physiological explanation of the scintillation of stars appears to account for all the observed facts, it does not rule out the possibility that in certain circumstances physical variations may also occur. These, however, are not likely to be present with purely local sources such as those used in our experiments.

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Inelastic Scattering of Deuterons

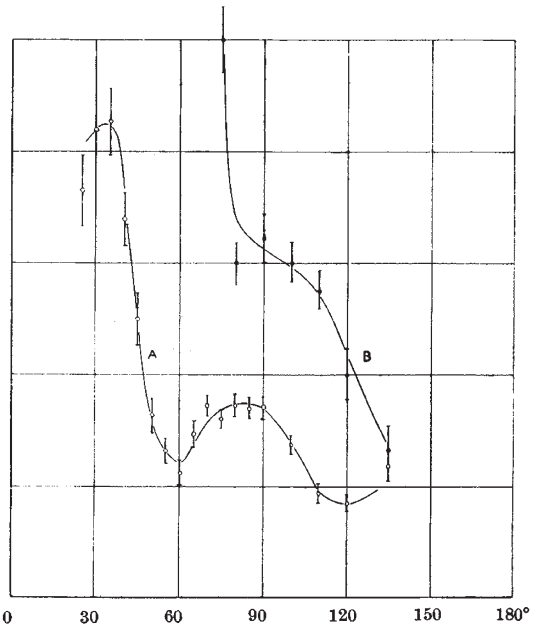
IN a recent communication, Greenlees, Kempton and Rhoderick[1] report observations which indicate that deuterons may be inelastically scattered by nuclei of magnesium and aluminium. We have independently reached a similar conclusion as a result of experiments in which a homogeneous beam of 7·5-MeV. deuterons from the Liverpool cyclotron were the bombarding particles.

In our apparatus the particles emitted from the target at angles within the range 25–145°, measured from the direction of the incident beam of deuterons, can be detected by means of a differential ionization chamber. Protons and deuterons near the end of their range give rise to pulses in this chamber which are different in size. By adjusting the biasing voltage of the pulse amplitude discriminator, it is possible to tell which peaks in the range spectrum of the particles are due to protons and which to deuterons. For example, an increase in the biasing voltage sufficient to reduce the height of a deuteron peak to one-half will reduce the height of a proton peak to one-thirtieth.

In this way, we were able to show that two prominent peaks in the spectrum from aluminium and one in that from magnesium are due to deuterons of smaller energy than that of the elastically scattered deuterons. As a check on this conclusion, we measured the decrease in the range of these groups of particles when the energy of the incident beam was decreased by a known amount. The decrease would be greater for a proton group than for a deuteron group of the same range. The measured decreases were, in fact, consistent with the particles being deuterons.

The energies of the nuclei excited in the inelastic scattering processes have been calculated from the range of the particles scattered elastically and inelastically. The excitation energies are found to be 0·99 ± 0·05 and 2·17 ± 0·05 MeV. in the case of aluminium, and 1·36 ± 0·05 MeV. in the case of magnesium. These figures are consistent with the values obtained by the workers at Cambridge. The deuteron peak corresponding to the 0·99-MeV. level in aluminium has a width greater by about 50 per cent than that of the 2·17-MeV. level. This probably indicates the excitation of more than one level at an energy of about 1 MeV. in the aluminium nucleus, in agreement with observations by Rhoderick[2] on the inelastic scattering of protons.

The formulation of a theory of the inelastic scattering process of deuterons will be aided by a knowledge of the way in which the nuclear cross-section for this process changes with the angle of scattering. Accordingly, we have measured the intensity of the groups of inelastically scattered deuterons from aluminium and magnesium in the range of scattering angles from 25° to 135°. The results for magnesium are displayed on curve *A* in the diagram. The vertical scale is proportional to the number of inelastically scattered deuterons leaving the target within a fixed solid angle; the mean angle of scattering is measured in the laboratory system. At each angle the counter accepts particles emitted within 3° around the mean value; the angular divergence of the incident beam itself is negligibly small. Curve *B* in the diagram shows, in the same way, the variation in the intensity of the elastically scattered deuterons from magnesium, the vertical scale being the same as for curve *A*.



Angular variation of intensity of deuterons scattered inelastically (curve *A*) and elastically (curve *B*) from magnesium

We have also made a search for deuterons inelastically scattered from targets of carbon, nickel and gold. With carbon no groups of such particles could be detected below an excitation energy of 1·9 MeV. A group having an intensity greater than 2 per cent of that of the elastically scattered deuterons at a scattering angle of 90° could have been detected. In the case of gold, no group having intensity greater than 0·5 per cent of that of the elastic peak at a scattering angle of 90° could be detected for excitation energy less than 2·9 MeV. The spectrum of the range of particles from the nickel target at 90° shows a small deuteron peak having an intensity about 2 per cent of that of the elastically scattered group. The corresponding excitation energy is 0·82 ± 0·05 MeV.

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