coincidences with the linear coincidences at various angles from the vertical. Such evidence is much less direct than the evidence for the ionizing character of the primary rays present at lesser depths that is presented in this report. Nevertheless, the three experiments support the original hypothesis that the first group consists of "heavy electrons" and the second of "neutrinos." It is felt that more work should be done along this line and plans have been made to repeat the above experiment at other depths.

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May 2, 1938.

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On the Structure of "Built-Up" Films on Metals

Holley has described[1,2] some x-ray and optical measurements on barium stearate and barium-copper stearate films. At the request of Professor Rideal and Dr. Bikerman I have examined some barium stearate films of the X type[3] with the use of the same apparatus that was employed in the study of the long spacings of tobacco mosaic virus protein.[4,5] This consisted essentially of a "condensing" monochromator[6] and a slit system to isolate the $K\alpha$ component of the reflected radiation. The measurements were made in air, with copper $K\alpha$ radiation ($\lambda = 1.539$A) and the distance from the specimen to the photographic film was up to 40 cm. It is quite unnecessary to employ vacuum cameras for long spacing measurements with monochromatic radiation. Fig. 1 shows 5 orders of the Bragg reflec-

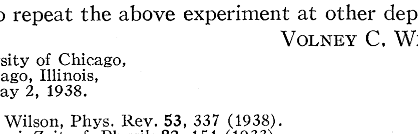

FIG. 1. Five orders of Bragg reflections from barium stearate multilayers. $\lambda = 1.539$, specimen to film distance 20.1 cm.

tions from 100 X layers of barium stearate rolled continuously on to a chromium plated ring 7.5 cm in diameter. (See following letter.) This gives a value of 51.5 ± 0.5A for the grating spacing. This agrees with Dr. Holley's results for X type films in giving an x-ray spacing similar to that of the Y films and to those obtained in the crystal. A 95 layer X type calcium stearate specimen gave a pattern which was substantially identical with the barium stearate insofar as intensities and spacing were concerned. The very long angle diffuse scattering is caused by the specular reflection of the x-rays by the chromium.

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On the Structure of "Built-Up" Films on Metals

The results of Fankuchen,[1] as well as those of Holley and Bernstein,[2] and of Holley,[3] which show the identity of the spacings in X and Y films, presumably admit of a simple explanation. The primary difference between X and Y films lies in the manner of their formation (Blodgett[4]); that they—even after the preparation—have different properties was first demonstrated by E. F. Porter and J. Wyman,[5] who have found that an X film affects the potential of the underlying metal much more strongly than a Y film of the same thickness. We are able to confirm (qualitatively) Porter's and Wyman's results although we have measured the potentials in a different manner. We have measured by a compensation method the potential difference in air between a radioactive needle and a metal slip coated with the multilayer. In addition we have found that the originally high potentials of X films gradually decay, and that the rate of decay is greatly accelerated by irradiation with x-rays or with α-particles of Po. The influence of the x-rays is complex since they also cause an electron emission from the multilayer; and we have as yet been unable to separate quantitatively both effects. At any rate, even after allowance for the photoelectric effect, the fact remains that the X films change their electric properties when irradiated by x-rays and that the direction of the change would correspond with the transformation of X into Y films. It is therefore certain that patterns produced by irradiation of X films are those of *transformed X* films, and it is not improbable that the transformed X films have the molecular arrangement of the Y films. Then the agreement between the spacings of the transformed X films and the Y films would be self-explanatory.

The barium stearate film measured by Fankuchen has been produced with a new technique. Instead of metal strips which are dipped in, and withdrawn from, the solution[4] we have used a metal ring (short cylinder) suspended by and rotating round a horizontal axis. About one-third was immersed in the solution. When the surface of the solution was covered with a monolayer on both sides of the ring, the ring after a complete rotation was coated by one "Y film." But, when the contaminated surface was separated from the clean surface by a floating barrier which was placed inside the ring, it was possible to let the ring go downwards through a monolayer and upwards through the clean water surface, so that the film was only picked up on the downwards journey similar to the usual X films technique. The film measured by Fankuchen consisted of 100 such "artificial X films." By placing the floating barrier inside the ring and covering the surface to the right and to the left side of the barrier with different monolayers, it is hoped that a complete rotation of the ring may produce a mixed film two molecules thick or a penetrated mixed monolayer.

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Colloid Science Department,
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May 6, 1938.

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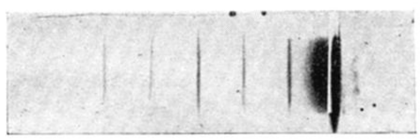

FIG. 1. Five orders of Bragg reflections from barium stearate multilayers. $\lambda = 1.539$, specimen to film distance 20.1 cm.