}$ MEV

3×MEV.
3.24) 9.87
9.72
315



Resonance

$\frac{\pi}{2} = \frac{3.1416}{2} = 1.5708$

$0.81 \times \sqrt{\varepsilon + u} \cong \pi$

$u = 13.8 \quad \varepsilon = 0$

$0.81 \times \sqrt{13.8} \cong \pi$

$= 3.04$

$\begin{array}{r} 0.56994 \\ \hline 2)1.13988 \end{array}$

$\begin{array}{r} 3.715 \\ 0.81 \\ \hline 3715 \\ 29720 \\ \hline 3.00915 \end{array}$

$\Delta\varepsilon = \left(\frac{3\pi}{2 \times 0.81}\right)^2 - 13.8$

$= \frac{9 \times 9.87}{\cancel{4 \times 0.81}\ 2.624} =$

$2.624 \overline{)88.830}$ 3…

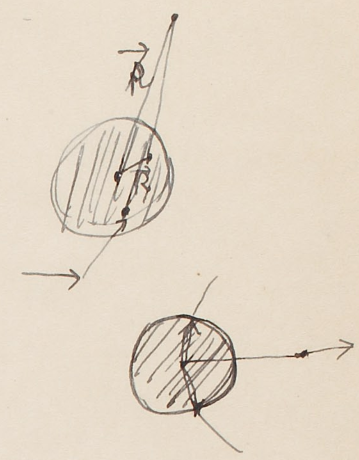
^2S (D)-state, excited level は 90 eV 絶対の所にある

$0.81 \times \sqrt{\varepsilon - v} \cong$

$$i\hbar\frac{\partial\Psi}{\partial t} = \frac{-\hbar^2}{2M}\left(\Delta_r\Psi + \frac{1}{2}\Delta_R\Psi\right) \qquad \mu = \frac{MM'}{M+M'}$$

$$E\Psi \qquad + U(\vec{R})\Psi - \frac{\hbar^2 a}{2\pi\mu}\delta\Psi$$

$$- \frac{2\pi\hbar^2 a}{\mu}\delta\Psi$$



$$-\frac{\hbar^2}{4M}\Delta_R\Psi + U(\vec{R})\Psi = -W_m u_m(\vec{R})$$

$$\Psi = \varphi(\vec{r})u_m(\vec{R})$$

$$(E+W_m)\varphi(\vec{r}) = -\frac{\hbar^2}{2M}\Delta\varphi - \frac{2\pi\hbar^2 a}{M}\left(\frac{M+M'}{M'}\right)\varphi\,\cancel{\delta(\vec{r}-\vec{R}))\varphi}$$

$$\varphi\int u_m^*(\vec{R})\,\delta(\vec{r}-\vec{R})\,u_m(\vec{R})\,dv.$$

$$u_0 = \left(\frac{4\pi M'\nu}{h}\right)^{\frac{3}{4}} e^{-\frac{1}{2}(\xi^2+\eta^2+\zeta^2)}$$

$$\vec{\xi} = \vec{R}\sqrt{\frac{4\pi^2 M'\nu}{h}} \qquad \vec{\xi} = \vec{R}\,\frac{\sqrt{M'W_0}}{\hbar}$$

$$h\nu = W_0 \qquad u_0 = \left(\frac{M'W_0}{\pi\hbar^2}\right)^{\frac{3}{4}} e^{-\frac{1}{2}(\xi^2+\eta^2+\zeta^2)}$$

$$\int \;,\; = \left(\frac{M'W_0}{\pi\hbar^2}\right)^{\frac{3}{2}} \int \delta\left(\vec{r} - \frac{\hbar\vec{\xi}}{\sqrt{M'W_0}}\right) e^{-(\xi^2+\eta^2+\zeta^2)} d\xi\, d\eta\, d\zeta \cdot \left(\frac{M'W_0}{\hbar^2}\right)^{-\frac{3}{2}}$$

$$= \left(\frac{1}{\pi}\right)^{\frac{3}{2}} \cancel{(4\pi)\int}$$

$$(2\pi)\int e^{-\rho^2}\rho^2 d\rho \int_{\frac{R_0^2 - r^2 - \frac{\hbar^2}{M'W_0}\rho^2}{\frac{2\hbar\rho r}{\sqrt{M'W_0}}}}^{1} dx \qquad \left|\frac{\hbar\vec{\xi}}{\sqrt{M'W_0}} - \vec{r}\right| \le R_0$$

$$\frac{\hbar}{\sqrt{M'W_0}} \ll R_0 ?$$

$$\frac{\hbar^2}{M'W_0}(\xi^2+\eta^2+\zeta^2)$$

$$(E+W_0)\varphi(\vec{r}) \qquad \frac{2\pi\hbar^2 a}{M}\left(\frac{M'+M}{M'}\right)\delta\,\varphi$$

$$= -\frac{\hbar^2}{2M}\Delta\varphi -$$

$$- \frac{2\hbar\,\vec{\xi}\,\vec{r}}{\sqrt{M'W_0}} + r^2 \le R_0^2$$

$$\left(\frac{\hbar^2}{M'W_0}\rho^2 - \frac{2\hbar\rho r}{\sqrt{M'W_0}}\cos\theta + r^2 \le R_0^2\right.$$

$$\frac{2}{\pi^2}$$

$$= \left(\frac{1}{\pi}\right)(2\pi)$$

$$x = \cos\theta \ge \frac{R_0^2 - r^2 - \frac{\hbar^2}{M'W_0}\rho^2}{\frac{2\hbar\rho r}{\sqrt{M'W_0}}}$$

$$\int_0^\infty e^{-\rho^2}\,\rho^2 d\rho\left\{1 - \frac{(R_0^2 - r^2)\sqrt{M'W_0}}{2\hbar\rho r} + \frac{\hbar}{2\sqrt{M'W_0}}\frac{\rho}{r}\right\}$$

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$\frac{\hbar\rho}{\sqrt{M'W_0}} - r \leq R_0$

$\rho \leq$

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$$\frac{2}{\pi^{\frac{1}{2}}} \int_0^{\infty} e^{-\rho^2} \rho^2 d\rho \left\{ 1 - \frac{(R_0^2 - r^2)\sqrt{M'W_0}}{2\hbar\rho r} + \frac{\hbar}{2\sqrt{M'W_0}} \frac{\rho}{r} \right\}$$

$$= \frac{2}{\pi^{\frac{1}{2}}} \left\{ \frac{\pi^{\frac{1}{2}}}{2} - \frac{(R_0^2 - r^2)\sqrt{M'W_0}}{2\hbar r} \int e^{-\rho^2} \rho d\rho \right.$$

$$\int e^{-x} \frac{dx}{2} = \frac{1}{2}$$

$$- \frac{\hbar}{2\sqrt{M'W_0}\, r}$$

$$\frac{2}{\sqrt{\pi}} \int \delta(\vec{r}' - \vec{\xi}) e^{-(\xi^2+\eta^2+\zeta^2)} \cancel{d\xi d\eta d\zeta}\, \rho^2 d\rho\, d(\cos\theta)$$

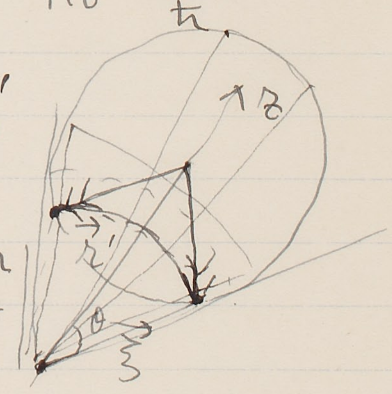
$$\vec{r}' = \vec{r} \frac{\sqrt{M'W_0}}{\hbar}$$

$$R_0' = R_0 \frac{\sqrt{M'W_0}}{\hbar}$$

$\delta(\vec{r}' - \vec{\xi}) \neq 0$

for $|\vec{r}' - \vec{\xi}| \leq R_0'$

$r'^2 + \rho^2 - 2r'\rho\cos\theta \leq R_0'^2$



i) $r' \geq R_0'$ $\quad r' + R_0' \geq \rho \geq r' - R_0'$

$1 \geq \cos\theta \geq \frac{r'^2 - R_0'^2 + \rho^2}{2r'\rho}$

$\frac{1}{\Omega}$

$$\frac{2}{\sqrt{\pi}} \int_{r'-R_0'}^{r'+R_0'} \frac{1}{\Omega} e^{-\rho^2} \rho^2 d\rho \left(1 - \frac{r'^2 - R_0'^2 + \rho^2}{2r'\rho}\right)$$

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$e^{-\rho^2}\rho^3 d\rho = e^{-x}\, x\, \frac{dx}{2}$

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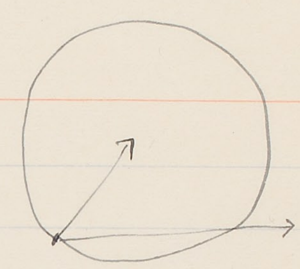
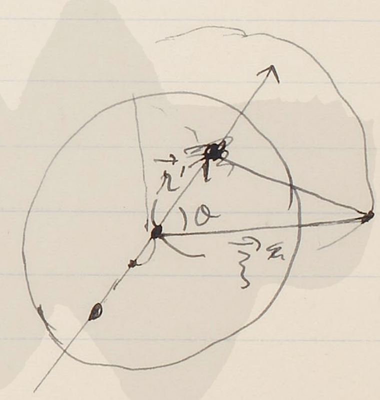
$\frac{1}{3!}$



ii) $r' = R_0'$ $\quad 2R_0' \geq \rho \geq 0$

$1 \geq \cos\theta \geq \frac{\rho}{2R_0'}$

$\frac{2}{\sqrt{\pi}}\int_0^{2R_0'} \frac{1}{\Omega} e^{-\rho^2}\rho^2\left(1 - \frac{\rho}{2R_0'}\right) =$



iii) $r' < R_0'$ $\quad r' + R_0' \geq \rho \geq R_0' - r'$

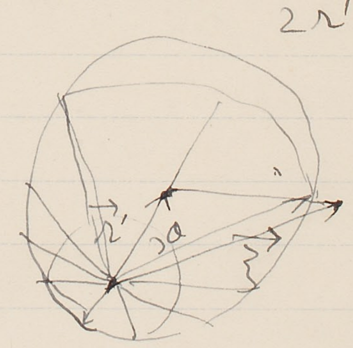
$\frac{2}{\sqrt{\pi}}\int_{R_0'-r'}^{R_0'+r'} \frac{1}{\Omega} e^{-\rho^2}\rho^2 d\rho\left(1 - \frac{r'^2 - R_0'^2 + \rho^2}{2r'\rho}\right)$

$R_0' - r' \leq \rho \leq r' + R_0'$

$r'^2 + \rho^2 - 2r'\rho\cos\theta \leq R_0'^2$

$1 \geq \cos\theta \geq \frac{r'^2 - R_0'^2 + \rho^2}{2r'\rho}$,

~~$e^{-\rho^2} \approx 1$. for 小さい ρ~~



$(R_0' - r')^2$

$2r'^2 - 2R_0'r'$