

Saha is of opinion that these bands may owe their origin to the transition of the valency electron of one of the atoms to the metastable state ($^4S_2, ^2D_2 \dots$), and hence they occur in the infra-red. According to Hund and Mullikan, such transitions are not only allowed in the molecular spectra, but also occur very strongly. These bands are therefore presumably analogous to A, B, a bands of oxygen, which are obtained in absorption and must therefore correspond to the forbidden electron transitions of the oxygen atom. But this suggestion can be tested only by a laboratory experiment on the absorption bands of nitrogen. Without going into details regarding the nature of active nitrogen, we are inclined to the view that it is a diatomic rather than a monatomic molecule of nitrogen. An attempt is being made to photograph the spectrum of active nitrogen in the Schumann region in search of the resonance lines of nitrogen.

Our attention has been directed to a note of Prof. J. C. McLennan, and Messrs. R. Ruedy and J. M. Anderson, published in NATURE of April 7, on the spectra excited by active nitrogen. These authors could easily obtain the lines of zinc and mercury corresponding to 8.4 volts, but were unable to excite the lines of either krypton or xenon. From this fact they conclude that only those substances become luminescent which combine chemically with nitrogen, and hence the activity is to be ascribed to chemiluminescence. We wish to point out that the resonance lines of both krypton and xenon, discovered by G. Hertz (*Naturwiss.*, p. 648; 1926) all lie in the Schumann region:

		Resonance Potential.
Krypton . . .	1235.8	9.99
	1164.9	10.66
	1469.5	8.40
Xenon . . .	1295.7	9.53

Prof. McLennan and his collaborators evidently did not work in this region. The next higher group of lines lies in the infra-red, and requires a potential of about 11 volts for excitation. It is not, therefore, surprising if they failed to obtain any impression of these lines on their plates, because on the present-day theories of active nitrogen, it is loaded to an energy content of about 11.4 volts.

We also feel, though here we tread on rather delicate ground, that the exposure of 12 hours given by these authors was not enough to bring out lines of inert gases if any were present, for they do not seem to have noticed the new band spectrum of active nitrogen in the infra-red, which we have photographed. So that the conclusion of Prof. McLennan and others regarding the chemical origin of the phenomenon associated with active nitrogen does not appear to be quite justified.

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Is Crystal Reflection of X-Rays entirely a Classical Phenomenon ?

ACCORDING to recent papers by Waller (*Phil. Mag.*, 4, 1228) and Wentzel (*Zeit. f. Phys.*, 43, 1, and 43, 779), the regular reflection of X-rays can be treated as a purely classical phenomenon and the modified scattering of the Compton effect can be disregarded. If this is so, then the values of the atomic structure factor for a given atom (or F values) at various angles of reflection have the property that

$$-(1/Z) \sum_{n=1}^{n=\infty} (-1)^n F_n \gg \frac{1}{2} \dots (1)$$

where F_n is the F value for the n th order reflection from planes of which the grating space is D , and Z is the number of electrons in the atom. The proof is indicated as follows: Let an electron be at a distance a from the centre of an atom, this centre being in a crystal plane and a being perpendicular to the plane, then (see Compton, "X-Rays and Electrons," p. 121) the structure factor for this electron is $\cos(4\pi a \sin \theta/\lambda)$. If in addition the centre of the atom is vibrating, due to heat motion, and carries the electron with it, the structure factor becomes

$$\exp. (-b \sin^2 \theta/\lambda^2) \cos(4\pi a \sin \theta/\lambda).$$

For reflection we have $n\lambda = 2D \sin \theta$, and hence

$$F_n = \exp. (-an^2) \cos \beta n \dots (2)$$

where $a = b/4D^2$ and $\beta = 2\pi a/D$. Substituting in the left side of (1), the series may be written

$$S = \sum_{n=1}^{n=\infty} [\exp. \{-a(2n-1)^2\} \cos \beta(2n-1) - \exp. \{-a(2n)^2\} \cos \beta(2n)] \dots (3)$$

since Z in this case is unity. By Cauchy's theorem $S \gg I$ where

$$I = \int_0^{\infty} [\exp. \{-a(2x-1)^2\} \cos \beta(2x-1) - \exp. \{-a(2x)^2\} \cos \beta(2x)] dx \dots (4)$$

Evidently

$$I = \frac{1}{2} \int_0^1 \exp. (-ax^2) \cos \beta x dx \dots (5)$$

By the mean value theorem

$$I = \frac{1}{2} \exp. (-au^2) \cos \beta u \dots (6)$$

where $0 < u < 1$. Now $\exp. (-au^2) < 1$ for $a > 0$ and $\cos \beta u \gg 1$. Hence $I \gg 1/2$ and also $S \gg 1/2$, so that (1) is proved.

We have plotted the F values as found by Havighurst (*Phys. Rev.*, 28, 875) for (Na + Cl) against $\sin \theta$ and drawn a smooth curve passing through the experimental F values and through an F value of 28 for $\sin \theta = 0$. For the large angles we have extrapolated to $F = 0$ at $\sin \theta = 0.81$. We have read off sets of F values for different values of D , that is, for different values of $\sin \theta_1$, the value of $\sin \theta$ for first order reflection and have calculated the values of the left side of (1), which we shall represent by A , for various values of $\sin \theta_1$. We obtain the following table:

$\sin \theta_1$.	A .
0.05	0.497
0.10	0.558
0.126	0.487
0.15	0.430

For $\sin \theta_1 = 0.10$, A is definitely greater than $1/2$ in opposition to the requirement of the classical theory as given in (1). This matter will be discussed more fully in a paper appearing elsewhere.

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The Palaeolithic Implements of Sligo, Ireland.

THE communication of Profs. Jones and Boswell in NATURE of June 2 does not, in my opinion, supply good reason for departing from my announced intention to wait until the autumn of this year before replying to criticisms and detailing the geological evidence on which my claim is based. A paper will then be read before the Society of Antiquaries of London. Nevertheless, there are one or two state-