for $j=l-\frac{1}{2}$

$$|M_{\mathrm{GT}}|^2=\frac{J+1}{J}\left|\frac{2\mu-(J/j+1)(l+0.12)}{3.70-l}\right|^2.$$

Using these formulas we have computed $|M_{\mathrm{GT}}|^2$ from the experimental magnetic moments and compared them with the experimental ft values by means of Eq. (3) in Fig. 17. A least-squares fit gives the values $g_F{}^2=(1.5\pm0.1)\times10^{-4}$ sec^{-1} and $g_{\mathrm{GT}}{}^2=(2.2\pm0.1)\times10^{-4}$ sec^{-1}, in good agreement with the work of Gerhart,[44] Blatt,[45] and Kofoed-Hansen.[46] An equally good fit to the same values of g^2 (with the exception of the point for He^3) can be obtained from the semiempirical matrix elements of Trigg,[13] who adjusted his LS matrix elements according to deviations of the experimental magnetic moment from corresponding computed values.

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Fission Cross Section of Plutonium-242*

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The cross section for neutron induced fission of Pu^{242} has been measured between 0.1 and 1.7 Mev. The measurement was made by determining the ratio of the Pu^{242} fission cross section to that of U^{235} using a back to back gas scintillation counter.

APPARATUS AND EXPERIMENTAL METHOD

THE ratio of the neutron induced fission cross section of Pu^{242} to that of U^{235} has been measured. The known[1] fission cross section of U^{235} was used to determine the fission cross section of Pu^{242}.

The details of the gas scintillation counter are shown in Fig. 1. The fissionable deposits were supported at the center of a thin walled (0.010 in.) stainless steel cylinder. Flanges were welded to the ends of the cylinder so that Vycor windows could be sealed on with lead gaskets. The gas filling mixture was 1.7% N_2 and 98.3% A at a total pressure of two atmospheres. This mixture was determined to give maximum α-particle pulse height for the particular counter geometry.

The fissionable samples were prepared by electrodeposition. The Pu^{242} used[2] was sample No. 2 of reference 2. The mass (230 μg) of this sample was determined by a mass spectrographic measurement of its isotopic composition combined with α counting. The mass of the uranium sample (4.73 mg U^{235}) was determined in its preparation by quantitative deposition.

The measurements were made by placing the counter with the centers of the deposits $3\frac{1}{2}$ in. from a lithium target. Neutrons were produced in the target by the $Li^7(p,n)Be^7$ reaction using protons from a 3-Mev Van de Graaff electrostatic accelerator. The energy of the neutrons was determined by measuring the energy of the protons with an electrostatic analyzer. The lithium targets used were about 30-kev thick at the (p,n) threshold and the energy spread due to geometry was less than 20 kev. The total combined neutron energy spread at all energies was always less than 60 kev. In order to correct for absorption in the sample backing foils the deposits were placed at an angle of 30° to the neutron flux with the flux alternately incident on the plutonium and the uranium samples.

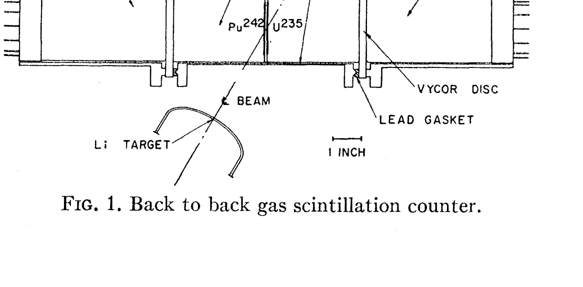

FIG. 1. Back to back gas scintillation counter.

* This work was performed under the auspices of the U. S. Atomic Energy Commission.
[1] *Neutron Cross Sections*, compiled by D. J. Hughes and R. Schwartz, Brookhaven National Laboratory Report BNL-325 (Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., 1958), second edition.
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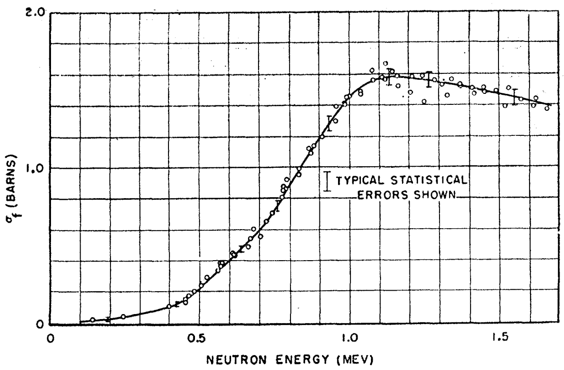

FIG. 2. Neutron induced fission cross section of Pu^{242}.

RESULTS

The results of the cross-section measurements are shown in Fig. 2. Only statistical counting errors are indicated.

The results have been corrected above 650-kev neutron energy for the low-energy group of neutrons from the lithium reaction.[3–5] The low-energy neutron flux at the counter due to air and room scattering was checked with a LiI(Eu) scintillation counter. One half of this flux was found to be below the cadmium cutoff. The intensity of the low-energy flux was such that it caused no greater than a $\frac{1}{2}\%$ increase in the U^{235} fission count rate and was therefore neglected.

In addition to the correction for the second group in lithium the results have been corrected for fissions of other isotopes of uranium and plutonium in the samples, and for spontaneous fissions in Pu^{242}. They have also been corrected for fissions which dissipated all or most of their energy in the fissionable deposits and therefore gave pulses below the discriminator settings.

The statistical errors shown in Fig. 2 do not include possible errors in the normalization of the curve. Possible normalization errors would result from any error in the U^{235} fission cross section, any errors in the correction for fission pulses below the discriminator settings, any uncertainty of the knowledge of the sample masses, or a small error in positioning or non uniformity of the fissionable deposits. The largest correction for fission pulses below the discriminator settings was 3.9% for the U^{235} sample. This correction may have been in error by as much as 50% thereby producing an error in the normalization of $\pm 2\%$. The accuracy of the determination of the mass of the Pu^{242} sample, limited primarily by the accuracy of the knowledge of the half-life for α decay of the Pu^{242}, was estimated from the scatter of the best half-life measurements to date[2,6,7] to be $\pm 2\%$. The probable error of the determination of the mass of the uranium sample was less than 1%. The error in the normalization factor due to improper positioning and non uniformity of the deposits was estimated by rotating the counter so that the neutrons traveled through it in exactly the opposite direction to that shown in Fig. 1. The measured fission ratio changed by less than 3% when this was done. The result of combining all these errors was a probable error in the normalization factor of 5% to which must be added any error in the U^{235} fission cross section.

Additional runs which could not be included in Fig. 2 because one discriminator was accidentally set too high confirmed the existence of an unusually large cross section below 400 kev. This cross section cannot be explained by any known contaminant, so it must be attributed[8] to Pu^{242}.

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