Then $$\frac{1}{\tau_n} = g^2 \frac{m^5 c^4 F(\eta_o)}{2\pi^3 \hbar^7}$$

and $$\alpha = \frac{1}{2\pi\ \tau_n} \times \frac{2\pi^3 \hbar^7\ c}{(mc)^5\ F(\eta_o)} \times \frac{m^2}{\hbar^4} = \frac{\pi^2}{c} \frac{\hbar^3}{(mc)^3} \frac{1}{\tau_n F(\eta_o)}$$

where $\tau_n = \tau_{1/2}/0.693 = (12 \pm 1.5/0.693) \times 60 = 1040 \pm 130$ sec and[7] the Fermi function $F(\eta_o) = F(P_{max}/mc) = F(2.324) = 1.633$.

The β^- spectrum from neutron decay measured by J. M. Robson[8] is consistent with an allowed shape having an end point of 782 kev.

Finally, $$\alpha = \frac{\pi^2}{c} \left(\frac{\hbar}{mc}\right)^3 \frac{1}{\tau_n\ F(\eta_o)}$$

$$= \frac{\pi^2}{3 \times 10^{10}} \left(\frac{2.426 \times 10^{-10}}{2\pi}\right)^3 \times \frac{1}{1040 \pm 130} \times \frac{1}{1.633}$$

$$\alpha = 1.12 \pm 0.14 \times 10^{-44}\ cm^2,$$

so that the desired cross section for a monoenergetic antineutrino is

$$\sigma(E_{\nu_-}) = (1.12 \pm 0.14) \times 10^{-44}\ (E_{\nu_-} - 2.53) \left[\sqrt{(E_{\nu_-} - 2.53)^2 - 1}\right] \times P \qquad (7)$$

where σ in cm^2 and E_{ν_-} is in mc^2 units.

APPENDIX II

The cross section for fission fragment antineutrinos

The β^- spectrum from fission fragments differs from the associated ν_- spectrum because of the finite mass of the electron and the spectral distortion due to electrostatic attraction between the electron and nucleus. Since, given an end point and coulomb factor, both the β^- and ν_- are determined, the problem is viewed as one of determining the end point distribution, considering coulomb effects. However, we do not as yet know the details of the short lived fission product chains and hence it is not possible to accurately predict these effects. Consequently, we adopt a procedure which enables us to bracket the expected cross section. We assume that the observed β^- spectrum results from the superposition of a continuous distribution of β^- emitters, each one having an allowed shape but all with the same nuclear charge Z. Two extreme values of Z (Z = 60,32) are assumed so as to place upper and lower limits on the coulomb distortion of the β^-, and hence the ν_- spectrum. The end point distribution is then determined by solving the appropriate integral equation and the cross section of Appendix I is integrated over the resulting ν_- spectrum.