probability that a deuton will disintegrate the Be nucleus on collision is independent of deuton energy over the observed range and that the increase in yield of neutrons with deuton range is due only to the increase of the frequency with which deutons make nuclear collisions.

It is hardly necessary to emphasize the importance of this disintegration process as a source of neutrons for nuclear research. Though the rate of production of neutrons in the present experiments exceeds considerably that of any heretofore used radioactive source, we intend to increase our deuton current to 10^{-6} amp. and thereby increase this neutron yield a hundred-fold.

Again we acknowledge our indebtedness to Professor G. N. Lewis for furnishing deuterium, to Commander T. Lucci for his assistance, and to the University Research Board, the Research Corporation and the Chemical Foundation for their financial support.

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Malcolm C. Henderson
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Radiation Laboratory,
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October 7, 1933.

An Unusual Nitrogen Tube

Further study of the unusual nitrogen discharge described last December,[1] has led to a great improvement of the tube. In the present tube, the first negative bands are much more intense in relation to the first positive bands than they were last year. At least twelve new members of the Lyman bands of nitrogen have been discovered in this tube showing that one of the properties of the tube is a remarkable enhancement of very high vibrational levels. The Lyman bands, it may be recalled, are the $a^1\pi \rightarrow X^1\Sigma$ bands of N_2. High vibrational levels of the $B^3\pi$ level are also enhanced, and the first positive bands arising on these are present in the spectrum with a far greater relative intensity than in ordinary tubes. One of the most striking characteristics of the tube is a strong nitrogen afterglow in which bands arising on the very high vibrational states of the $B^3\pi$ level have been visually observed. The heretofore reported afterglows in nitrogen consist of bands chiefly from the B_{10}, B_{11} and B_{12} levels. Visual observation indicates that in this new afterglow, strong bands appear which originate on levels around B_{18}. Since no photographs of the afterglow have been obtained so far, the actual origin of these new bands is not accurately known. It is certain, however, that the afterglow is considerably different from the heretofore reported afterglows of nitrogen. This tube also has characteristics which are of value in auroral studies, but these will be discussed in a more detailed communication.

Joseph Kaplan
University of California at Los Angeles,
October 9, 1933.

[1] Kaplan, Phys. Rev. **42**, 807 (1932).

On the Production of Neutrons from Lithium

It was mentioned in a previous letter to the *Physical Review*[1] that lithium, when bombarded with protons gave a measurable intensity of neutrons. The effect has since been investigated further, and a curve plotted of the yield of neutrons as a function of voltage from 400,000 to 800,000 volts, with an ion current of 20 microamperes. As in the previous measurements of neutrons, an electroscope, the inner walls of which were coated with paraffin, was used as a detecting device. The electroscope was enclosed in a lead cylinder with 5 cm walls, through which the neutrons were obliged to pass. To determine whether the effect observed was due to neutrons or to γ-rays, a measurement was made with the paraffin removed from the electroscope. The deflection without the paraffin was less than half the deflection with the paraffin, indicating that the greater part of the effect was due to recoil hydrogen particles ejected from the paraffin by neutrons. The effect observed without the paraffin is not to be attributed entirely to γ-rays, because the neutrons are capable of producing some ionization by means of recoil oxygen and nitrogen atoms produced in the air in the chamber.

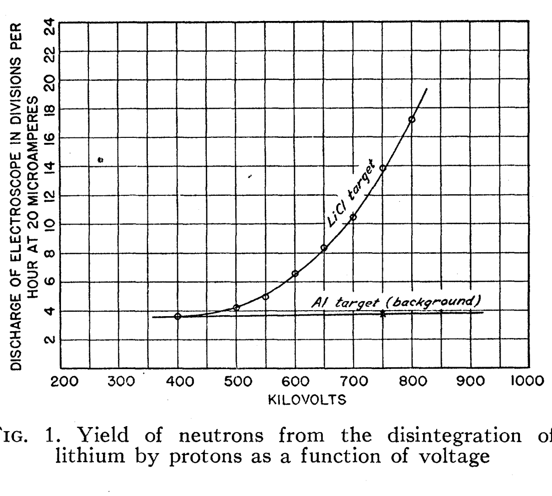

Fig. 1. Yield of neutrons from the disintegration of lithium by protons as a function of voltage

No simple and plausible reaction, which gives a neutron from lithium and a proton, suggests itself, so we have considered a double reaction in which the α-particles produced by protons and Li^7 in turn bombard Li^7 with the production of neutrons.

$$Li^7 + H^1 \rightarrow 2He^4 (+17 \times 10^6 \text{ e.v.}) \quad (1)$$

$$Li^7 + He^4 \rightarrow B^{10} + n^1 (-3 \times 10^6 \text{ e.v.}). \quad (2)$$

The first of these reactions is well known from the work of

[1] Crane, Lauritsen and Soltan, *Production of Neutrons by High Speed Deutons*, Phys. Rev. **44**, 692 (1933).