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DELAYED NEUTRONS FROM 49

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Physics - Fission

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ABSTRACT

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Neutron counts in a BF_3 chamber near a sample of 49 or 25, observed just after having turned off the source of primary neutrons, are attributed to delayed neutrons. It is found that the delayed neutrons from 49 are distributed in time just as those from 25, as though attributable to the same products, but are about 46% as numerous per fission.

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DELAYED NEUTRONS FROM 49

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The number of delayed neutrons from 49 relative to the number from 25 has been measured by means of a boron trifluoride ionization chamber immersed in a block of paraffin. The sample of 49, 565 mg in the shape of a disk 2 5/16" o.d., was placed on one end of the BF_3 chamber and the paraffin block was exposed to the direct beam of neutrons from the cyclotron target about 10' away. The strong neutron intensity, with the cyclotron on, caused the grid of the first amplifier tube to drift to such a negative voltage that nothing was recorded. However, as soon as the cyclotron was turned off the grid voltage would snap back to a sensitive bias within a few milliseconds and the amplifier system would then record boron disintegrations due to delayed neutrons. The procedure, then, was to expose the block to the cyclotron beam for 5 minutes and then to count for 5 minutes with the beam off. This was sufficient time for the delays to build up to equilibrium during exposure and to completely die out during the recording period. On the average 835 counts per run were recorded.

A sample containing 1.93 grams of 25 (E10, R = 8.05 where R is the ratio of number of atoms of 28 to number of 25 atoms) prepared in as nearly as possible the same geometry as the 49 was then substituted for the 49 and the same procedure was gone through. This gave 3830 counts per run on the average. To determine the contribution of the 15.5 g of 28 in the sample of E10, a disk of tuballoy metal weighing 275 g was then substituted for the E10 sample, giving 4130 counts per run. No sample at all gave no counts at all.

A comparison ionization chamber in which known amounts of 49, enriched 25, and enriched 28 could be placed was inserted in the paraffin

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block in the same position that the 49 or 25 sample had occupied. Relative counts when exposed to the cyclotron beam gave the following relative fissions per mg of material: 49, 1.54; 25, 1.00; 28, 2.8 $\cdot$ 10^{-4}. Thus we see that the fissions of 28 in sample E10 was only 0.2% of those due to 25. This checks the relative numbers of delayed neutrons from the tuballoy and from the E10 sample if one assumes the same number of delays from 28 and 25. The ratio of 49 fission/mg to 25 fissions/mg in the paraffin was 10% higher than that ratio measured in the well thermalized part of the graphite block. From the above numbers one can calculate that there are only 48% as many delayed neutrons per fission from 49 as there are from 25. If one assumes the neutrons are all thermalized and applies an absorption correction of 0.095 for the 49 (1050 barns), and 0.183 for the 25 (669 barns) the percentage of delayed neutrons from 49 relative to 25 is changed to 44%. However, not all the neutrons are thermal so we can only say that the proper ratio lies within the range 44-48%, and is probably about 46%. It is difficult to draw any conclusions about the delayed neutrons of 28 from the above data.

A decay curve was obtained for 49 by noting the time corresponding to each click of the scale-of-64 recorder just after the cyclotron was turned off. Similar data was taken for the 25 sample and the results plotted in Fig. 1. No difference between the two decay curves can be observed when the two are superimposed.

The above research indicates that the delayed neutrons observed possibly come from the same fission products in the case of 49 and 25, but that the branching ratio for formation of these products for 49 is about 46% that for 25.

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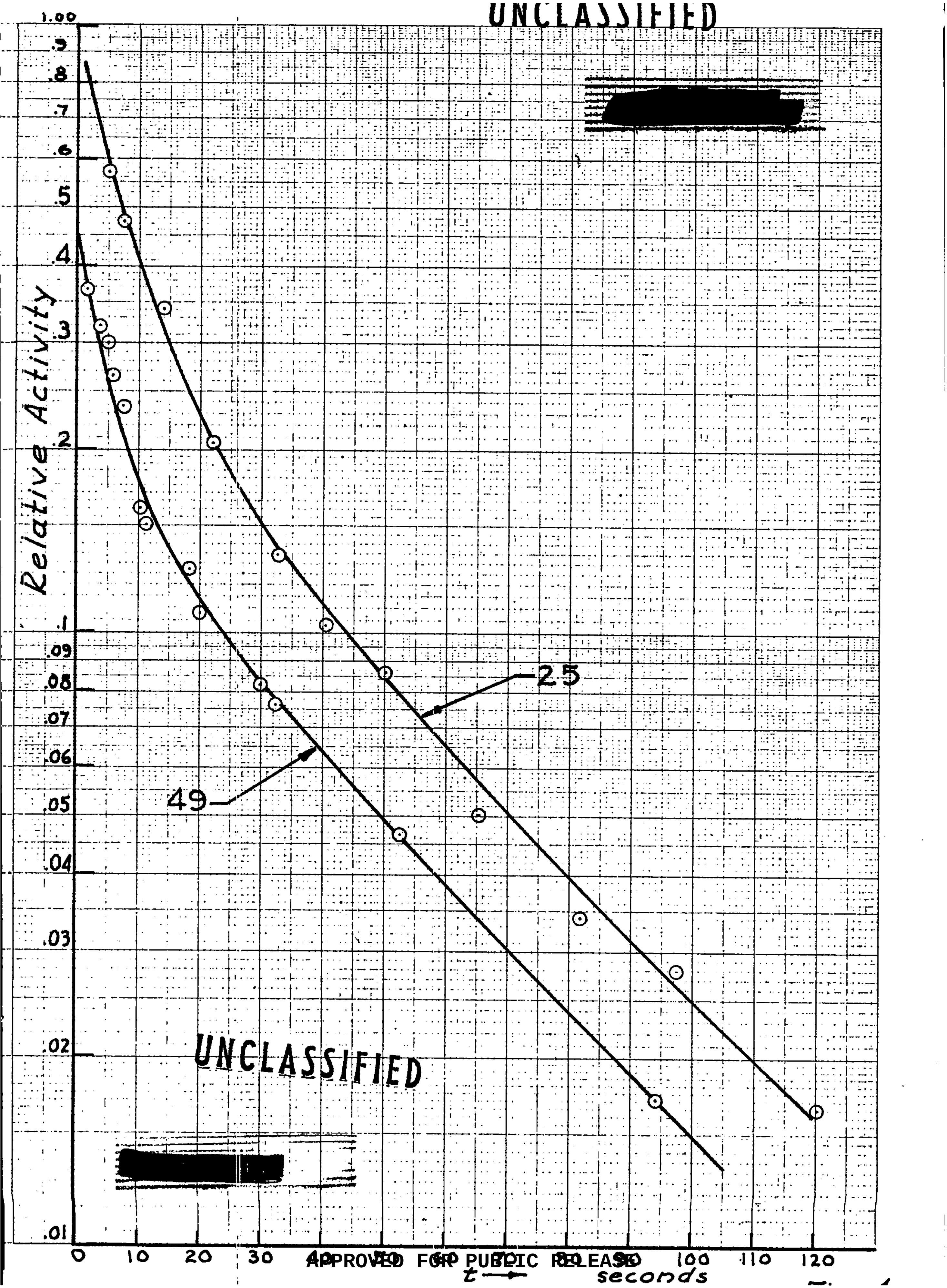
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