When magnesium of commercial purity is bombarded with 16-Mev α-particles both negative and positive electrons are observed. The latter show a half-life of 4.0 hours and are due to a calcium impurity. The sign of the charge was determined by magnetic resolution using a counter as a detector. With a source of very pure magnesium no positive electrons are observed by this method. The decay curve of the negative emission is similar to that for the total emission and shows the two periods of 2.3 and 6.4 min.

Photographs have been taken in a Wilson cloud chamber beginning 30 minutes after bombardment. At this time the intensity of the 2.3-min. activity is less than 1 percent of the total intensity. A series of 100 photographs taken after this time show that the electrons emitted by the 6.4-min. body are predominantly negative. However, several positive electrons were observed coming from the source. Out of a total of 748 tracks there were 22 positives. The positives were equally numerous at the beginning and end of the run, while the negative emission decreased by a factor of eight. They, therefore, seem to decay with a much longer period than 6.4 min. and may probably be due to a very small calcium impurity in the magnesium. Calculating from the known intensity of a pure calcium target, it turns out that one part in 5000 calcium impurity in the magnesium target would give rise to the observed number of positives.

The new assignment solves all the difficulties mentioned above. The actual Si^{27} has been produced by Kuerti and Van Voorhis[7] since these experiments were begun. Kuerti and Van Voorhis find that Si^{27} is produced by the reaction Al^{27} (p, n) Si^{27} and has a half-life of 3.7 seconds which agrees with the expectation from analogous nuclei (paragraph 2 above).

Measurements of the curvature of 314 tracks of the negative electrons give a rough energy distribution and show that the upper limit of the spectrum is about 2.5 Mev. An absorption curve of the β-rays in aluminum gives an absorption coefficient $\mu/\rho = 5.3$ and a range for the β-rays of 1.10 g/cm². These are consistent with the above value for the upper limit. The γ-rays, if any, associated with the 6.4-min. period are very weak; no ionization could be detected in the electroscope when the aluminum absorber had a thickness corresponding to 1.10 g/cm². With the mass of Si^{29} given in reference 5, the mass of Al^{29} is 28.9893 which fits in well with the masses of the neighboring elements.

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A Study of the Protons from Calcium under Deuteron Bombardment

Targets of CaO have been bombarded by 3.1-Mev deuterons from a cyclotron. Fig. 1 shows an absorption plot of the protons from both a thick and thin target, observation being made at right angles to the incident deuteron beam. Since protons from the reaction O(dp) have a range of only 27 cm the groups at 66 cm and 96 cm corresponding to "Q" values of 4.51 Mev and 6.30 Mev must be attributed to Ca(dp). The 66-cm group is considerably more intense than the corresponding yield from Sc(dp). Sc has only a single stable isotope. Since the element calcium is predominantly Ca^{40} (96.76 percent), one can almost certainly attribute this group to the reaction

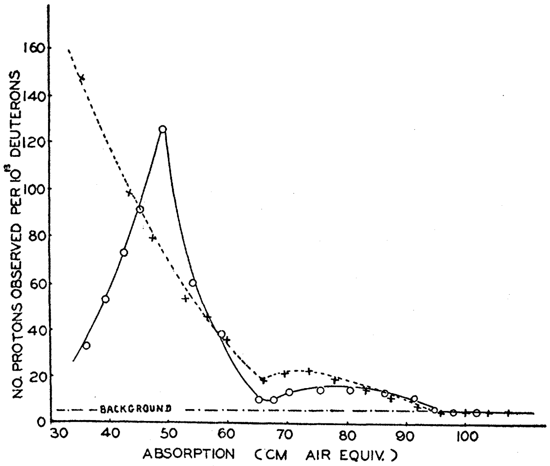

FIG. 1. Absorption plot of the protons from $CaO + H^2$. Circles refer to thin target yields; crosses to yields from a thick target. The abundant O(dp) group at 27 cm is not included.

$$Ca^{40} + H^2 \rightarrow Ca^{41} + H^1,$$

giving positive evidence for the actual formation of Ca^{41}. Walke[1] has searched unsuccessfully for the radioactivity resulting from such an isotope. Thus one can conclude that Ca^{41} is either stable or else its half-life must be very short or very long. The former view seems untenable both from the result of Nier's[2] work which places an upper limit of $Ca^{41}/Ca^{40} = 1/150{,}000$ and from the fact that adjoining stable isobars are extremely rare. Another possibility is that Ca^{41} may decay to K^{41} via K-electron capture. Such a possibility might explain why its activity was not observed, since the soft x-radiation may have been masked by the electrons from Ca^{45}.

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