and some adjacent observing stations, and gave mean heights varying between 80 and 89 kilometres, heights vastly greater than those of cirrus clouds. Jesse found velocities ranging from 100 to 300 metres per second from east-north-east in the case of the clouds of July 2, 1889, and velocities of more than 100 metres per second were observed to be of frequent occurrence. He found, further, that the usual drift was from north-east before midnight and from east-north-east after midnight. Størmer's apparatus and observing stations used for the measurement of auroral heights served also for these cloud measurements, and the apparatus and method are described in this paper. Photographs were obtained on the nights of July 10–11 and 24–25, 1932, and gave heights ranging from 74 km. to 92 km. with a mean of 81·4 km., thus confirming Jesse's figures of 82·1 km. for 1889–1891. The clouds of July 10–11, 1932, were found to be moving from north-north-east, with a velocity between 44 and 55 metres per second. No emission lines were found in a spectrum of those observed on July 24–25. The observations are held to be insufficient to allow definite conclusions as to the nature of such clouds to be drawn. Apart from meteor trails, they are the only objects available for studying the winds so high up in the stratosphere.

Polish on Metals. R. C. French (*Proc. Roy. Soc.*, A., June) has investigated the structure of the surface layer formed on metals by polishing, using the electron diffraction pattern as an index to the surface arrangement. The metal specimens used were copper, silver, chromium and gold, and in every case the diffraction patterns showed sharp rings after treatment with emery, and blurred rings after polishing. The author interprets these experiments as showing that an amorphous layer is formed by the polishing process. This explanation is contrary to that given by Germer, who suggests that the disappearance of the rings is due to the suppression of diffraction by thin upstanding ridges of metal. In the present experiments, however, definite, though broad, rings were observed and it seems probable that these are really formed by scattering from an altered surface layer.

Ionisation Constants of Carbonic Acid. The thermodynamic equilibrium constants of the first and second ionisations of carbonic acid: (1) $H_2CO_3 \rightleftharpoons H^{\cdot} + HCO_3'$; (2) $HCO_3' \rightleftharpoons H^{\cdot} + CO_3''$, are of considerable importance, since they intervene in many biological investigations. MacInnes and Belcher (*J. Amer. Chem. Soc.*, July) have made a careful redetermination of the constants $K_1 = [H^{\cdot}]\,[HCO_3']\,\gamma^{H}\gamma_{HCO_3}/[CO_2]\,\gamma_{CO_2}$ and $K_2 = [H^{\cdot}]\,[CO_3'']\,\gamma_H\gamma_{CO_3}/[HCO_3']\,\gamma_{HCO_3}$, in which square brackets denote molar concentrations and γ the activity coefficient. The terms referring to CO_2 denote that substance in solution as CO_2 and as H_2CO_3; it appears from other investigations that less than one per cent of the dissolved CO_2 is in the form of H_2CO_3. The measurements have been made by means of galvanic cells without liquid junctions and with the glass electrode, the liquid being in equilibrium with gaseous CO_2 at a known partial pressure. Very full experimental details are given. The value of γ_{CO_2} is taken as 1 and $[CO_2]$ is assumed proportional to the pressure, both approximations being justified in the discussion. The asymmetry potential due to the glass electrode was eliminated. The final results at 25° are $K_1 = 4{\cdot}54 \times 10^{-7}$ and $K_2 = 5{\cdot}61 \times 10^{-11}$. The first figure is considerably at variance with published and generally accepted values of the constant obtained from conductivity measurements, but is in close agreement with a redetermination by that method described in the paper, and also agrees with the potentiometric measurements of Michaelis and Rona. The second constant agrees, in order of magnitude, with published work based on equilibrium measurements.

Astronomical Topics

Orbit of Comet 1907 IV (Daniel). This comet was discovered on June 9, 1907, by Z. Daniel, at Princeton, New Jersey. It was a conspicuous object of the second magnitude during the summer of 1907, its head being 2′ in diameter, with a fairly sharp nucleus. It was under observation for 12½ months, the number of observations being about 600. A definitive study of its orbit has recently been published by U. Baehr (*Astr. Nach.* 5965). Nineteen normal places were formed, 12 in 1907 and 7 in 1908. The perturbations by Jupiter and Saturn were examined and found to be very small. The following are the final elements:

T	1907 Sept. 3·9614468 G.M.T.	
ω	294° 25′ 55·79″	1910·0
Ω	143 2 53·70	1910·0
i	8 58 4·56	1910·0
q	0·5121729	
e	0·9987929	

Period, 8740 years ± 56 years
Aphelion distance, 848 units.

Variation in the Light of Vesta. It is well known that the light of many of the asteroids is variable. The *Bulletin of Kwasan Observatory*, Japan, for January 30, 1933 contains a paper by T. Kanamori, which gives 27 photometric observations of Vesta, made between December 17 and 24, 1932. The individual determinations range from mag. 6·71 to 7·76, but on adopting a mean light-curve the range is found to be half a magnitude, from 7·2 to 7·7, the period of variation being 3 hours. The variation may arise either from irregularity of shape or unequal albedo in different regions. In either case the light-range is likely to change with variation in the axial presentation of the planet, though the period should not alter. In the case of Eros the light-range is sometimes nearly 2 magnitudes, at other times it practically disappears.

The Planet 1933 *HH*. This planet, which was recently announced from Johannesburg as a new one of unusual brightness, proves to be identical with No. 192, Nausicaa, which has been known for half a century. Ephemerides are only calculated for the asteroids for the dates when they are nearly in opposition, which is the reason for the delay in making the identification. Nausicaa is among the brightest of the whole family. *Kleine Planeten* for 1933 gives an ephemeris for October and November next. Opposition will occur on November 3; the planet will then be in R.A. $2^h 33^m$, N.Decl. 28° 5′; its magnitude will be 7·8, so it will be an easy object with a good binocular.