and found to be 5·8 min. The 2·6-hr. period observed in the case of erbium is probably due to traces of the strongly active element holmium, as was suggested by Marsh and Sugden[2].

Our thanks are due to the Union Minière du Haut Katanga for the loan of the radium used, and also to Messrs. Adam Hilger, Ltd., for the loan of a specimen of neodymium oxide.

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[1] Hevesy and Hilde Levi, NATURE, **136**, 103, July 20, 1935.
[2] Marsh and Sugden, NATURE, **136**, 102, July 20, 1935.

'Extra' Electron Diffraction Rings

DR. G. I. FINCH and A. G. QUARRELL[1] have reported many 'extra' rings in electron diffraction patterns from thin metal foils containing preferentially oriented crystals. At first they attributed these to diffraction from two-dimensional gratings made up of the atoms in the crystallographic faces through which electrons might leave the foil. In a later comprehensive paper, Finch, Quarrell and Wilman[2] have stated that the extra rings do not appear unless the metal foil is contaminated; the earlier explanation has been abandoned. In this later paper are given, however, the results of the calculations concerning diffraction by atoms in exit faces. This note is concerned solely with the results of such calculations.

It is worth pointing out that the extra diffraction rings cannot be explained in the manner first proposed. The case is one of face-centred cubic crystals oriented with a (110) direction parallel to the primary beam and to the surface normal. It was first proposed[1] that atoms in (111) and (120) exit faces were responsible for the extra diffraction rings. In the later paper[2], the exit faces were described as (110) and (120). The previous designation of an exit plane as (111) was clearly an oversight or typographical error, as it can be shown that a (111) plane of atoms would give rise to all the Debye-Scherrer rings for the oriented crystals, and to no extra rings.

In regard to scattering by atoms in a (120) plane when the primary beam direction is (110), one can show that there will result diffraction cones about the primary beam direction, the semi-apex angles of which are approximately equal to:

$$\frac{\lambda}{a_0} \sqrt{\frac{1}{9}\left(11\,h_1^2 - 8\,h_1\,h_2 + 8\,h_2^2\right)}.$$

Here λ represents the wave-length, a_0 the length of the edge of the unit cube of the face-centred structure, and h_1 and h_2 are any positive or negative whole numbers. The radical has the following series of values: 0·94; 1·11; $\sqrt{3}$; 1·89; $\sqrt{4}$; etc. The integers 3 and 4 correspond, of course, to the first two Debye-Scherrer rings. The extra rings corresponding to the other values are not those calculated by Finch, Quarrell and Wilman[2], and they do not agree with the extra rings observed.

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Sept. 12.

[1] NATURE, **135**, 183; 1935.
[2] *Trans. Faraday Soc.*, **31**, 1074; September 1935.

THE observed ring radii are given in the table below, col. 1, and the ring radii we attributed to scattering from a (110) exit face [(111) is obviously an error] in col. 2. In cols. 3, 4 and 5 are set forth the values calculated by Finch, Quarrell and Wilman, and by Germer using his approximate and accurate expressions respectively.

Table

1	2	3	4	5
0·99	1·00	0·98	0·94	0·9407
1·10	—	1·11	1·11	1·105
—	—	1·12	—	1·107
1·40	1·41	—	—	—
1·65	—	—	—	—
1·73	1·73	1·73	1·73	1·727
—	—	—	—	1·729
1·76	—	1·76	—	—
1·78	—	1·78	—	—
—	—	—	1·89	1·877
—	—	1·95	—	—
2·00	2·00	2·00	2·00	2·001

Germer's results are the more accurate; we evidently placed too much reliance on four-figure tables in working out results involving small angles. We had, however, to consider more than one plane and so preferred the more direct method of calculation indicated in our paper.

I may add that, even before the experimental discovery of the real origin of 'extra' rings, the 'exit face' idea had lost much in attraction when it was realised that any and every 'extra' ring could be accounted for by postulating a suitable exit face.

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Pigments of the Bull Frog Retina

THE substances and processes found in the retina and pigment epithelium of the bull frog, *Rana catesbiana*, are identical with those in species of frogs

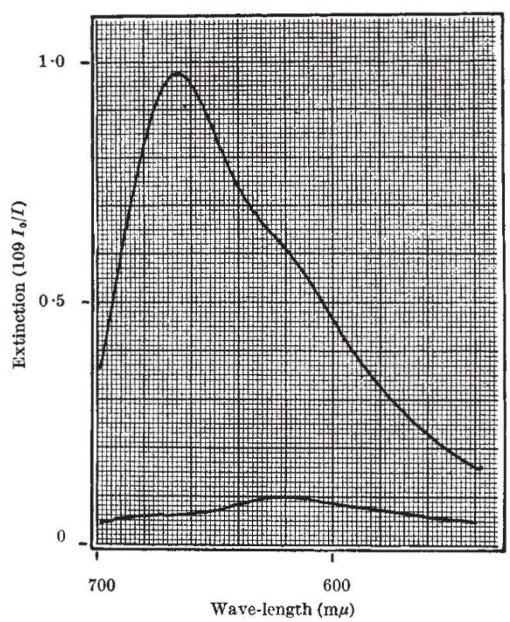

FIG. 1.

previously examined[1]. The retina contains varying amounts of the carotenoids retinene and vitamin A. Retinene is yellow, and when mixed with antimony trichloride reagent yields a sharp absorption band at