on such a section of a crystal as a crystal face. Hence all observations of small-scale regular markings such as etch figures and slip bands at the crystal surface and especially their minimum dimensions are highly relevant to the subject.

The dimensions of the sharply defined triangular markings shown in numerous photomicrographs[3] of natural (111) faces of diamond are all large compared with the hypothetical dimensions, about 1 μ, of mosaic irregularities. Whilst examining the surface irregularities on some unusually good specimens kindly lent by Prof. W. T. Gordon for X-ray study, it was noticed that a number of regions on one specimen which at ordinary powers of magnification appeared to be free from triangular markings, at magnifications of about 750 diameters showed many minute triangles (Fig. 1). Their orientation was normal, with the angles pointing towards octahedron edges, and the edge of the smallest clearly resolved triangle measured 1·3 μ.

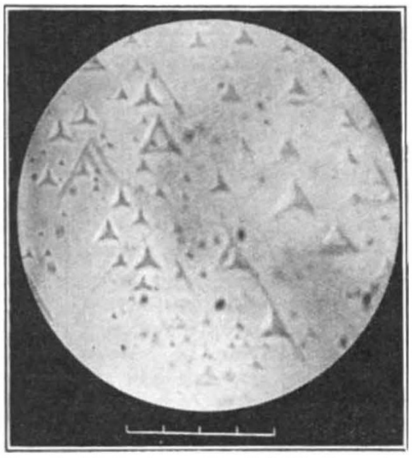

FIG. 1. Photomicrograph of (111) face of a diamond showing some triangular markings of 'mosaic' dimensions. Each scale division represents 0·01 mm.

These abnormally small regular markings were found only in groups and only at the edges of the crystal face. They were not detected on any of the other specimens examined similarly. The specimen measuring about 6 mm. × 4 mm. was the only one from the new diamond field at Sierra Leone. No trace of striations of this 'mosaic' order of magnitude was detected optically, but even the triangular markings themselves were difficult to observe because of their minuteness and the high transparency of the diamond. The optical difficulties were too great to justify an attempt to find the unit size of the largest equilateral triangular network fitting *all* the observed triangles[4]. For the (111) face of bismuth this derived quantity, claimed to be of the order 1·4 μ, is about the same as the observed dimensions of the edge of the smallest triangle on the diamond. Sufficient contrast to see or to photograph the markings was got by defocusing, and I am indebted to Mr. G. A. de Belin for the trouble taken to get the photomicrograph reproduced.

W. H. GEORGE.

Physics Laboratory,
University, Sheffield.

---

[1] See Ann. Report Chem. Soc., 189 (1935).

[2] Buerger, *Z. Krist.*, **89**, 195 (1934).

[3] A. F. Williams, "The Genesis of the Diamond", vol. 2 (1932); and J. R. Sutton, "Diamond" (1928).

[4] Goetz, *Proc. Nat. Acad. Sci.*, **16**, 99 (1930).

Optical Experiments on Liquid Helium II

THE anomaly in the specific heat of liquid helium at 2·19° K. has the same shape as that of the λ-point anomaly in crystalline substances. In crystalline bodies the λ-point anomaly, similar to that shown by ferromagnetic bodies at the Curie point, is due to some process connected with a change of order in the crystal.

It is natural to suppose that in the case of liquid helium II we also have to do with some form of order. As this type of transition is observed in liquids when liquid crystals are formed, it is not impossible that liquid helium at temperatures below 2·19° K. also forms liquid crystals.

Liquid crystals are anisotropic, and it is therefore interesting to study the optical properties of liquid helium II. If liquid helium II does in fact form liquid crystals, polarized light, on passing through a layer of helium, must be depolarized, as on its way it traverses a large number of optically anisotropic regions of different orientation.

In our experiments a layer of helium, 10 cm. in length, was placed between crossed nicols. The accuracy was such that a change in the intensity of light corresponding to a rotation of the prisms of ± 1·5° could easily be registered. On cooling the helium from 4·22° to 1·72° K. no change in the intensity of the light could be detected. It is possible that the effect could not be observed owing to the small dimensions of the liquid crystals. We therefore studied the Kerr effect in liquid helium II at 1·72° K. in a constant field of 63,000 volts per cm. No change in the light intensity could be observed with crossed nicols, the planes of polarization of which formed an angle of 45° with the direction of the electric field.

Assuming that the field was sufficiently strong completely to orient the optical axes of the crystals, we have computed that the anisotropy of the refractive index for helium II is less than 7×10^{-8}. If the optical axes were oriented perpendicularly to the direction of the field, this ratio would be 1×10^{-7}.

As the optical anisotropy which might have been expected in helium II lies within the accuracy of measurement, it must be assumed that the anomaly in liquid helium cannot be explained by a transition into the liquid crystal state.

L. W. SHUBNIKOV.
A. K. KIKOIN.

Ukrainian Physico-Technical Institute,
Kharkov. Sept. 10.

Infra-red Absorption Spectrum of Heavy Phosphine (PD_3)

THE infra-red absorption spectrum of PD_3 has been investigated with the view of testing the applicability of the 'valence force field' in correlating the fundamental vibration frequencies of a pyramidal molecule of the type YX_3. If it is assumed that the valence force field applies to PH_3, then one can deduce the values of the force constants of this molecule from its known vibration frequencies. This has been done by Howard[1], who gives $3{\cdot}09 \times 10^5$ dynes/cm. for the force required to alter the PH distance, and $0{\cdot}34 \times 10^5$ dynes/cm. for that required to alter the HPH angle. From these data one may compute the frequencies of the PD_3 molecule (since it is permissible to assume that these force constants are not appreciably altered by the substitution of a