when the negative electron combines with the positron of the diplon. This proton with excess energy disintegrates by emitting a positron. From the reaction suggested it is expected that the positrons emitted will have definite energy and not a continuous range of energies as with the β -rays of the normal radioactive elements. The varying periods of disintegration are thought to be due to the varying nuclear fields in which the radioproton is formed.

Further, it is to be anticipated that similarly induced radioactivity will be observed with all elements which give rise to protons under α -particle bombardment. A full account of this hypothesis will be published shortly.

H. J. WALKER.

Department of Physics,
Washington Singer Laboratories,
Exeter.

¹ Curie and Joliot, *C. R.*, **198**, 254; 1934.

² Ellis and Henderson, *NATURE*, **133**, 530, April 7, 1934.

³ Wertenstein, *NATURE*, **133**, 564, April 14, 1934.

⁴ Oliphant, Harteck and Rutherford, *NATURE*, **133**, 413, March 17, 1934.

⁵ Walke, *Phil. Mag.*, in print.

⁶ Perrin, *C. R.*, **197**, 1302; 1934.

⁷ Walke, *Phil. Mag.*, **17**, 729; 1934.

Accurate Electron Diffraction Measurements

IN order to compare the diffraction pattern of a substance of unknown characteristics with that of a known material, Shishancow and Tartarinowa¹ suggest using two convex specimens mounted face to face, the two patterns being recorded simultaneously.

This method is obviously inapplicable to transmission diffraction, and in the case of diffraction at grazing incidence the defects compared with the double shutter method² will be apparent. Thus, (1) owing to the specimen shadows, the two sets of rings do not meet at a common pattern boundary, (2) the rings are not described about a common centre, (3) structural changes of a single specimen cannot be recorded under comparative conditions, and (4) since only two relatively small segments of the 'beam cylinder' are diffracted, rings corresponding to large Bragg plane spacings are obscured. (1), (2) and (4) militate directly against the attainment of accuracy, (3) precludes the application of the method to a wide range of interesting phenomena³, and (4) is conducive to error in assigning the correct crystal structure.

The hollow cylindrical type of beam employed by Shishancow and Tartarinowa and previously described by de Laszlo and Cosslett⁴, is a phenomenon well-known in high-speed cathode ray oscillography, and is often observed with a badly pitted cathode. The effect can be still further exaggerated by the use of a discharge tube of a design unsuitable for the production of the homogeneous 'solid' pencil of cathode rays employed by us in our experiments.

Other workers⁵ in this field besides ourselves have used curved surfaces, wires, fibres, etc. Where possible, however, the flat, or approximately flat surface is generally preferred, partly on account of the ease with which it can be prepared and systematically explored with the beam, and also because the ratio of diffracted to undiffracted electrons is higher.

We have previously shown that the occurrence of any voltage change during the recording of a double shutter pattern is automatically rendered self-evident in the resulting photograph². The double

shutter method permits of the attainment of a high order of accuracy, comparable with that of X-rays, and can be employed in both transmission and grazing incidence diffraction; its successful practice, however, like that of precision spectrography, calls for suitable equipment and instrumental technique.

G. I. FINCH.

A. G. QUARRELL.

Imperial College of Science and Technology,
South Kensington, London, S.W.7.

May 7.

¹ *NATURE*, **133**, 686, May 5, 1934.

² Finch and Quarrell, *NATURE*, **131**, 842, June 10, 1933. *Proc. Phys. Soc.*, **46**, 148; 1934.

³ Finch, Quarrell and Roebuck, *NATURE*, **133**, 28, Jan. 6, 1934.

⁴ *NATURE*, **130**, 59, July 9, 1932.

⁵ For example, Yamaguti, *Proc. Phys. Math. Soc. Japan*, **14**, 57; 1932. **12**, 203; 1930. Trendelenberg, *Die Naturwissenschaften*, **21**, 173; 1933; and Eisenhut and Kaup, *Z. Electrochemie*, **37**, 469; 1931.

Full Period Effect in Miller's Ether Drift Experiment

IN his memoir¹ on the ether drift experiment, Dayton C. Miller mentions that harmonic analysis of the curves of the displacements of the fringes, obtained by a complete rotation of the interferometer, puts in evidence in all cases the existence of a full period effect which accompanies the Michelson half-period effect, utilised in the elaboration of the results of the experiment. The amplitude of the full period effect is of the same order of magnitude as the Michelson effect; it is, however, proportional to the number of visible fringes in the field of view and—in the most favourable conditions for the experiment, with six visible fringes—perceptibly less than the amplitude of the half-period effect.

According to Miller, the full period effect is identified with that foreseen and calculated by Dr. Hicks in a memoir of 1902², as a consequence of the small angular displacement μ of a few seconds of arc from its theoretical position, that must be given to one of the mirrors, to obtain the interference fringes.

That this explanation of the full period effect cannot hold, results at once if we consider that the Lorentz contraction ought to eliminate entirely any effect of the ether drift on the phenomenon of interference, although it should influence only the half-period effects. It is then clear that the ether drift, supposing it should appear, is only able to produce half-period effects, that is displacements of the interference fringes that are reproduced identically every half turn of the interferometer. This occurs, of course, whatever may be the effective adjustment given to the various parts of the instrument including the telescope.

A direct demonstration may be derived from the results obtained by me³ in 1925, in treating by a new method and in a complete manner the theory of the Michelson experiment, following up the work of Righi⁴, quoted by Miller in his memoir, which was interrupted by the death of the author. My theory leads to the following formula for the displacement of the fringes, when we take into consideration only the terms variable with the orientation of the interferometer given by the angle α ,

$$\Sigma = \frac{D\xi^2}{\lambda} \cos 2\alpha + \mu \frac{D^1\xi^2}{\lambda} \cos 2\alpha - \mu \frac{(D-D^1)\xi^2}{\lambda} \sin 2\alpha, \quad (1)$$

where ξ is the velocity ratio, λ the wave-length, D the effective length of the arm of the interferometer, D^1 the distance of the plane on which the observed inter-