

### Scattering of X-rays by bound Electrons.

In 1923, Compton gave a theory with experimental verifications of scattering of hard X-rays by free electrons, and in a subsequent paper he considered theoretically the case of modification of radiation scattered by bound electrons (Compton: "X-rays and Electrons", p. 286) in which the latter may be removed from one orbit to the other. Recently, I have observed that a part of the monochromatic X-rays in passing through carbon undergoes a change in frequency and appears on the longer wave-length side of the primary radiation. Copper  $K\alpha$  radiation was allowed to pass through carbon soot and the transmitted radiation was analysed by a calcite crystal fitted up in a Siegbahn spectrograph. A current of 8 m.a. was passed through the X-ray tube at a peak voltage of 28 k.v. In addition to the original copper  $K\alpha$  radiations and other lines in the tungsten  $L$ -series, a new diffuse broad line of wave-length 1592 X.U. ( $\nu/R = 572$ ) appeared on the photographic plate. This new line appears to have a more or less sharp edge on the short wave-length side. The wave-length of this line was compared with those of other lines the presence of which might be expected from the X-ray tube excited under the given condition and was found not to coincide with any one of them. The time of exposure was varied from 8 to 14 hours in different cases and all of them showed the same effect.

The origin of this line may be explained by the fact that the copper  $K\alpha$  radiation in passing through carbon loses a part of its energy equal to that of removing the electron from the  $K$ -shell either to the optical level or to infinity. The frequency difference between this line and the original copper  $K\alpha$  lines is 20.1 (in  $\nu/R$ ), whereas the value of carbon  $K\alpha$  is 20.4 (in  $\nu/R$ : Soderman, *Zeit. f. Phys.*, 52).

It may be mentioned here that the possibility of this type of radiation was also predicted by Kramers and Heisenberg, and it shows a certain similarity with the Raman effect in molecules.

Nickel  $K\alpha$  radiation produces a similar effect on passing through carbon. Further, this effect has also been observed in the case of oxygen and nitrogen for copper  $K\alpha$ , nickel  $K\alpha$ , nickel  $K\beta_1$ , tungsten  $L\alpha_1$  radiations, the measurements of which with photographs will be published in due course. B. B. RAY.

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### The Identity of Colloidal Particles in Soap Sols and Gels.

DR. M. E. LAING MCBAIN and Prof. J. W. MCBAIN found about ten years ago that several properties, for example, the conductivity, lowering of vapour pressure, concentration of sodium ion, etc., of the sols and gels of sodium oleate are identical; and from this they came to the conclusion that the colloidal particles in the two states are identical in nature and amount.

It is well known that light scattering gives us an accurate idea of the delicate changes in the colloidal particles in sols and gels, and is therefore a very significant property of colloids. During my investigations on the scattering of light in soap sols and gels I found that the intensity of the light scattered by gels of sodium oleate is distinctly greater than that in sols at the same temperature (*NATURE*, Nov. 2, 1929, p. 690). In a recent letter to *NATURE* (Jan. 25, 1930, p. 125) Dr. M. E. Laing McBain and J. W. McBain report that they have succeeded in preparing samples of the same solution of sodium oleate, some

of which were fluid sols and others typical jellies, but the light scattering of which was identical within the limits of experimental error. They further suggest that the enhanced intensity of the scattered light in the gels observed by me might be due to a partial curdling or crystallising out.

It may be permissible to point out here that J. W. McBain appears to have previously observed a slightly enhanced opalescence during the formation of gels from soap solutions (cf. McBain's article in J. Alexander's "Colloid Chemistry", vol. 1, p. 140), though the other properties, such as electrical conductivity and lowering of vapour pressure, remain unaffected. K. KRISHNAMURTI.

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### Intensities in Band Spectra.

PROF. E. CONDON (*Phys. Rev.* 32, p. 858; 1928) has shown that on the basis of the new quantum mechanics, certain nuclear transitions associated with electronic transitions are more probable than others. The actual intensities of the lines emitted depend upon the integral of the electric moment and the wave functions of the initial and of the final states. The evaluation of this integral can be approximately carried through for symmetrical diatomic molecules. The intensities of the lines associated with vibrational electronic transitions may therefore be calculated and expressed in terms of the change in separation of the nuclei during the transition.

The intensities calculated by this method agree very well with experiment especially in the case of the alkali molecules. The calculated intensities for  $\text{Na}_2$  and  $\text{K}_2$  at the positions (1-2) and (2-1) in the band spectra double entry table for intensities are very small, thus being in good agreement with the experimental intensities given by Fredrickson and Watson (*Phys. Rev.*, 30, p. 429; 1927). The occurrence of a large number of transitions between high quantum states for iodine is also explained. There are certain regular deviations from experiment in the case of hydrogen that have not as yet been explained. The complete calculations will be published in the *Physical Review*. ELMER HUTCHISSON.

Berlin, Friedenau,  
April 17.

### The New Planet.

I SEE that, in the notice which appeared in *NATURE* announcing the discovery of the new planet, it was suggested that the object might represent the outermost member of the family of planets formed from a portion of the sun drawn out by the attraction of the star the approach of which caused the catastrophic formation of the planetary system; or, as it was put—the new planet might be formed from the tip of Sir James Jeans' cigar. Since then the further particulars of the orbit appear to indicate that it is cometary in character, being eccentric and inclined at a considerable angle to the ecliptic. These two divergencies from the characteristics of the previously known planets, coupled with its great distance, would appear to be better explained by the theory of capture. At least, it may be said that the capture theory deserves consideration. If capture is possible, the new planet might be regarded as the first of a new series. Further, if the capture theory were actually established, by implication it would be probable that the majority of the stars have captured planets.

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Maidstone, April 25.