

unless, therefore, satisfactory non-continuous spectra can be produced, future progress, like that in the past, must depend largely on increasing the temperature of the light sources.

A SPECIMEN of a new form of pyknometer has been sent for our inspection by Messrs. C. E. Müller, Orme and Co. It consists of two parts, the pyknometer proper and a device for filling it expeditiously. The former is a spindle-shaped tube of about 0.4 cubic cm. capacity, drawn out at each end to a capillary bore. It fits into the filler, a wider tube, by means of a ground-glass joint. The other end of the filler is closed by a rubber bulb or teat. On inserting the free end of the spindle into the liquid to be tested, and pressing the bulb, air is expelled, and on releasing the pressure the liquid fills the spindle tube. Excess of liquid falls into the filler. The full tube is then withdrawn and weighed. Where a high degree of accuracy is not required, and especially when only small quantities of liquid are available, the instrument will often be useful.

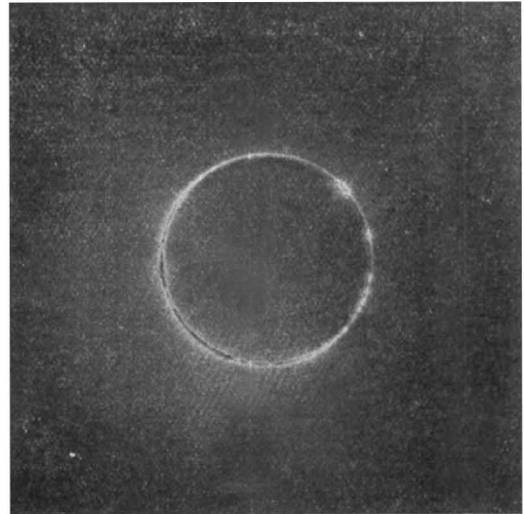
PART VI. of the *Verhandlungen* of the German Physical Society contains an abstract of a dissertation by Dr. K. Eisenmann, of Berlin University, on the distribution of potential in the kathode dark space of a vacuum tube through which an electric current is passing. The kathode used was an aluminium wire of 0.2 millimetre diameter, and the potential was measured by means of an exploring electrode of fine platinum wire projecting 0.2 millimetre out of an enclosing glass tube. The kathode was connected to earth, and the potentials at points from 3 millimetres to 10 centimetres from the kathode for different pressures of the gas and for different currents were measured. If  $V$  is the potential in volts and  $C$  the current in milliamperes, then  $(V-142)^2$  is proportional to  $C(C+0.65)$ , and inversely proportional to the pressure. The author's results lead to the conclusion that for a plane kathode the potential at a distance  $x$  from it would be proportional to  $1-ae^{-bx}$ , where  $a$  and  $b$  are constants. From this it would follow that only positive charges of electricity are present in the kathode dark space.

THE first of a series of articles on concrete-mixing appears in *The Builder* for May 31. It is generally admitted that hand mixing is less efficient than machine mixing. Under careful superintendence, good concrete can undoubtedly be produced by hand labour, but the nature of the work is monotonous, and the men engaged on it are apt to think little of efficiency. Some specialists make a practice of specifying a larger proportion of cement for all hand-mixed concrete. Careful tests made in the United States show that the strength of concrete mixed by hand may range from about 50 to 90 per cent. of the strength possessed by concrete of the same composition mixed by machine. The attempt to make amends for imperfections in the mixing process by increasing the proportion of cement cannot be successful. An excess of mortar reduces the compressive strength for the reason that mortar is less strong than stone.

#### OUR ASTRONOMICAL COLUMN.

THE SOLAR ECLIPSE OF APRIL 17.—A number of papers dealing with the recent eclipse of the sun have appeared in the *Comptes rendus*, and in one of them M. Salet, who was at Ovar, reports that no observer questioned by him saw the corona; all the facts considered, he concludes that nowhere along the central line in Portugal was the eclipse actually total.

At Maisons-Laffite, Mr. A. C. and Miss Allen secured several excellent photographs during the various phases. One, which we reproduce here, was taken by Mr. Allen at, or very near, the maximum phase. He used a mirror arranged and mounted to reflect the eclipsed sun into his camera at any moment, and the original image is 0.25 in. in diameter. The negative shows, very plainly, a prominence group just to the left of the two smaller beads seen at the top of the disc, and the uncovered parts of the photosphere are shown by the solarised, dark arcs. These prominences are probably the two mentioned as Nos. 8 and 9 by MM. Croze and Demetresco in a paper appearing in the *Comptes rendus* (No. 20). They give the position-angles as  $222^\circ$  and  $225.5^\circ$ , counting from south through west,



north, and east, and the heights as  $1/21$  and  $1/19$  of the solar diameter respectively. Their plates also show indications of the lower corona, which they conclude can be photographed and seen even when the broadest section of the luni-solar crescent attains  $1/37$  of the solar diameter. The fact that the lower corona appears on their plates in the equatorial regions suggests that the corona was of a "minimum" type.

ORIGIN OF THE "EARTH LIGHT."—When from the total brightness of the moonless night sky is deducted that produced by the stars, either directly or by diffusion in the atmosphere, there still remains a quantity of light which has puzzled many observers.

In a paper published in No. 4, vol. xxxv., of the *Astrophysical Journal*, Dr. W. J. Humphreys makes some most interesting suggestions as to the origin and nature of this "earth light." He shows that it is probably due to the bombardment of the outer layers of our atmosphere by extra-terrestrial particles, such as meteor-dust. This bombardment, on reasonable assumptions, may produce enormous temperatures capable of ionising surrounding matter, and the consequent electric discharges might produce a glow analogous to a perpetual aurora. But whatever the

secondary effects, the bombardment can in several ways reasonably account for the observed phenomena connected with the earth light.

THE MINOR PLANET 1911 M.T.—When the minor planet 1911 M.T. was discovered by Dr. Palisa, its direct motion suggested proximity to the earth, which might prove useful in parallax determinations. In No. 4573 of the *Astronomische Nachrichten* Dr. Palisa now gives elements, calculated by Messrs. Haynes and Pitman under Prof. Leuschner, which give the perihelion distance as 1.1273 or 1.1643, and the aphelion distance as 2.8629 or 2.5043; both sets of elements would probably be modified by further investigations, but the former appears to fit better the observations yet compared with it.

### THE ROYAL OBSERVATORY, GREENWICH.

THE annual visitation of the Royal Observatory took place on Saturday last, June 1, when the Astronomer Royal presented to the Board of Visitors his report of the work done during the year ended May 10.

Many of the instruments were opened up for inspection, with assistants in charge to explain the many wonderful devices which are an essential part of the equipment of a great observatory of the present day. Visitors were greatly attracted by a new feature, the floating zenith telescope designed by the late Mr. Bryan Cookson, and lent to the observatory by the Cambridge Observatory authorities for a period of seven years. Similar to an ordinary zenith telescope in principle, the V's which carry the vertical telescope are carried by an iron ring floated on mercury, so that, with the two axes properly adjusted, verticality is automatically secured. Observations of pairs of stars by Talcott's method are being made to determine the variation of latitude and the aberration constant, and by combining the results for several years it is hoped to secure a very satisfactory determination of the aberration. This instrument replaces the old reflex zenith tube, which is incapable of giving the accuracy now required.

The fine summer enjoyed last year allowed the meridian observations of stars between  $24^\circ$  and  $30^\circ$  north declination, begun in 1906, to make good progress, but the part of 2h. to 6h. R.A. is yet somewhat under-observed. During the twelve months nearly 14,000 transits were observed with the transit circle, besides the usual observations of nadir and level. From the 1910 observations, using the Pulkowa refractions,  $38^\circ 31' 21.83''$  was derived as the value of the colatitude, and the reduction of the observations of the sun gives a correction to the tabular value of the obliquity of the ecliptic of  $+0.07''$ . From the observations of the moon's limbs and the crater Mösting A, with the transit circle and altazimuth, the mean error of the moon's tabular place for 1910 was  $-0.537s$ . in R.A. and  $+0.32''$  in declination.

An investigation of the large discordance between north polar distances given by altazimuth in reversed positions points to faults in the eye end of the instrument, and this is being replaced by a new part. At the same time, a travelling-wire micrometer is to be introduced for observing R.A. and a printing micrometer for the zenith distances.

More than 700 observations of double stars, mostly pairs showing relative motion, were made with the 28-in. refractor, nearly 300 of the observed pairs being separated by less than  $1.0''$ . The 26-in. refractor, carried with the 30-in. reflector and the 6-in. Franklin-Adams lens on the Thompson equatorial, is

being devoted to the determination of the parallaxes of stars in the Greenwich Astrographic Zone, photographs on the same plate being made at intervals of six months of all stars showing large proper motions. For this purpose an attempt was made to secure a better adjustment of the crown and flint components of the objective, to give greater accuracy, and it has been found necessary to order a new cell, carrying necessary adjustments, for the crown lens.

The work, with the 30-in. reflector, of securing photographic standards for the magnitudes of the stars counted on the Franklin-Adams plates, is delayed by the scarcity of nights at Greenwich on which the transparency of the sky is the same at the pole as at a similar altitude in the south. Variations of focus when the mirror was directed to different parts of the sky were also troublesome, but it is hoped to eliminate this trouble by using a subsidiary device for examining visually the focus. Among the interesting exhibits displayed on Saturday was a series of photographs taken with this instrument on October 11, 1911, to locate the new minor planet M.T., believed to be very near to the earth. At first the examination of these plates failed to reveal the object, but later, when further data were received, images believed to be of the planet were found on three plates.

The Franklin-Adams 6-in. lens is used for determining photographic magnitudes of bright stars in the Greenwich zone, all of which can be covered by eighty-four fields; of these, fifty-five have been photographed and forty-one of the plates measured. A  $30^\circ$  prism placed in front of this lens enabled photographs of the spectrum of Nova Geminorum (2) to be taken on several dates. Some of these exhibited on Saturday show excellent definition and great changes in the general nature of the spectrum, although the dispersion is small. The changes of magnitude of the nova were shown by photographs taken with the astrographic equatorial having a coarse wire grating placed in front of the object glass. With a grating made of 1.65 mm. wire, with spaces from centre to centre of 5 mm., the first diffraction images were sensibly round, and differed from the primary image by nearly two magnitudes.

Photographs of the sun were secured on 256 days, as against 182 days in the previous twelve months. Part of this increase was due to a greater amount of bright sunshine received and part due to an arrangement whereby work is commenced at 7 a.m. in the summer. The series of photographs for 1911 is complete except for January 1, on which date no photograph appears to have been taken at any of the four contributing observatories. All the evidence points to the present epoch as one of minimum solar activity, and advantage was taken of the lull to discuss the thirty-eight years' observations now available for determining the position of the sun's axis. The result shows that Carrington's position requires but a very small correction.

Two observers are going from Greenwich to Cruzeiro (lat.  $22^\circ 39' S.$ , long.  $44^\circ 58' W.$ ) to observe the Brazilian eclipse of the sun on October 10. Their equipment will include the Thompson 9-in. coronagraph and a quartz spectrograph especially fitted for recording the extreme ultra-violet part of the chromospheric spectrum.

Magnetic observations were carried out as usual, and showed that in 1911 there were no days of "great" magnetic disturbance. For 1911 the elements determined were:—

Mean declination ...	$15^\circ 33' 0'' W.$
,, horizontal force ...	$0.18529$ (in C.G.S. units)
,, dip (with 3-in. needles) $66^\circ 52' 6''$	