over a long period of time so that it is of little value for this purpose.

We have been able to differentiate between tracks emitted during separate time intervals (24 hours) using double development of the emulsion. This method enables us to distinguish according to the degree of development the heavy tracks of alpha-particles recorded before the first (full) development from the finer ones, which were emitted during the time elapsed between the first and second (partial) development.

In our experiments we deposited a fine suspension of Io (Th^{230}) in water on the surface of a Ilford C 2 emulsion. After 24 hours the plate was developed in the usual manner for ten minutes, washed, and dried without being fixed. After another 24 hours the plate was developed a second time but only for 2 minutes in the same (ID-19) developer and then treated with acetic acid and fixed. Many aggregates of alpha-tracks (such as those shown on Fig. 1) can be observed, in which two sorts (roughly equal in number) are clearly discernible. Heavy tracks in these aggregates were emitted during the first day and revealed by the first development. Thin tracks from the second development (recorded during the second day) appear to have smaller grain size but there is no reduced grain density along the tracks. We think that with proper procedures three or more developments could be used for various purposes and when temperature development is[1] applied, the time intervals between each development could be reduced, if desirable, to a few minutes.

[1] Dilworth, Occhialini, and Payne, Nature 162, 102 (1948).

Internal Conversion Electrons and Other Radiations from Cl^{34}

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THE radiations emitted by Cl^{34} have been investigated in a large magnetic lens spectrometer similar to that of Hornyak *et al.*[1] The spectrometer has been calibrated with the 623.9-kev conversion electrons of Ba^{137} and its linearity checked with other sources.

The spectrum of the 33-min. Cl^{34} has been investigated by Zah Wei-Ho[2] using a cloud chamber. His results indicated a gamma-ray of 3.4 Mev and two groups of positrons with maximum energies of 5.1 and 2.4 Mev.

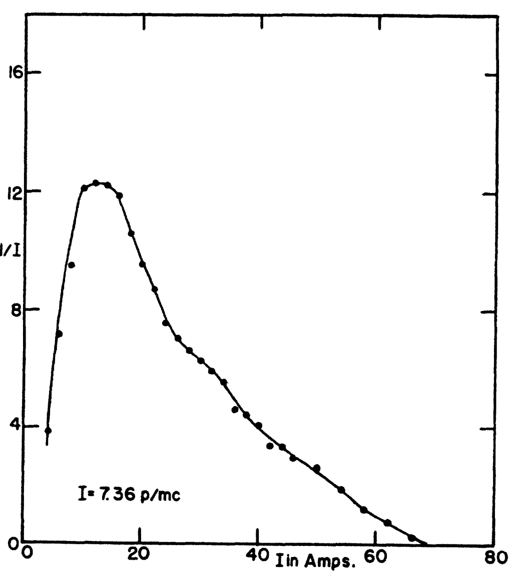

FIG. 1. The positron spectrum from Cl^{34}. The Kurie plot of this spectrum separates into three groups with upper limits at 4.55 Mev, 2.6 Mev, and 1.3 Mev.

We produced the Cl^{34} activity by bombarding NaCl with 18-Mev protons from the U.C.L.A. cyclotron according to the reaction $Cl^{35}(p,pn)Cl^{34}$. The activity was also produced by bombarding sulfur, giving the reaction $S^{34}(p,n)Cl^{34}$.

Our results on the positron spectrum indicate that it is complex (Fig. 1). The Kurie plot is consistent with the presence of three components. The end point of the most energetic component can easily be evaluated at 4.55±0.11 Mev. The other two components separate out of the Kurie plot at 2.58±0.26 Mev and 1.3±0.2 Mev. We tend to believe in the validity of this separation because of the supporting evidence of the gamma-radiation.

Internal conversion electrons at 142±3 kev from a previously unreported gamma-ray have been found as shown in Fig. 2. The

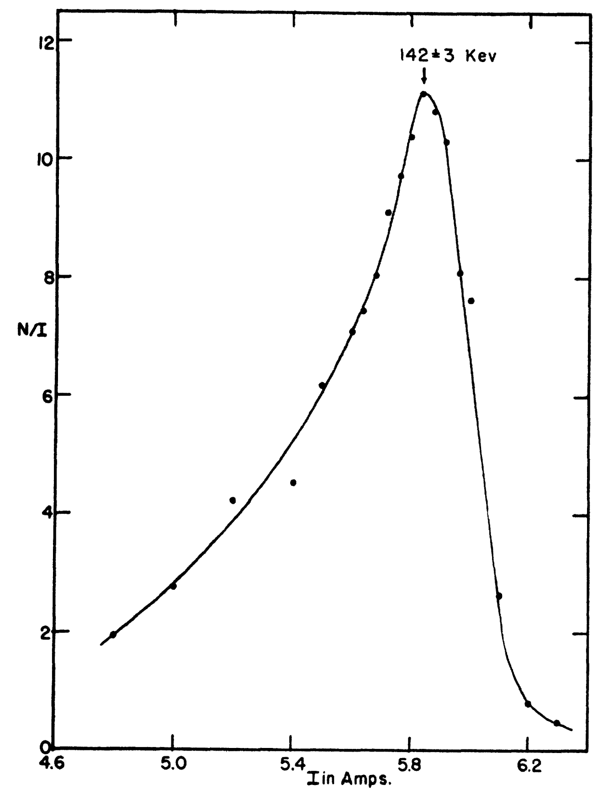

FIG. 2. The internal conversion electrons associated with Cl^{34}. This group corresponds to a gamma-ray of energy 0.145 Mev.

line is broadened by the size of the NaCl crystals. The decay of this line has been followed for three half-lives in the spectrometer to verify its origin in the Cl^{34} activity. The ratio of positrons to conversion electrons is 17 to 1. This gamma-ray is not entirely internally converted as seen from the appearance of an L conversion peak in the photo-electron spectrum from a thorium radiator. The energy of this peak is consistent with a gamma-ray of energy 145 kev.

The Cl^{34} high energy Compton spectrum has an inflection point at 3.06±0.13 Mev corresponding to a gamma-ray of energy 3.30±0.14 Mev and an inflection point at 1.90±0.12 corresponding to a gamma-ray of energy 2.13±0.12 Mev. The general features of the probable energy level diagram are obvious from the numbers involved, but they have not yet been verified by coincidence counting. The place of the 145-kev gamma-ray in the scheme has not been uniquely determined.

* This work was assisted by the joint program of the ONR and AEC.
[1] Hornyak, Lauritsen, and Rasmussen, Phys. Rev. 76, 731 (1949).
[2] Zah Wei-Ho, Phys. Rev. 70, 782 (1946).