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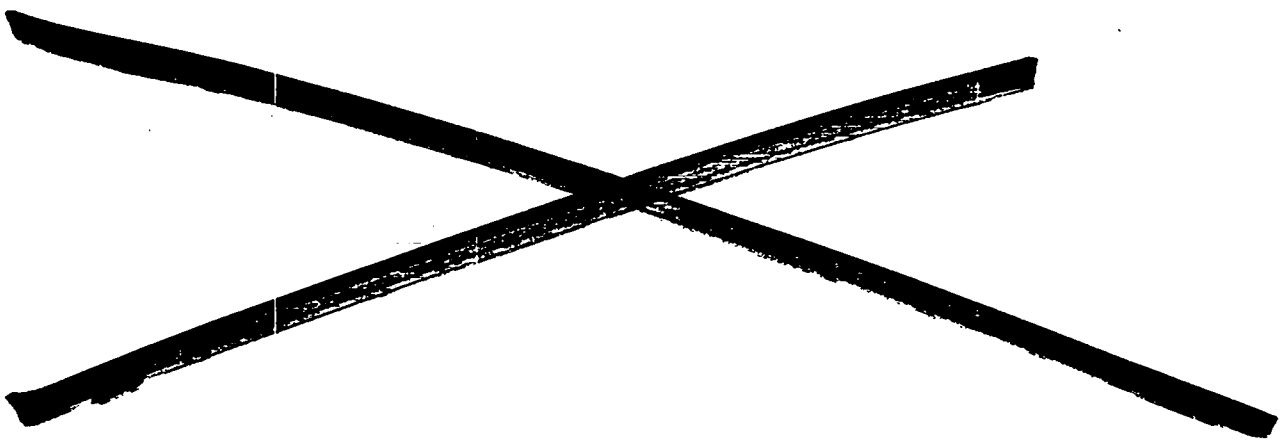

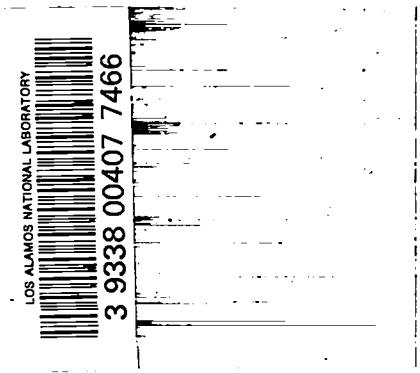

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THE FISSION CROSS SECTION OF 37

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The experiments at 2.5 Mev and 3.0 Mev were carried out using the D-D source in cooperation with:

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ABSTRACT

The cross section for fission of isotope 37 has been measured for neutrons of energies from near thermal to 3 Mev by counting simultaneously the fissions from known 37 and 25 foils placed back to back in a monoenergetic neutron beam. No fission was detected with near-thermal neutrons. The threshold energy is about 350 Kev, the cross section rising to a constant value of about 1.45 barns from 1.1 Mev to 3 Mev. The absolute values of the cross sections given depend on the values of $\sigma_f(25)$ and on the mass of 37.

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THE FISSION CROSS SECTION OF 37

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The fission cross section of isotope 37 has been determined for neutrons of energies from near thermal to 3 Mev. The method and apparatus used were the same as had been employed in the measurement of the fission cross section of isotope 23 [1]. The fissions from known foils of 37 and 25 placed back to back in a parallel plate comparison chamber filled with pure argon were counted simultaneously. A preliminary study of the 37 cross section was made previously and was reported in LA-150.

The long electrostatic generator was used for neutron energies from near thermal to 1.67 Mev. The Li(p,n) reaction with a Li target 60 Kev thick was the source of monoenergetic neutrons. The 2.5 Mev and 3.0 Mev points were taken with the D-D source in building 2, using a thick heavy-ice target and an accelerating voltage of 200 Kev.

The 37 foil was prepared by Sgt. Miller of Dodson's group. The material was received as 100 gammas of 37 metal dissolved in 1 N sulfuric acid, the solution containing in addition 50 gammas of potassium as bisulfate. This solution was deposited in drops on a platinum foil by means of a micropipette and evaporated. It has been assumed that all the 37 in the solution was transferred to the foil. The sample received contained about .05 percent of 49 by weight. Therefore the foil was not alpha counted, and the 37 mass was taken as 100 gammas. The 25 foil, E5C, was the same one used in the 23 fission cross section measurements.

The fission cross section of 37 is given in Fig. 1, and the $\sigma \cdot v$ curve is plotted in Fig. 2. For each point in Fig. 1, the error given is the statistical error. For the points obtained with the long electrostatic generator, the cross sections are given for the average neutron energy in each case. A correction was

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made for the 49 in the 37 foil for the 270 and 370 Kev points, assuming .05 per cent 49 by weight. The 25, 28, and 49 fission cross sections used in correcting the observed counting rates and in obtaining the 37 cross section were taken from curves given in LA-140 and LA-150.

The diameter of the 37 foil was 4 cm, and the diameter of the 25 foil was 3.1 cm. The flux from the long electrostatic generator was sufficient to allow placing the foils far enough away from the target to make both the variation in energy and yield across the foils small enough to be neglected. The difference in distances of the foils from the target was also small enough to make the inverse r^2 effect negligible. With the D-D source, it was necessary to place the foils quite close to the target. For the observations in the forward direction, the maximum half-angle was 16.8° for the 25 foil and 21.3° for the 37 foil. At 90°, the half-angle was 21.4° for the 25 foil and 26.9° for the 37. The corrections to the observed ratio of 37 to 25 fissions to take account of the variation in neutron yield with angle were made by Mr. D. R. Inglis on the basis of measurements taken in Z with a 28 spiral detector. These corrections amounted to +2.5 per cent for the 2.5 Mev point and +4 per cent for the 3.0 Mev point. At 2.5 Mev a +2.5 per cent and at 3.0 Mev a +2 percent correction was applied to take account of the different distances of the foils from the target.

A point was taken with the long electrostatic generator with a maximum primary neutron energy of 150 Kev and a block of paraffin about 1 7/8 inches thick between the target and the comparison chamber. Over 19,500 counts were observed from the 25 foil with 1 count from the 37 foil. Using the ratio of cross sections of 25 and 49 at near thermal energy and assuming the 37 foil to contain .05 percent of 49 by weight, the 1 count can more than be accounted for by the fission of 49. Thus no thermal fission was observed in 37 within the accuracy of this experiment.

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It is, of course, difficult to obtain the exact shape of the cross section curve near the threshold energy with such a small sample of material. It is planned to use a spiral chamber containing 37 and the short electrostatic generator to get the shape of this part of the curve more accurately.

The cross sections given here for 37 are, of course, based on the mass of 37, which was assumed to be exactly that determined by the Chicago groups, and the fission cross section of 25.

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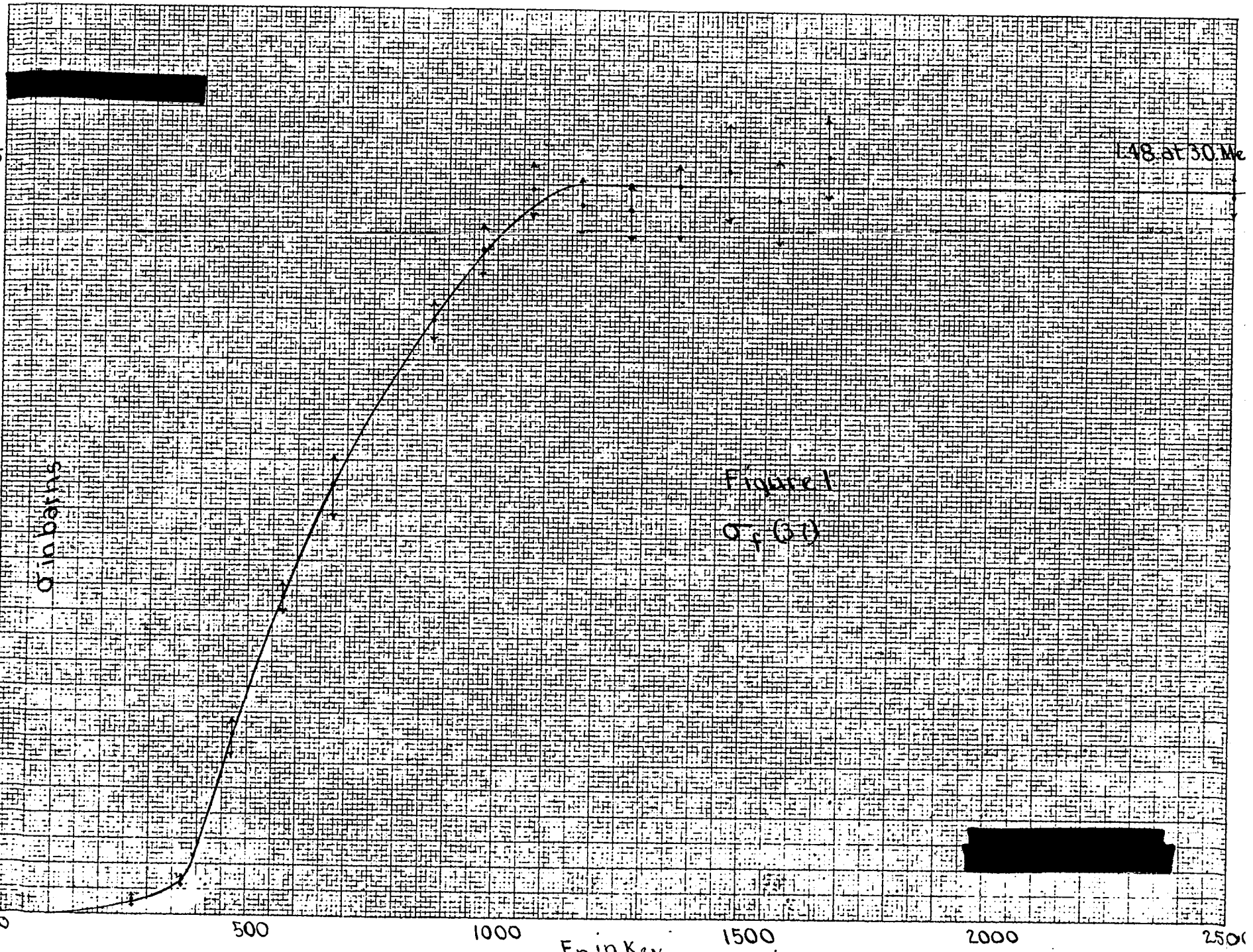

Figure 1

$\sigma_f(30)$