Fig. 2 represent the $(h00)$ cross-section through a thin crystal. Then the points of the corresponding cross-grating are also the projections of infinitely long atom rows, and the lattice extends virtually to infinity in the $(00l)$ plane dimensions, but is strictly limited in the l axis direction by the thickness of the crystal, in this case taken as three lattice points thick by way of example. It will immediately be evident that, though the $(0k0)$ planes all contain equal numbers of lattice point rows, successive $(0kl)$ planes (where k and l are one even, one odd and $k < 3$) in general contain different numbers of lattice rows, with the result that, in the example under consideration, the effective d_{0kl} values are integral multiples of what, in the absence of limitation in the l axis direction, would have been the corresponding normal Bragg plane spacings.

FIG. 2.

We have on these lines been able to account with excellent quantitative agreement for the graphite 'extra' rings so far observed. Similarly, the banded nature of the 100-101 group can be reasonably explained in terms of this new effect.

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Production of Positrons by β -Rays

In an earlier communication¹ it was shown that the passage of β -rays through matter is accompanied by the emission of positrons. Since this is quite inconsistent with present theory, further confirmation was clearly necessary by a more direct method. Investigations were accordingly carried out with a beam of fast β -rays from a radioactive source (3-5 mc. of radium bromide) placed outside the expansion chamber at a distance of about 30 cm.

A beam of β -rays, passing through a slit and deflected through an angle of 90° by a small electromagnet, entered the chamber through an aluminium window, after which it passed through various screens inside the chamber. The latter was protected from the γ -radiation of the source by a 15 cm. layer of lead. The velocities of the β -rays obtained in this way were mostly greater than 2,000 ekv. Screens of aluminium (0.5 and 1 mm. thick) or lead (0.07 and

0.13 mm.) were placed at right angles to the rays, as well as in certain cases a glass plate at an angle of 45° .

FIG. 1.

With the above arrangement, the formation of 'pairs' could be observed directly at the point of collision of the β -particle. The greatest number of 'pairs' was found in the lead (not less than 10 'pairs' in the course of 300 expansions, with 4 particles on the average emerging from the screen during one expansion). Fig. 1 is a photograph of such a 'pair' produced in lead.

In addition to the formation of 'pairs', the absorption of the primary β -particle is sometimes accompanied by the emission of a single positron. In aluminium, this is the predominating effect.

A comparatively weak magnetic field (500 gauss) was used on purpose, so that the electrons emitted by the plate should not return to it. In a field of this intensity, the tracks of the primary particles are only slightly curved and the photographs cannot be used for verifying the energy balance.

The production of positrons along the path of the β -particle in the *gas*, as has been already reported in our previous publications, was also observed in these experiments. Five positrons have been detected over a total length of 275 m. The effective cross-section in nitrogen is therefore of the order of 5×10^{-24} cm.², while according to our previous estimate the value obtained was 10^{-23} cm.².

Our results disagree with those of Alichanow² obtained by means of the electrical counting method. The percentage yield, as given previously by us, requires therefore verification. However, significant error in the order of magnitude is impossible, and Alichanow was certainly incorrect in concluding that the effective cross-section for β -rays is smaller than that for γ -radiation.

With regard to the disagreement with theory, the facts described in our previous note, as well as some experimental data which will shortly be published on the scattering of β -rays, show that the interaction between fast β -particles and the nuclear field cannot be described by any of the existing theories.

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¹ *J. de Phys.*, 6, 1 (1935).

² A. Alichanow, A. Alichanlian and M. Kozodaew, *NATURE*, 136, 719 (1935).