YHAL E10 010 P15

0.714
1.28
5612
1428
714
0.91292
2.738
2.74

$\tau_0 = 2.74 \times a \times x^{-4} \times 10^{-6}$

x	x^{+4}	a	τ_0
= 1	1	3.48	9.5×10^{-6}
= 1.25	2.44	3.15	3.5×10^{-6}
= 1.6	6.55	2.78	1.2×10^{-6}
= 2	16	2.70	4.6×10^{-7}

2.74 0.43775
3.48 0.54158
(2.44) 0.97933 9.535
81624

2.74 0.43775
2.78 0.44404
$(6.55)^{-1}$ ~~1.1778~~
1.52 0.05897
$\bar{1}.18376$
1.163 0.06555

m_0	τ_0 100m	125m	160m	200m
case i)	9.5×10^{-6}	3.5×10^{-6}	1.2×10^{-6}	4.6×10^{-7}
case ii)	1.9×10^{-6}	0.7×10^{-6}	2.4×10^{-7}	$0.9_2 \times 10^{-7}$

$\tau^{(1)}\tau^{(2)} = 1 \qquad \frac{8}{24} = \frac{1}{3}$

(35) $V_{12} = \frac{1}{3} \cdot \frac{g^2 e^{-\kappa r}}{r}$

$g_1 = \frac{a}{4}\frac{\kappa\hbar^2}{M} \qquad g_2 = \frac{5a}{8} \cdot \frac{\kappa\hbar^2}{M}$

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Short Note

The Mass and the Life Time of the Mesotron

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According to the new field theory of the nuclear forces and the -decay, the mesotron with the charge -e (or ~~positive~~ +e) can transform into a negative (or positive) electron and an antineutrino (or a neutrino) even in vacuum, the mean life time due to this process being proportional to the energy.[1] In the previous papers,[2] the proper life time ~~ττ~~ of the mesotron, i.e. the mean life time at rest, was calculated by assuming the interaction of it with the light particle, which was equivalent to that in Fermi's theory of -decay. The result was

(1)

which has the numerical value

$$= 1.3 \quad 10^{-7} \text{ sec} \qquad (2)$$

for m = 200 m, g' = 4 10^{-17} and : The proper life time became smaller by afactor $(m/m)^2$, ~~if we assumed the in~~ than (1) for the interaction equivalent to that in Konopinski-Uhlenbeck's theory.

On the other hand, the proper life time was determined by various authors[4] from the experiments on the cosmic ray according to the suggestion of Euler and

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1) Bhabha, Nature 141, 117, 1938.
2) Yukawa, Sakata and Taketani, Proc.Phys.-Math. Soc. Japan 20(1938), 319~~,~~. (III)~~,~~.
Yukawa, Sakata, Kobayasi and Taketani, ibid., 720.(IV).
3) Blackett, Nature 142(1938), 992; Rossi, ibid. 993; Ehrenfest and Freon, C. R. 207(1938), 853; Johnson and Pomerantz, Phys. Rev. 55(1939), 104; Blackett, Phys. Rev. 54(1938), 973.

$$G = \frac{f\, m^2 c}{\sqrt{2\pi^3}\cdot \hbar^3} = \frac{f\cdot(mc^2)^2}{\sqrt{2\pi^3}\,\hbar^3 c^3}\quad \frac{cm^3\, erg\cdot erg^2}{erg^3\, sec^3\cdot \frac{cm^3}{sec}}$$

$f = 4\times10^{-50}\ cm^3\, erg$

~~$m =$~~ ~~$mc^2 =$~~ $m = 9.035\times10^{-28}$ $\quad mc^2 = 8.119\times10^{7}\, erg$

$c = 3\times10^{10}$

$\hbar = 1.042\times10^{-27}$

$\sqrt{2\pi}\cdot\pi = 2.5066\times3.1416$

-64
$+81$
-145

$$G = \frac{4\times10^{-50}\times(8.119)^2\times10^{-14}}{2.5066\times3.1416\times(1.042)^2\times10^{-81}\times 27\times10^{30}}$$

$$= \frac{4\times(8.119)^2}{2.5066\times3.1416\times 27\,(1.042)^2\times} \times10^{-143}$$

$8.119^2 = 65.92$

$1.042^2 = 1.084$

$65.92 \times 4 = 263.68$

3.1416
2.5066
188496
188496
157080
62832
7.87474
1.084
31500
63000
7875
8.536

8.53
27
5971
1706
23031

1.1
23.03) 263.68
2303
333

Heisenberg.[5] Their results all point to a value of the order of

$$= 2 \quad 10^{-6} \text{sec} \qquad (3)$$

which is in qualitative agreement with the theoretical value (1) corresponding to Fermi interaction. The discrepancy of a factor 10 between the numerical values (2) and (3) seems to be due to various uncertainties on the side of the theory rather than to possibles errors on the side of the experiment. In fact, the life time as given by (1) ~~decreases~~ increases rapidly as m becomes smaller, so that it is necessary to determine the numerical values more carefully for different values of m .

In the first place, the constants g_1, g_2, which are characteristic to the inetraction between the mesotron and the heavy particle, can be cosen in the following way. The interaction between two heavy particles in S state is given approximately by

(4)

if we assume

(5)

From the small binding energy 2.17 10^6eV of the deuteron, it follows that

$$a = g^2 M / h^2 \qquad (6)$$

changes slowly with $= m\, c/h$, where M is the mass of the heavy particle.[6] According to the result of numerical solution of the deuteron problem by assuming the potential of the form (4),[7] we obtain

5) Euler, Naturwiss. 26(1938), 382; Zeits. f. Phys. 110(1938), 450; Euler und Heisenberg, Ergeb. exakt. Naturwiss. 17(1938), 1. See further Ferretti, Nuovo Cimento 15(1938), 421.
6) Kemmer, Proc. Camb. Phil. Soc. 34(1938), 354. See ~~f~~ further IV, §2.