automatic recorders for various types of service. The gaseous discharge lamp¹ gives a positive indication of very weak echoes which are far below the static level. When used under such extreme conditions, the photographic trace shows a series of black echo lines on a dark grey mottled background.

Although it is not yet certain that the refracting regions are directly overhead, it is convenient to describe the experimental results by a tentative classification into 'G reflections' and 'H reflections'.

The G reflections are much weaker than the F reflections. They produce a broad diffuse turbulent trace with a sharply defined lower boundary which normally remains relatively constant from midnight to sunrise. At this geographical location the boundary commonly has an effective height of approximately 600 km. It is ordinarily observed whenever the F region is completely penetrable, but it is also frequently present in combination with the various F components.

On different occasions the H reflections have returned from various effective heights ranging from 1,100 km. to 1,800 km. During a single observation the reflection often remains comparatively steady in signal strength and position for a period of six hours or more. The signals are weak but sharply defined, and the photographic traces are quite different in appearance from those produced by the G reflections. A slow steady downward drift has sometimes been observed from midnight to sunrise. On a number of occasions the 'H layer' has been recorded in the evening hours while lower layers have been present. G and H layers may be observed at points very close to the transmitter as well as at a distance. The seasonal variation is not yet certain.

The early experiments were made in collaboration with Dr. Pao H. Wang. Mr. Paul B. King has obtained a large part of the recent data.

HARRY ROWE MIMNO.

Harvard University,
Cambridge, Massachusetts.
May 14.

¹ H. R. Mimno and P. H. Wang, *Proc. Institute of Radio Engineers*, 21, 529; 1933.

Induced Radioactivity and Transmutation

WITH reference to Fermi's work¹ on the bombardment of elements with neutrons and the production of β -rays, we suggest that the bombardment produces unstable and missing isotopes containing α -particles, a dipton and neutrons. Thus with aluminium the transmutation would be as follows:

The missing isotope ${}_{13}\text{Al}^{28}$ is unstable, disintegrating thus:

to form the next stable α -particle configuration ${}_{14}\text{Si}^{28} [7\alpha]$. Similarly for chlorine:

and the latter being unstable and a missing isotope, we have:

as observed by Fermi. In addition ${}_{17}\text{Cl}^{37}$ may be spontaneously radioactive:

and although such spontaneous radioactivity has not yet been observed, it does occur with potassium. In the case of magnesium—an isotope of even atomic number—

so that β -rays would be emitted as found by Fermi.

Similarly, with silicon,

Then with phosphorus ${}_{15}\text{P}^{31} [7\alpha + D + n] + n \rightarrow {}_{14}\text{Si}^{31} [7\alpha + 3n] + \text{proton}$ and ${}_{14}\text{Si}^{31} [7\alpha + 3n] (\text{unstable}) \rightarrow {}_{15}\text{P}^{31} [7\alpha + D + n] + \beta$. These transmutations agree with Fermi's observation that phosphorus bombarded with neutrons emits protons and electrons, the unstable silicon isotope returning to the original isotope ${}_{15}\text{P}^{31}$.

According to our theory of nuclear structure, a full account of which will be published shortly, missing isotopes are unstable, emitting either an electron or a positron. The theory also predicts stable but at present missing isotopes such as ${}_{18}\text{Ar}^{37}$ and ${}_{18}\text{Ar}^{38}$.

F. H. NEWMAN.

H. J. WALKER.

Physics Department,
University College,
Exeter.
June 8.

¹ NATURE, 133, 757, May 19, 1934.

Induced Radioactivity of Potassium

I HAVE bombarded potassium chloride with the α -rays of radium C of 55 mm. effective range and found that it acquires a greater radioactivity than that due to the natural activity of potassium. The effect is due to potassium, because no similar effect was exhibited by sodium chloride irradiated in the same conditions. In order to measure exactly the amount of induced radioactivity, all counting experiments were done by taking the difference between the number of impulses due to two identical samples of potassium chloride, one of which has been irradiated.

Irradiating potassium chloride for 12 hours with 30 millicuries of radon, I have found that the corrected initial activity amounts to about 50 impulses per minute, while the non-irradiated sample gave an effect of 17 impulses per minute. The induced activity decays exponentially with a half-period of 3 hours. I have found that the radiation consists of positrons and is completely absorbed by a sheet of lead of 0.27 gm./cm.². No positron emission takes place when the range of α -rays is reduced to 45 mm.

The probable reactions are:

- (1) ${}_{19}\text{K}^{41} + {}_2\text{He}^4 = {}_{21}\text{Sc}^{44} + \text{neutron};$
- (2) ${}_{21}\text{Sc}^{44} = {}_{20}\text{Ca}^{44} + \text{positron}$

or analogous reactions due to the 39 potassium isotope.

In order to test this possibility, I have tried to separate chemically the assumed scandium isotope, with the help of Mr. A. Wronberg, to whom my best thanks are due. Irradiated potassium chloride was