YHAL Letter to the Editor E09 040 P09

On the Nuclear Transformation by the Capture of the Orbital Electron

~~The nuclear transformation~~

Bethe and Bacher,

$$w\,d\epsilon = \frac{mc^2}{2\pi^3\hbar}\left(\frac{g}{mc^2(\hbar/mc)^3}\right)^2 |G|^2 \epsilon(\epsilon^2-1)^{\frac{1}{2}}(\epsilon_0-\epsilon)^2 d\epsilon$$

$$\cancel{g^2|G|^2} \sim$$

Y. S.

$$w\,d\varepsilon = \frac{256\pi^4 m^5c^4 g'^2}{\hbar^7\{\Gamma(2\gamma+1)\}^2}\left(\frac{4\pi mc\,a_N}{h}\right)^{2(\gamma-1)}$$

$$\times\left\{\frac{1+\gamma}{2}\left|\int U_0 d\vec{\tau}\right|^2 + \frac{1-\gamma}{2}\left|\int\frac{U'}{3}d\vec{\tau}\right|^2\right\}$$

$$\times\quad F(\varepsilon_+,0)(\Delta w-\varepsilon_+)^2 d\varepsilon_+$$

$$F(\varepsilon_+,0) = \eta_+^{2\gamma-1}\exp\left(-\pi\alpha Z\frac{\varepsilon_+}{\eta_+}\right)\left|\Gamma\left(\gamma+i\alpha Z\frac{\varepsilon_+}{\eta_+}\right)\right|^2$$

$$\times\ \varepsilon_+(\Delta w-\varepsilon_+)^2\ \cancel{(\Delta w-\varepsilon_+)}\quad \frac{mc}{\hbar}\cdot\left(\frac{\hbar}{mc}\right)^2\cdot\frac{mc^2}{\frac{\hbar}{2\pi^3}\hbar}$$

$Z\to 0.$

$$w\,d\varepsilon = \cancel{\frac{4\pi mc}{h}}\left\{\frac{(2\pi)^4 m^3c^2}{h^4}\right\}^2 \frac{m\,2\pi\hbar}{4\pi^4 m\,2\pi^3}\ \left(\varepsilon_+^2-1\right)^{\frac{1}{2}}$$

$$\times\, g'^2\Delta\{\quad \}^2(\Delta w-\varepsilon_+)^4(\varepsilon_+^2-1)^{\frac{1}{2}}\varepsilon_+$$

$$g^2|G|^2 \sim \left(\frac{\hbar}{mc}\right)^2\cdot g'^2\{\qquad\}^4$$

$$= 1.9\times10^{-60}\,\mathrm{erg.cm}^4.$$

$$w\,d\varepsilon = 1.9\times10^{-60}\,\cancel{\mathrm{erg}}\left(\frac{m^3c^2}{\hbar^4}\right)^2\cdot\frac{mc^2}{2\pi^3\hbar}\cdot(\quad)(\quad)\cdots$$

$$P_K = \frac{256\pi^5 m^5 c^4 g'^2}{h^7 \Gamma(2\gamma+1)}\left(\frac{4\pi m c a_N}{h}\right)^{2(\gamma-1)} (\alpha Z)^{2\gamma+1}$$

$$\{ \qquad \} \times (\Delta w+\gamma)^4$$

$$= \frac{256\pi^5 m^5 c^4}{h^7 \Gamma(2\gamma+1)}\left(\frac{2\pi m c}{h}\right)^2 \{g^2|G|^2\} (\alpha Z)^{2\gamma+1} (\Delta w+\gamma)^4$$

$$\left(\frac{4\pi m c a_N}{h}\right)^{2(\gamma-1)}$$

αZ	Z	$\gamma=\sqrt{1-\alpha^2 Z^2}$	τ
1/137	1	1	1856 years
0.1	14	1	13.2 days
0.2	27	$\sqrt{0.96}=0.98$	16.5 days
0.5	69	0.866	8.~~7.5~~ ~~days~~ hours

$$\frac{256\pi^5 m^5 c^4}{h^7} = \frac{1.16}{16}\times 10^{96} = \cancel{9}\frac{0.29}{4}\times 10^{96} = \frac{29}{4}\times 10^{94}$$

$$16\overline{)1.16}\;\; 0.0725 \quad 112 \quad 40$$

$$0.29 \quad 4\overline{)1.16}$$

$$g^2|G|^2 = (1.9)^2\times 10^{\cancel{-60}\,-120}$$
$$= 3.61\times 10^{-120}$$

$$19 \times 19 = 171 + 19 = 361$$

$$\left(\frac{2\pi m c}{h}\right)^2 = 6.71\times 10^{+20}$$

$\log \pi$	0.49715
$\log 2$	0.30103
$\log m$ +28	0.95424
$\log c$ ~~-~~+10	0.47712
$-\log h$ ~~+~~27	~~0.81624~~ $\bar{1}.18376$
〃 ~~+19~~	1.41334
〃 ~~+22~~ −18	2.82668

$6.71\times 10^{+20}$

$$16\overline{)1856}\;\; 116 \quad 16 \quad 25 \quad 16 \quad 96$$

$$P_K = \frac{(\Delta W+\gamma)^4}{\Sigma(2\gamma+1)}\left(\frac{4\pi m c a_N}{h}\right)^{2(\gamma-1)}(\alpha Z)^{2\gamma+1}.$$

$$\times \underbrace{\frac{29\times10^{94}}{4}\times 3.61\times10^{-120}\times 6.71\times10^{20}}_{=1.756\times10^{-4}}$$

6.71
3.61
671
4026
2013
24.2231
29
21798
4844
4)702.38
175.6

$Z=1.$ $\quad 137^3 = 2.57\times10^6$

$$P_K = \frac{\cancel{\Delta W+\gamma}(\Delta W+1)^4}{2.57\times2}\times 1.756\times10^{-4}\times10^{-6}\ \cancel{\times 2}\div 2$$

$$\tau = \frac{2.57\times2}{1.756}\times10^{10}\times\frac{1}{(\Delta W+1)^4}\ \mathrm{sec}\ \cancel{\div 2}\times 2$$

$$= \frac{2.57\cancel{\times 4}\times4\times10^{3}}{1.756\times3.1536\ (\Delta W+1)^4}\ \text{years} = \frac{1856\ \text{years}}{(\Delta W+1)^4}$$

3600
24
14400
72
86400
365
432000
5184
2592
31536000
$=3.1536\times10^{7}$ sec

log 4 0.60206
log 3.1536 ~~0.49880~~
$\bar{1}$.50120
log 2.57 0.40993
log 1.756 ~~0.24452~~
$\bar{1}$.75548
0.26867
1856

$Z=27.5$ $\quad P_K = 1.756\times10^{-4}\,(\Delta W+1)^4\,\frac{(0.2)^3}{2}$

$\alpha Z=0.2$

$\tau = \frac{1}{1.756\,\cancel{\times}\,0.004}\times10^4(\Delta W+1)^4$

$0.004 \quad = \frac{10^7}{1.756\times4}(\Delta W+1)^4$ sec $\rightarrow$ $\frac{864}{\cancel{8.64\times10^4}}$ day

log 4	0.60206
log 1.756	0.24452
log 8.64	0.93651
	1.78309
	$\bar{2}$.21691
	0.01648

$= \frac{10^3(\Delta W+1)^4 \text{days}}{1.756\times8.64\times4}$

$= \underline{\underline{16.5}}(\Delta W+1)^4$ days.

$\alpha Z=0.1$ $\quad \tau = \frac{2\times10^{\cancel{4}3}}{1.756\,\cancel{\times2}\,8.64}(\Delta W+1)^4$ day

0.30103
~~0.24452~~
$\bar{1}$.75548
$\bar{1}$.06349
$\bar{1}$.12000

$= \frac{131.8 \text{ days}}{(\Delta W+1)^4}$

$\cdot 16.5$
$\quad 8$

$132\,0$

$\alpha Z=0.5$ $\quad \gamma=0.866$ $\quad \Gamma(2.732) = \cancel{\frac{1}{\Gamma(2)}} = 1.5824$

$\left(\frac{4\pi mca_N}{h}\right)^{2(\gamma-1)} = 2.65.$

$\tau = \frac{1.58\times\cancel{2}\,10^4 \text{ sec}}{2.65\times(0.5)^3\times1.756\,(\Delta W+0.87)^4}\times\frac{2}{1.866}$

$3 - 2\gamma + 1 = 2 \times 0.134 = 0.268$

~~30103~~
3

1.58	0.19866
2.65^{-1}	$\bar{1}.57675$
2^{7}	0.90309
1.756^{-1}	$\bar{1}.75548$
	0.43398

$$\tau = \frac{2.716 \times 10^4\ \mathrm{sec}}{(\Delta W + 0.87)^4} \times \frac{2}{1.868}$$

$$= \frac{\cancel{7.5\ \text{hours}}\ 7.544}{(\Delta W + 0.87)^4} \times 8\ \text{hours}$$

0.36) 2.71.6
252
196
180
160
144
16

0.36) ~~4~~5.
36
140
14

2) 7.54
3.77

1.866
3.77
13.062
13062
5598
7.03482

$\frac{1+8}{2}$

2) 1.866
0.933

0.933) 7.544
7464
800
809