a Π state. In that case it may be either $1s\sigma 5p\pi^1\Pi_u$ or $1s\sigma 5p\pi^1\Pi_u$, but I think it certain that it has one unexcited electron ($1s\sigma$). All the other properties of the new upper states are in agreement with what would be expected for these assignments.

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¹ "Molecular Hydrogen and its Spectrum", pp. 303 ff.

Fluorescence of Fluorite and the Bivalent Europium Ion

EXPERIMENTS conducted in this Institute¹ had led to the conclusion that the blue fluorescence of fluorite excited by filtered ultra-violet light is due to traces of europium under the influence of radioactive substances, and that a yellow-green fluorescence which some fluorites show at the temperature of liquid air—especially those from acid magmatic rocks—is, in the same way, due to ytterbium. As these rare earths are those most readily obtained in the bivalent form², as further the reducing action of Becquerel rays is well known, and as the blue fluorescence can also be obtained in CaF_2 containing europium, simply by reduction through heating, the hypothesis was put forward that these broad 'radio-photo-fluorescence' bands are to be ascribed to the *bivalent* forms of the rare earths.

Through the courtesy of Prof. G. Jantsch, of Graz, we are now able to *prove* this hypothetical assumption in the case of europium. Prof. Jantsch kindly lent us preparations, made in the Institut für anorgan. chem. Technologie und analyt. Chemie of the Technische Hochschule, Graz, of pure SmCl_3 , SmCl_2 , EuCl_3 and EuCl_2 , of which the last shows, when excited by filtered ultra-violet light, a brilliant purplish pink fluorescence, as already noticed by Prof. Jantsch. Spectrograms of this fluorescence, taken by Miss B. Karlik in this Institute, show a *broad band in the blue, identical with the well-known fluorite band*, and in the red a rather narrow line at $690\text{ m}\mu$, as well as a diffuse band with a maximum at about $630\text{ m}\mu$, which strikingly resembles a red band shown by some fluorites but also by synthetic 'pure' CaF_2 after suitable heat and radium treatment. Whilst there can be no more doubt about the blue fluorite band being due to bivalent europium, the question if the red band in fluorite is also to be attributed to minute traces of this substance must form the subject of further investigations.

EuCl_3 and SmCl_3 show no fluorescence, the latter perhaps because of its deep black colour. SmCl_2 fluoresces orange³, with lines at 603.5 and $598.5\text{ m}\mu$. It is to be hoped that these observations may also furnish new clues to the atomic structure of the rare earths. A detailed report will be presented to the Vienna Academy of Sciences.

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¹ H. Haberlandt, B. Karlik and K. Przibram, *Wien Ber.*, IIa, **143**, 151; 1934. See also *NATURE*, **133**, 99; 1934.

² G. Jantsch and W. Klemm, *Z. anorgan. Chem.*, **218**, 80; 1933.

³ For the line-fluorescence of other trivalent rare earth salts, see E. Tomaschek and O. Deutschbein, *Phys. Z.*, **34**, 374; 1933 and M. Haitinger, *Wien. Ber.*, IIa, **142**, 339; 1933.

Quasi-Crystalline Structure of Liquids and the Raman Effect

IT is known that at the scattering of light in liquids a continuous spectrum appears¹ around the primary line on both sides to a distance of about $15\text{--}20\text{ A}$. This effect is usually referred to as 'wings'.

These wings are generally ascribed to unresolved rotation Raman lines. It seemed to one of us² more probable that the appearance of wings is connected not with rotation of molecules but with a new type of frequency change of the scattered light found by one of us³. For several years the wing phenomenon has been systematically investigated in our laboratory in various compounds and in different experimental conditions. One of us (E. G.) has investigated the influence of temperature on the wings. It might be expected that the raising of temperature would cause a broadening of wings, if they were really due to rotations of the molecules, but no difference could be found in the breadth of wings given by xylene at $t_1 = 15^\circ\text{C}$. and $t_2 = 160^\circ\text{C}$. ($T_2/T_1 = 1.5$). Only a slight increase of the intensity of the wings just near the primary line could be noticed. With diphenyl ether, $(\text{C}_6\text{H}_5)_2\text{O}$, which could be heated to 250°C . ($T_2/T_1 \approx 2$), we have obtained similar results, the only difference being that the increase of intensity just near the primary line was more pronounced. Therefore we can conclude that the wings consist of two different parts behaving differently on heating: an inner part (about 20 cm^{-1}) in the closest vicinity of the primary line, and an outer and much greater part. The absence of broadening of the second part on heating is opposed to the rotation hypothesis. This part behaves on heating like vibrational Raman lines and could be attributed to the loosely bound vibrations.

Fig. 1. Raman effect of crystalline and liquid diphenyl ether.

With the view of putting the vibrational and rotational hypothesis to the test, we have investigated the Raman effect in a crystal of diphenyl ether, and have obtained most interesting results. Instead of wings, we obtained on their position four lines lying on both sides of the primary line (Stokes and anti-Stokes lines). Some of the lines, marked by arrows, are clearly seen in Fig. 1. These lines correspond to infra-red frequencies of $\nu_1 = 21\text{ cm}^{-1}$, $\nu_2 = 39\text{ cm}^{-1}$, $\nu_3 = 69\text{ cm}^{-1}$ and $\nu_4 = 100\text{ cm}^{-1}$. These new lines are the vibrational Raman lines and not the rotational ones, for the following reasons: