that of the normal echoes from the *E* or *F* layer (indicating a completely different mechanism of reflection). Whereas the latter all give a quite well-defined balance, it is almost impossible with 20 m. spacing to find any balance at all on the former, except on rare occasions. With 6 m. aerial spacing, the balance is broad and ill-defined, with a minimum-maximum ratio of $\frac{1}{2}$ to $\frac{1}{3}$ implying angular spreads of the order of 30° . Thus the spaced aerial system, used first as a direction indicator and secondly as an interferometer, indicates, in both cases, that the sporadic short-scatter reflections are of an entirely different character from the normal *E* and *F* reflections. Both the results imply that the sporadic echoes are not reflected from a uniform *E* layer, but from high density patches in the *E* region, which are irregularly distributed both in time and in space.

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¹ NATURE, 140, 846 (Nov. 13, 1937).

Spectrum of Chromium Chloride, CrCl

RECENTLY Mesnage¹ has reported a system of bands, degraded to the red, in the region 2600–2650 Å. He obtained the bands by an electrodeless high-frequency discharge through a heated quartz tube containing chromium chloride. We have noticed that the wave-lengths recorded agree very closely with those of the known system of aluminium chloride. The wave-lengths given by Mesnage, with their vibrational quantum numbers, are reproduced beside those for the corresponding aluminium chloride bands as observed by Bhaduri and Fowler²; the intensities given are those for AlCl, Mesnage not having recorded any intensities for the bands which he observed.

CrCl (Mesnage)		AlCl (Bhaduri and Fowler)	
λ	v', v''	λ	Int.
2638.1	2,4	2638.10	3
2632.9	1,3	2632.80	3
2629.8	0,2	—	—
2627.0	1,2	2627.00	3
2623.5	3,2	2623.54	5
2622.3	0,1	2622.40	4
2619.9	1,1	2619.98	4
2618.1	2,1	2618.21	3
2614.3	0,0	2614.44	8
2612.0	1,0	—	—
2610.3	2,0	2610.22	6

It will be seen that all except two of the eleven bands agree to within 0.14 Å. Of the AlCl bands, all the strongest of those which are degraded to the red are included in the above list; the AlCl bands degraded to shorter wave-lengths in the same region do not appear to have been observed. Jevons³ has commented on the occurrence of AlCl bands when using aluminium electrodes in discharge tubes, and the bands appear to be of frequent occurrence as an impurity, but it is not easy to see how the bands could arise in an electrodeless discharge, unless perhaps the chromium chloride picked up a chip from the mortar when it was pulverized. In the absence of published photographs of Mesnage's bands, or any estimates of their intensities, it is difficult to be quite certain of the identity of the two systems,

but the agreement seems to be much too close to be entirely fortuitous.

The vibrational analysis proposed by Mesnage gives the vibrational constants $\omega_{1/2}'$ and $\omega_{1/2}''$ for the upper and lower electronic states of CrCl as about 33 cm.⁻¹ and 117 cm.⁻¹ respectively. These values are in any event surprisingly small and can scarcely be correct; judging by the values of these constants for other chlorides, we should expect values of the order 300–400 cm.⁻¹ for CrCl.

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¹ Mesnage, P., *C.R. Acad. Sci.*, **201**, 389 (1935).

² Bhaduri, B. N., and Fowler, A., *Proc. Roy. Soc., A*, **145**, 321 (1934).

³ Jevons, W., *Proc. Phys. Soc.*, **48**, 563 (1936).

Lecture-Room Demonstration of Electron-Optical Crystal Patterns

AN electron-optical image of the crystalline pattern of a metal surface in a sealed-off cathode-ray tube was obtained by Schenk¹ for nickel, caesium metal serving as activator. The optimum of emission was obtained at a temperature of about 500° C.

Some time ago, we succeeded in obtaining similar results for nickel, nickel iron and iron, using strontium and barium as activator. Metallic strips of the first-mentioned metals were mounted as cathodes in vacuum tubes of similar type to that already described², in which a tungsten spiral covered with a suspension of strontium carbonate in amyl acetate and a barium evaporator³ were mounted.

After evacuation and while the tube was still connected with the pumps, the cathode was heated to a fairly high temperature, then strontium (probably together with strontium oxide) was deposited on it by heating the tungsten spiral. Afterwards a quantity of barium was evaporated in order to absorb the gas residue. Although by this procedure the main part of the evaporated barium was deposited on the wall of the tube, part of it was deposited on the cathode, the latter thus being probably activated by both strontium and barium. Finally the tubes were sealed off.

With an 'electron-microscope' of this type (using a magnetic focusing coil as described elsewhere), intensive emission patterns could be obtained after a (not always identical) heat treatment of the cathode. With nickel and nickel-iron, the intensity of the emission after suitable activation at a temperature of the cathode of about 700°–800° C. was such that the fluorescent pattern could be projected optically on a screen (for example, 50 cm. × 50 cm.), thus giving rise to a highly magnified image of the crystal pattern of the metal surface, visible in a lecture-room⁴.

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¹ Schenk, D., *Z. Phys.*, **98**, 753 (1935).

² Burgers, W. G., and Ploos van Amstel, J. J. A., *Physica*, **4**, 5, 15 (1937); *J.A.T.M.*, London Congress (1937), p. 82.

³ See Burgers, W. G., and Ploos van Amstel, J. J. A., *Physica*, **3**, 1057 (1936). Kemnitz, G., Knoll, M., and Walcher, W., *Z. Phys.*, **98**, 612 (1935).

⁴ Cf. Burgers, W. G., *Z. Metallk.*, **29**, 250 (1937).