Averrhoa Carambola, giving out a distinct soft white light, from a covering of forest bed in Barisal in Bengal. Four years back I got a similar collection of luminous leaves, wood, etc., from the Bikrampur district in Bengal. In most cases I could find a colourless fungus-hyphæ in their sections. Luminosity was usually confined to certain spots only, while in some cases thin flat surfaces were luminous all over. Stalks showed a white streak of light along their lengths; no particular tissues within the stalks could be located as luminous.

Molisch attributed the cause of luminosity to fungi in decaying leaves, but so long as the fungus is not isolated and brought under pure culture so that its identity may be established, the point is not free from doubt. Molisch holds that the fungus gives out a photogen which, coming in contact with oxygen and water, gives out light; it is a process of slow chemical combustion without production of heat. But the photogen cannot be extracted. When I began crushing those luminous specimens with pestle in mortars containing a little cold and hot water in a dark room, the luminosity failed altogether, showing that photogen is not an extracellular secretion or excretion, but is bound up inseparably with the protoplasm of the living hyphæ—so long as the fungus is in a living condition it continues to emit light. The response of the light-giving substance in this case was in every way similar to that of a living one, namely, when I put those luminous specimens in a receiver and supplied them with a current of pure oxygen, they glowed more intensely than before. Light diminished on passing currents of pure hydrogen, nitrogen, and carbon dioxide gas, the former luminosity reappearing on access to the oxygen of the air. Putting specimens in a vacuum-bath and using an air-pump the light failed, but as soon as air was let in, the former condition of luminosity revived at once. Luminosity increased when specimens were immersed in dilute solution of hydrogen peroxide. Luminosity failed permanently on dipping the specimens in strong alcohol or chloroform, thus showing that if the fungus is somehow killed, there can no longer be the production of photogen.

The present lot of specimens remained luminous for about ten weeks, being kept in a moist condition. Specimens lose their luminosity when in a dried condition in blotting paper, but revive partially when in contact with water.

I could develop a photographic plate by exposing the film side to the direct action of a luminous stalk for nearly 48 hours, keeping a control.

S. R. BOSE.

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Calcutta, November 26.

The Origin of the Satellites in the Ultraviolet OH Bands.

IN a letter in NATURE of February 7, 1925, p. 194, G. H. Dieke suggests that the numerous satellites in the ultraviolet OH bands originate in the same quantum states of the molecules as do the main lines. The test of this supposition is to see whether or not these faint lines are additional combinations between the same terms which are given for the principal lines, but sufficiently precise measurements for the application of this criterion have not been available. I have therefore remeasured the λ3064 band, using a high dispersion plate (1·3 Å.U. per mm.) on which this band was strongly developed, the main lines being necessarily over-exposed in order that the satellite system be well brought out.

The following "satellite" Q_1 and Q_2 series which, if combined with the main P and R lines, satisfy the combination relation $Q(m) - P(m+1) = R(m) - Q(m+1)$, have been located. They must, then, have the same final rotational state as the P and R branches, and so can be represented by the term formulas $F_1(m) - f_1(m)$ and $F_2(m) - f_2(m)$ respectively. Vacuum wave numbers are given, and unresolved doublets are denoted by *

m.	$\sigma Q_1(m)$.	$\sigma Q_2(m)$.	m.	$\sigma Q_1(m)$.	$\sigma Q_2(m)$.
9	32283·74	32333·38*	18	31915·75	31944·36*
10	256·97	300·21	19	851·91*	885·41
11	226·49*	269·28	20	794·18*	820·96
12	192·24	231·48*	21	723·29	752·77*
13	154·69	192·24	22	653·88	683·42
14	113·27	149·53	23	577·50	604·27
15	070·55*	104·49	24		528·05
16	022·50*	053·50	25		439·38
17	1969·84				

It seems probable that most of the remaining satellites can also be represented by combinations between the terms in the main branches.

The same combination defect, $Q(m) - P(m+1) = R(m) - Q(m+1)$, which exists in these OH bands is also present in the magnesium hydride bands.[1] In view of the general similarity between the two band systems—both having the same characteristic spreading of the doublets near the band origins—it is reasonable to assume that the MgH bands, too, owe their combination defect to the existence of displaced Q levels. Satellite lines also exist in the MgH bands, but their investigation is obstructed by the presence of the many faint isotope lines.

These additional energy-levels have not as yet received interpretation in the theory of band spectra. More quantitative results such as the above would be a great aid in the solution of this problem.

The word satellite as used in this connexion, however, is somewhat of a misnomer, since, for example, $Q_2(24) - \sigma Q_2(24) = 2·1$ Å.U., with five other lines falling in this interval.

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Ryerson Physical Laboratory,
The University of Chicago,
December 22, 1925.

The Crystal as Diffraction Grating.

THE use of a crystal as a grating for measuring the wave-lengths of Röntgen rays affords a beautiful illustration of the value of a second reference frame that may be associated with the customary reference frame of vector analysis. Let $\mathbf{e}_1$ $\mathbf{e}_2$ $\mathbf{e}_3$ be the prime vectors of the customary frame. The second or derived frame, the prime vectors of which we will denote by $\mathbf{e}^1$ $\mathbf{e}^2$ $\mathbf{e}^3$ with superior affixes, is such that the scalar products $\mathbf{x}.\mathbf{e}_1$ $\mathbf{x}.\mathbf{e}_2$ $\mathbf{x}.\mathbf{e}_3$ of any vector $\mathbf{x}$ and the original prime vectors are the cartesian components of the vector in the derived frame, and the scalar products $\mathbf{x}.\mathbf{e}^1$ $\mathbf{x}.\mathbf{e}^2$ $\mathbf{x}.\mathbf{e}^3$ of the vector $\mathbf{x}$ and the derived prime vectors are the cartesian components of the vector in the original frame.

Because of this property we use x^1 x^2 x^3 with superior affixes to denote the components of $\mathbf{x}$ in the original frame, and x_1 x_2 x_3 for the components in the derived frame, so that with the usual convention as to the summation of affixes we write

$$\mathbf{x} = x^a \mathbf{e}_a = x_a \mathbf{e}^a$$

In a crystal of any form we take the origin at a point occupied by an atom, and for the heads of the

[1] W. W. Watson and P. Rudnick, *Astroph. Journal*, January 1926. That these bands have as their carrier the MgH^+ ion is shown by several independent lines of evidence.