for their interest and help, to Drs. R. L. Thornton, H. L. Crane, S. A. Goudsmit, J. Turin, D. S. Bayley, and to Mr. W. C. Parkinson and others. Finally we gratefully acknowledge support from the Horace H. Rackham School of Graduate Studies of the University of Michigan.

C. T. ZAHN
A. H. SPEES

Physics Department,
University of Michigan,
Ann Arbor, Michigan,
August 6, 1937.

[1] See reference to Crane's report on the possible difference between nuclear beta-particles and electrons, G. Breit, Third Washington Conference on Theoretical Physics, Rev. Sci. Inst. **8**, 141 (1937).

Further Search for Transmutations with Possible Emission of Negative Protons

I have been privileged to use the Berkeley cyclotron, to try again[1] to detect reactions in which there could be a chance of a negative proton being ejected during the transmutation.

The existence of the negative proton has been shown by G. Gamow[2] to be not impossible. In fact, Dirac's equation, being valid only for elementary particles of radius smaller than h/mc, does not apply to the proton whose radius is of the same order of magnitude as is its de Broglie wave-length (1.3×10^{-13} cm). Thus, no analogy to the "hole" positron theory is here required and therefore the proton—positive or negative—can be imagined as being a complex particle (neutron+positron+anti-neutrino, or, neutron +electron+neutrino).[3] Furthermore the existence of the negative proton would tentatively explain the possibility of the formation of isomeric nuclei such as: *UX*2 and *UZ*, Pb^{210}(?) and RaD, Br^{80} (18 min. and 4.2 hr.).[4] Attempts by various workers to detect the negative proton in a Wilson chamber having failed, and no evidence[5] having been found yet in any of the cosmic-ray tracks, I have looked for some process in which the detection of the negative proton was not essential to prove its existence. Radioelements such as those formed according to the schematic reaction:

$$_ZX^M+{}_0n^I\rightarrow{}_{Z+I}Y^M+{}_{-I}H^I;\quad {}_{Z+I}Y^M\rightarrow e_++{}_ZX^M \qquad (1)$$

if detected would give some support to the possible existence of the negative proton. The element bombarded should be of high isotopic content, and should not give any other positronic radioelement whose lifetime is comparable to the one looked for. The lifetime of $_{Z+I}Y^M$ should be very well established by means of a different nuclear reaction, and not be too short, so that chemical separation could be possible. Those conditions and energetic considerations lead to a very restricted choice of possible radioelements. Thus radiocarbon (C^{11}, 21.3 min.) radioaluminum (Al^{26}, 7 sec.) or radiosilicon (Si^{27}, 2.6 min.) are favorable cases.

Attempts to detect C^{11} and Si^{27} after bombardment of boron and aluminum with fast neutrons (deuterons of about 7 Mev on Be or Li targets) have completely failed to show any activity with a thin Geiger-Müller counter, or any track in a Wilson chamber, which could not be traced to an impurity or a contamination.

The disintegration cross section for reaction (1) is therefore found to be smaller than 10^{-27} cm^2.

It is a pleasure to acknowledge my indebtedness to Professor E. O. Lawrence, Dr. D. Cooksey and co-workers for their friendly hospitality.

M. E. NAHMIAS*

Radiation Laboratory,
University of California,
Berkeley, California,
August 7, 1937.

[1] M. E. Nahmias and R. J. Walen, J. de phys., April 1937, p. 159.
[2] *Atomic Nuclei* (1937), p. 14.
[3] J. Solomon, J. de phys., May 1937, p. 182.
[4] A. H. Snell, unpublished.
[5] J. Crussard and L. Leprince-Ringuet, J. de phys., May 1937, p. 216.
* Rockefeller Fellow.

Grating Space of Barium-Copper-Stearate Films

We have recently shown[1] that films of barium stearate built according to the method of Dr. Katharine Blodgett[2] give sharp x-ray diffraction. A preliminary determination made by one of us[3] of the grating-space of several barium-copper-stearate films indicated fairly good agreement between x-ray measurements and measurements made with an interferometer from films of known numbers of layers. A more thorough investigation of these films now discloses the fact that the x-ray and optical measurements do not agree.

Interferometer measurements give 48.40A for the mean thickness of the double-layers of stearates deposited on glass. X-ray measurements, based upon the crystal wave-length[4] of 1.47336A for the tungsten $L\alpha_1$ line, give 50.31A for the grating-space of the films for an infinite order. With Bearden's[5] weighted average of 1.00248 as the ratio between ruled-grating and crystal wave-length values, the grating-space of the films in terms of the ruled-grating scale is found to be 50.43×10^{-8} cm. The observed position of the $M\alpha$ line is also consistent with these values for the grating-space. The values given are corrected for the refraction of the x-rays, our experiments giving a unit decrement of 5.4×10^{-6} for the $L\alpha_1$ line of tungsten.

We find also that the films designated by Dr. Blodgett as *X* films,[6] have approximately the same x-ray grating-space as do the *Y* films. The similarity in structure of the *X* and *Y* types of films and the lack of agreement between the x-ray and optical measurements of the grating-space, are difficult to reconcile with the idea that the crystalline structure of the films used in these experiments is imparted to them by the dipping process used in their construction.

A detailed report of the work will be given at a later date.

CLIFFORD HOLLEY
SEYMOUR BERNSTEIN

Ryerson Physical Laboratory,
University of Chicago,
Chicago, Illinois,
August 4, 1937.

[1] Clifford Holley and Seymour Bernstein, Phys. Rev. **49**, 403 (1936).
[2] Katharine B. Blodgett, J. Am. Chem. Soc. **57**, 1007 (1935).
[3] Clifford Holley, Phys. Rev. **51**, 1000 (1937).
[4] M. Siegbahn, *Spektroskopie der Röntgenstrahlen*, second edition (1931), p. 237.
[5] J. A. Bearden, Phys. Rev. **48**, 385 (1935).
[6] Blodgett, reference 2, p. 1011.