47. *Slowing Down of Neutrons by Thin Layers of Paraffin.*

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It is well known that the neutrons in passing through a paraffin layer are slowed down and activate some elements more strongly than the case without paraffin. Fermi and Amaldi¹⁾ have observed that in the slow neutrons which activate elements, there are several groups which were named by them A, B, C, D and I. If the neutrons of different groups have different velocities, it is expected that the relative number of neutrons of these groups depends on the thickness of paraffin layers, through which they pass. On this view an analysis of the neutron groups was made in the following experiment.

A Rn-Be source was placed 5 cm below a detector and between the source and the detector thin plates of paraffin were interposed, which were prepared by pressing together several sheets of paper soaked with paraffin, so that each plate had an equivalent thickness of 1.5 mm paraffin.

The irradiation of detectors, silver and iodine, through paraffin layers of various thickness was performed with or without absorbers, and the induced β -activity was measured by a thin walled aluminium Geiger-Müller counter.

The results are shown in Figs. 1 and 2, in which the arrangement of the source, paraffin, absorbers and detector are given by the notation according to Fermi and Amaldi.²⁾

In the case of silver detector (half-value period 2.3 min.), curves I and II in Fig. 1 show a regular rise very similar in shape except a slight difference in the thickness of paraffin less than about 0.7 cm. The difference may be explained by assuming the neutrons of C group initially present in the source. Curve III, which shows the activity due to the residual neutrons filtered by cadmium (0.22 gm/cm^2), changes its slope at the thickness of about 2.0 cm of paraffin and tends to become nearly flat. This indicates that there exists, besides C, another group, which is also effective to activate silver. The fact that curve IV obtained with the addition of silver absorber (1.1 gm/cm^2) retains a similar form as curve III shows that this group is not selectively absorbed by silver and may be the same group as B pointed out by Fermi and Amaldi. Curve V shows the effect of C group only and its monotonous rise is specially to be noticed.

In the case of iodine, more complex and interesting results are obtained. Both curves I and II (with and without Cd filter) are very

1) E. Fermi and E. Amaldi: *La Ric. Sci.*, **6** (1935), 443; **7** (1936), 56.

2) *loc. cit.*

Fig. 1. Silver Detector.

Curve I; S P R.
 Curve II; S Cd P R.
 Curve III; S Cd P Cd R.
 Curve IV; S Cd P Ag Cd R.
 Curve V; C group (I-III).

similar in shape, each indicating two inflexions at certain thickness of paraffin. This fact suggests that there exist at least two groups besides C and they are more effective for the activation of iodine than the C group. Further, if an iodine absorber (KI ; 1.4 gm/cm^2) is added, the curve becomes flat from the thickness of about 1.8 cm of paraffin, which corresponds to the first inflexion of curves I and II, as seen by curve III. Curve IV, indicating the difference of intensity between the curves I and II, is monotonous and shows the effect of C group only.

Curve V plotted from the difference between II and III, shows the effect of a group which is markedly absorbed by iodine. Another group, shown by the bending of curve III, is not much absorbed by iodine and the energy of this group seems to be higher than that of

the above group, for the thickness of paraffin by which the inflexion of the curve takes place is less for the former than for the latter group. The I group found by Fermi and Amaldi seems to be the mixture of these two groups.

Fig. 2. Iodine Detector.

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