and Krishnan were only able to establish their existence experimentally in 1928 (Nature, **121**, p. 501). After a short account of experimental methods, the author reviews the theories and deals with the structure of the undisplaced lines, the entry of rotational frequencies, the intensities of the displaced lines, and the relation between the displacement of the lines and the structure of the molecule of the substance. References to 103 papers on the subject are given.

Absolute X-Ray Wave-lengths.—Since it has been found possible to measure the wave-lengths of X-rays by diffraction from an ordinary ruled grating, there has been some doubt as to the value of the charge on an electron, which can be calculated from the X-ray data, and has appeared higher than Millikan's value. Some new absolute measurements of X-ray wave-lengths are described and discussed critically by J. A. Bearden in the second May number of the *Physical Review*. The lines measured were the K lines of copper and chromium, which are as long as can be used conveniently without an exhausted spectrometer. Gratings were used which had been ruled by Prof. R. W. Wood and under the direction of the late Prof. Michelson, and in some cases as many as eighty orders of diffracted lines were obtained. The results are of high accuracy, the wave-length of the K_β line of copper, for example, being given as 1·39225 A., with a limiting error of $\pm$ 0·00014 A., which is definitely about 0·2 per cent greater than the wave-length from crystal measurements. The corresponding charge upon the electron is $4 \cdot 806 \times 10^{-10}$ e.s.u. This could be taken to indicate that the standard value of $4 \cdot 77 \times 10^{-10}$ e.s.u. is wrong, and has at times been so interpreted. Dr. Bearden, however, now takes the contrary view, that the charge as found from the X-ray measurements is too high, and that there is a flaw in one step in the deduction of the electronic charge, in neglecting the imperfections in crystal structure the existence of which has been pointed out by Zwicky. If the difference found is entirely due to this cause, it gives in fact a precise method for determining quantitatively the magnitude of the effect in crystals, and further, if a good independent estimate of the flawing existed, the present data could be applied to the determination of the electronic charge with higher precision than has been attained by other methods.

The Jet-Wave Rectifier.—The extending use of direct current for electric traction has caused a great demand for devices which will rectify alternating current into direct current. High power rectifiers based on the valve patented by Cooper Hewitt in 1903 are widely used. The Hartmann jet-wave rectifier, which is a purely mechanical device based on interrupting a jet of mercury carrying a current by means of a tungsten knife, is also being used in practice, but they each have special fields where they do not compete with each other. In a treatise entitled "The Jet-Wave Rectifier: an Account of its Constructional Development during the Years 1919–1929" (*Danmarks Naturvidenskabelige Samfund: Ingeniørvidenskabelige Skrifter*. A, Nr. 24. Pp. 300. København: G. E. C. Gad. 30·00 kr.), Jul. Hartmann gives a fairly complete account of the research work carried out by the Hartmann Rectifier Co. in Copenhagen on this rectifier. The author gives an interesting account of the development of the invention. When preparing for his master's degree at Copenhagen, in 1906, he was given by Prof. Christiansen the problem of determining the velocity and the charge-mass ratio of the particles of a cathode ray using the method of deflection in a magnetic field. A few months later, when using induction coils with mechanical interrupters, he found them very unsatisfactory. Thinking over his previous work, it suddenly struck him that a mercury jet might be deflected by a magnetic field in the same way as a cathode ray, and this led him to devise the jet-wave rectifier.

Astronomical Topics.

Encke's Comet.—A letter from Mr. H. E. Wood, Director of the Union Observatory, Johannesburg, announces that he detected this famous comet a week earlier than Mr. Bobone at Cordoba; but as he did not send a telegram, the announcement of the latter arrived first. The comet was so low in the evening twilight when first photographed that part of the field of the object-glass was cut off by the wall of the dome. In spite of this, the comet gave such a strong image with eight minutes' exposure that Mr. Wood estimates its magnitude as fully 7, which is 2 magnitudes brighter than Mr. Bobone's estimate. The plates have not yet been accurately measured, but the following rough positions are sent:

1931	R.A. (1931.0)	N. Decl.
June 14·7 U.T.,	7^h $1 \cdot 6^m$,	15° 23′
June 16·7	7 10·8	13 38

These positions fully confirm those of Mr. Bobone in indicating that perihelion passage was about 18 hours earlier than Matkiewicz's prediction, which was June 3·84757 U.T.

This is the thirty-eighth observed apparition of the comet; it was seen in 1786, 1795, 1805, 1819 (when its periodicity was recognised by Encke), and at every return since then. The reason for the unbroken records held by this comet and by that of Halley is that their perihelion distances are small, so that they are easy objects when near their perihelion.

As a proof that Encke's comet is gradually fading, it may be mentioned that in 1865 the perihelion passage was 5·7 days earlier than in 1931, so that the conditions of observation were similar; in 1865 the comet was observed in February with instruments of moderate size; but in 1931, Prof. G. van Biesbroeck, using the powerful instruments at Yerkes Observatory, failed to obtain the faintest image of it on his photographic plates in February and March.

Impact of Stars with Nebulæ.—Mr. K. Hirayama, of Tokyo Observatory, investigates in *Proc. Imperial Acad. Japan* (**7**, No. 5; 1931) the effects of the impact of a star with a spherical nebula. The relative velocity is probably hyperbolic before impact, but it may be reduced by the impact below the parabolic value, in which case there will be repeated impacts, which will result in the capture by the star of part of the matter of the nebula, while the star's orbit relatively to the nebula will be reduced in size. The author suggests that the nebula might in time be so reduced and broken up as to form a system of planets revolving round the star; this is an alternative to the theory that explains the formation of the planets by the tidal action of a star passing near the sun. The paper goes on to show that a binary system passing through a nebula would have the size and eccentricity of the orbit diminished and the masses of the components increased. It also suggests that a large spherical nebula might, by capturing a great number of stars, form a globular cluster, while the repeated impacts of the stars with nebulous matter would end in the absorption of most of the latter.