LETTERS TO THE EDITORS

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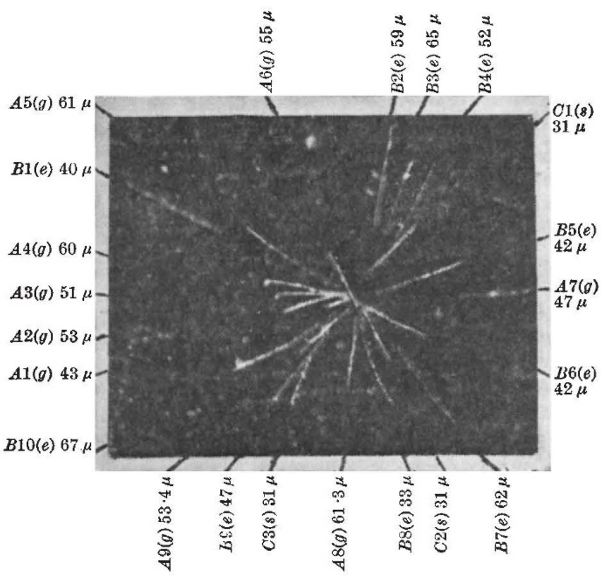
Nuclear Explosion Recorded by Photographic Emulsion Method

THE existence of multiple disintegration produced by cosmic rays in photographic emulsion has been recorded by Perkins[1] and by Occhialini and Powell[2]. These multiple disintegrations, recorded at high altitudes, were attributed to slow mesons and resulted in the emission of protons and α-particles. This phenomenon of multiple disintegration by the capture of a slow meson was also noted at sea-level by Evans and Griffiths[3].

Recently we have recorded a nuclear burst caused by cosmic rays at sea-level. In our experiment the photographic emulsion used was of thickness 40 μ (type Ilford *C*.2), and in order to avoid radioactive contamination the plates were covered with a mica sheet of 4 cm. air-equivalent. The plates were exposed for three days. In one of them we observed a case in which 22 particles were ejected in various directions in the form of a star. The accompanying figure shows the photograph of the star, taken after reprojection on the screen. From a study of the number of grains per division, it seems probable that all the tracks are due to protons. Examination of the tracks under a microscope revealed that the star originated in the mica, and the fact that some of the tracks are somewhat apart from the rest is explained by this, since most travelled directly to the plate, while these few entered laterally.



To facilitate the study of the tracks the notation given by Powell and Occhialini[4] has been used. Those tracks which pass into the glass have been denoted by $A(g)$, those which stop in the emulsion by $B(e)$, and those which leave the surface of the emulsion by $C(s)$.

It is difficult to determine the energies of the particles which pass into the glass, or of those which leave the surface of the emulsion. However, from the grain-spacing along the length of the tracks, a rough estimate has been made that the energies of the particles from $A1(g)$ to $A9(g)$ (that is, those passing into the glass) lie between 3 and 10 MeV. Those from $C1(s)$ to $C3(s)$ (that is, those leaving the surface of the emulsion) lie between 3 and 12 MeV. The energies of those particles which remain in the emulsion—$B1(e)$ to $B10(e)$—have been calculated as lying between 3 and 5 MeV.

Since the burst occurred in the mica sheet, it is, in the first place, not possible to state which component of the cosmic radiation caused this phenomenon; it may, however, be due to a slow meson, as mesons constitute a large component of the cosmic radiation at sea-level. In the second place, it is probable that not all the protons have been registered in the emulsion. Consequently, it is not possible to define the nature of the disintegrated nucleus. However, if it is assumed that all the protons have been recorded, the nucleus is titanium, in which there are 26 neutrons. Hence, even the minimum energy involved in this reaction is of the order of 250 MeV.

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[1] Perkins, D. H., *Nature*, **159**, 126 (1947).
[2] Occhialini, G. P. S., and Powell, C. F., *Nature*, **159**, 186 (1947).
[3] Evans, G. R., and Griffiths, C. G., *Nature*, **159**, 879 (1947).
[4] Powell, C. F., and Occhialini, G. P. S., *Nature*, **159**, 93 (1947).

Gamma-Ray Yield Curves of Separated Neon Isotopes Bombarded with Protons

THE fact that only very small amounts of materials are required in studies of the resonance capture of protons in the lighter elements invites attempts to prepare targets by means of ion beams. In this manner it is possible to investigate substances, such as inert gases, otherwise unsuited as target material, and in addition it is possible to study samples of separated isotopes.

With the mass spectrograph at this Institute[1], neon targets have been prepared by bombarding silver disks with beams of the different isotopes. At the high energy of 60 keV. of the ions and at the currents (70 micro-amp. for ^{20}Ne) used in the experiments, it was possible to collect sufficient neon in the surface layer of a thickness of about one hundred atomic diameters, in which the ions according to theory[2] will be stopped. The targets proved to be fairly stable, no change being detectable after storage for several weeks. They were also able to withstand heating to 200° C. for one hour; but heating to 350° C. destroyed them in less than 20 minutes. Under the bombardment of the 1–3 micro-amp. proton beam they were worn out in a few hours.

The techniques of proton bombardment and gamma-ray detection were the same as those used in an earlier investigation of aluminium resonances[3]. Saturation intensities of gamma-rays were obtained with targets which had received about 10 millicoulombs of neon ions per cm.^{2}, corresponding to 2 micrograms per cm.^{2}. Such targets showed a bluish tinge where they were hit by the neon beam. If all the neon is still present in the target, the stopping power of the neon layer is approximately