

Complex Rotatory Dispersion of Optically Active Tetrahydrofuryl-2-carbinol

THE dextro- and the lævo-rotatory forms of tetrahydrofuryl-2-carbinol, obtained by crystallization of the brucine salt of its hydrogen phthalic ester, exhibit complex rotatory dispersion, the carbinol obtained from the (-) hydrogen phthalic ester having

$$\alpha_{6708}^{20} - 2.23^\circ, \quad \alpha_{6438}^{20} - 2.36^\circ, \quad \alpha_{4603}^{20} + 0.56^\circ,$$

$$\alpha_{4032}^{20} + 5.69^\circ, \quad \alpha_{3392}^{20} + 28.4^\circ, \quad (l = 1).$$

Determinations of specific rotatory power of the carbinol at increasing dilutions in aqueous solution give a family of curves of which the inflexions, maxima and reversals of sign are displaced towards the ultra-violet as the dilution increases. (This effect has been observed with tartaric acid by Lowry and Austin¹.)

A similar family of curves is given by the specific rotatory powers of the carbinol dissolved in the simple aliphatic alcohols (5 per cent solution), the characteristic features of the curves being moved towards the longer wave-lengths as the molecular weight of the solvent alcohol is increased.

In dioxan solution the specific rotatory power in the visible spectrum is practically independent of concentration. The rotatory power of the carbinol is not peculiarly sensitive to temperature changes and the rotatory dispersion of its esters is simple.

A more detailed description will be published elsewhere when circumstances permit. We have to thank Dr. C. B. Allsopp, of Cambridge, for determinations of rotatory power in the ultra-violet.

M. P. BALFE.
M. IRWIN.
J. KENYON.

Chemistry Department,
Battersea Polytechnic,
London, S.W.11.
Oct. 17.

¹ *Phil. Trans., A*, **222**, 249 (1922).

Classical and Quantum Reflections of X-Rays in Crystals

IT appears desirable that we reply, though very briefly, to the comments that have appeared in NATURE^{1,2} on our first note³ on this subject and which were evidently written before our second and supplementary note⁴ had been published. Our purpose in these communications was very definite, namely, to indicate it as a necessary consequence of classical optics and of quantum mechanics that there should be two types of X-ray reflection in crystals, due respectively to static and to dynamic stratifications of electron density; in the language of quantum mechanics, these correspond respectively to an elastic collision of the photon with the crystal lattice and to an inelastic one in which part of the energy of the photon is transferred to the crystal as an optical vibration of its lattice structure.

From the optical point of view, the two types of reflections are on a very similar footing; we have respectively $2d \sin \theta = n\lambda$ and $2d^* \sin \psi = n\lambda$. Here $\psi = \frac{1}{2}(\theta + \varphi)$, where θ and φ are the glancing angles of incidence and quantum reflection measured with reference to the crystal planes under consideration. The dynamic spacing d^* and the corresponding static

spacing d are connected by the vector relation $\vec{1/d^*} = \vec{1/d} + \vec{1/\Delta}$, where Δ is the phase-wave-length of the lattice vibration. The scalar magnitudes of d and d^* become indistinguishable when Δ is infinite or when, though finite, it is transverse to d . The law of quantum reflection then assumes the very simple symmetric form $2d \sin \frac{1}{2}(\theta + \varphi) = n\lambda$. More generally, $d^* = d$ when $\theta = \varphi$, but deviates in one direction or the other from it according as θ is greater than or less than φ .

For the experimental proof of our thesis, it is necessary that new reflections should be observed which are not greatly inferior in definition to the usual Laue spots, and in which reflections corresponding to different wave-lengths appear clearly resolved from each other as demanded by the Bragg formula. These features are precisely those which were observed and reported upon by us. The streaks and diffuse spots in Laue patterns noticed by earlier workers were not particularly relevant to our thesis, especially in view of the very varied and entirely different but apparently quite plausible explanations of them which had been put forward in the literature. It can, we believe, scarcely be contended that these earlier observations are, in any real sense, an anticipation of our fundamental observations and conclusions.

We have observed that the quantum reflections given by diamond are sharply defined over a wide range of incidences and continue to be visible even when the crystal is cooled down to liquid air temperatures. These facts wholly exclude any explanation of these reflections in the terms of the diffuse thermal scattering of X-rays (Faxen⁵, Zachariasen⁶). Measurements made by us over a wide range of incidences also show that neither in the case of ionic crystals nor in the case of diamond are the observed positions of the reflections in agreement with a formula of the Faxen-Zachariasen type.

C. V. RAMAN.
P. NILAKANTAN.

Department of Physics,
Indian Institute of Science,
Bangalore.
Sept. 20.

¹ Knaggs, Lonsdale, Müller and Ubbelohde, NATURE, **145**, 821 (1940).

² Zachariasen, NATURE, **145**, 1019 (1940).

³ Raman and Nilakantan, NATURE, **145**, 667 (1940).

⁴ Raman and Nilakantan, NATURE, **145**, 860 (1940).

⁵ Faxen, Z. Phys., **17**, 266 (1923).

⁶ Zachariasen, Phys. Rev., **57**, 597 (1940).

Isolation of Acetylsulphathiazole from Human and Rabbit Urines following Administration of *M.* and *B.* 760

SEVERAL reports have been made in the American clinical literature during the early part of this year of concretions in the urinary system and of crystals in the urine of humans treated with sulphathiazole (*M.* and *B.* 760). In some instances^{1,2} these concretions and crystals are merely referred to as a derivative or a conjugated form of sulphathiazole; in other instances^{3,4}, however, the statement is made that the crystals are acetylsulphathiazole, although no chemical evidence for their identity is given.

During work in progress in this laboratory on the fate of sulphonamide drugs *in vivo*, we have had occasion to examine crystals from both human and rabbit