The Scattering of the fast Neutrons.

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Recently, we\(^1\) measured the scattering cross section of several elements for D-D neutrons and found that it varies in a complicated manner with the atomic number. To study the problem more precisely, we carried out the similar experiment with the arrangement shown in Fig. 1. Both D-D neutrons (monochromatic 2.4 mev.) and Li-D neutrons (heterogeneous 0~14 mev.) were investigated. The neutrons were detected by an ionization chamber C\(_1\) filled with methane at 20 atm. connected to a quadrant electrometer. Another ionization chamber C\(_2\) filled with methane at 1 atm. connected to a Shimaz electric meter was used as the indicator of the neutron intensity. The ionization current in both chambers was usually about 10\(^6\) times the natural leakage current. The scatterers were of cylindrical form 6cm in diameter and their thickness was different from 4 to 8cm. By an auxiliary experiment it was confirmed that the amount of transmission is independent of the thickness provided that equal amount of the substance per unit area was used. The amount of wall effect was estimated on the other hand by studying the neutron intensity as the function of the distance of the chamber from the target, and on the other hand by observing the minimum neutron intensity which could be reached when a sufficient thick scatterer was inserted between the target and the ionization chamber. It was estimated to be 10±2% in the case of D-D neutron and 7±8% in the case of Li-D neutron at the distance of 40cm from the target where the experiment was carried out. Our chamber was decisively more sensitive to neutrons than to gamma-rays and it was confirmed experimentally that the effect of gamma-rays emitted in the D-D and Li-D reaction, if existed, is negligibly small.

The results are shown in Fig. 2 in which points corresponding to D-D neutrons are indicated with \(\circ\) while those for Li-D neutrons are indicated with \(\bullet\). Firstly, we shall confine our attention to the case of D-D neutrons. As to the elements
which are investigated in our previous experiment, our new values are in good agreement with the previous ones. The conclusion given in our previous work that the cross section is by no means a monotonic increasing function of the atomic number is further confirmed by the addition of new data. This is true even in the region of high atomic number. In the region of low atomic number points seem to lie on a smooth curve indicated with the dotted line. It is interesting to note that the curve shows a sign of periodicity similar to that observed in the usual periodic system of the elements.

As will be seen, the cross section for Li-D neutrons is in general different from that for D-D neutrons. We notice a general trend that the deviation of the points from the monotonic increasing curve as suggested by Dunning is less in the case of Li-D neutrons. The observed facts seem to be reasonably accounted for by the resonance phenomenon in the interaction of the neutron with the atomic nuclei. The detailed description of the results and discussions will be given in a note which will be published soon in this proceeding.

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The Beta-Ray Spectrum of $^{13}$N.

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Beta-ray spectrum of $^{13}$N was investigated by the magnetic spectrometer constructed by Watabe and Itoh(1) in their research on the beta-ray spectrum of radium E. $^{13}$N was produced by bombarding carbon with high energy deuteron beam obtained by Osaka cyclotron. The energy of the deuteron ion was about 4.5 mev, and the ion current received on the carbon target was about 5 μa. Carbon was bombarded in form of soot and a fraction of mg of activated soot was rubbed on a source holder. To see the effect of back scattering from the holder, we compared the spectra with each other, which were obtained when an plate of 0.1 g/cm², brass plate of 4 g/cm² and polystyrol film of 1 mg/cm² in thickness were used as source holder. In the first and the second case the low energy electrons (< 0.7 mev) were much more abundant than in the third case. The mica foil in front of the counter was 0.3 cm air equivalent and the absorption and scattering due to this foil can be neglected when the energy of electrons is larger than 0.1 mev (~1000 keV). The effect of the scattering in the source itself is very difficult to estimate. But it must be very small for the electrons of energy above 0.1 mev, as the thickness of the soot layer was very thin. This effect together with the effect of scattering from the polystyrol film and walls of the spectrometer will make the number of electron of lower energy somewhat (not larger than 4%) larger. The decay of activity during the measurement was corrected by assuming the half value period of $^{13}$N to be 10.30 min.

The curve I of Fig. 1 shows the energy spectrum obtained with polystyrol film as source holder. The inspection upper limit of the spectrum was 1.20 mev, while that