"Chameleon Barometer"

IN my first communication (vol. xi. p. 307) upon this subject, I stated that the actual temperature had apparently no effect upon the colour of the paper. Since then I have had reason to change my opinion. During the late severe weather I have had better opportunities of studying the behaviour during frost, and I have observed that though in summer the paper will remain red for a difference of 3° between the thermometers, in very cold weather it is only red when that difference falls to 0°, or perhaps ·5°. This seems to agree with the fact that cold air cannot dissolve so much aqueous vapour as warm air. A. PERCY SMITH

Rugby, March 6

OUR ASTRONOMICAL COLUMN

TOTAL SOLAR ECLIPSE OF 878, OCTOBER 29.—In a communication to the *Times* in August 1872, this eclipse, in the days of King Alfred, was pointed out by the Rev. S. J. Johnson, of Upton Helions, Devon, as having been probably total in London. In the Saxon Chronicle it is merely stated that "the sun was eclipsed one hour of the day," without reference to any phenomena of totality; the *Chronicon Scotorum* records "a dark noon;" in the *Annales Fuldenses* we read: "Sol quoque in 4 Kal. Novembris post horam nonam ita obscuratus est per dimidiam horam, ut stellæ in cœlo apparent et omne-noctem sibi imminere putarent." This night-like appearance of nature clearly indicates that the eclipse was total at Fulda (Hesse-Cassel), and if our calculations assign elements for the eclipse, which show totality at this spot, it may fairly be assumed that they will give very nearly the true phase for London. Correcting the arguments of Damoiseau's Lunar Tables of 1824, so as to bring them into agreement with Hansen for moon and Le Verrier for sun, and taking the minor equations from the Tables, we find the following elements for 878, Oct. 29 :—

Conjunction in R.A., oh. 51m. 24s. M. T. at Greenwich.

	°	′	″	
R.A.	218	6	10	
Moon's hourly motion in R.A.		37	25	
Sun's ,, ,, ...		2	29	
Moon's Declination	14	6	44	S.
Sun's ,, ...	15	4	40	S.
Moon's hourly motion in Decl.		8	25	S.
Sun's ,, ,, ...		0	48	S.
Moon's horizontal parallax		60	35	
Sun's ,, ,, ...		0	9	
Moon's true semi-diameter		16	31	
Sun's ,, ,, ...		16	12	

Assuming the position of Fulda to be in longitude oh. 38m. 41s. E., and latitude 50° 33′·7, we find by direct calculation from the above elements a total eclipse, totality commencing at 2h. 9m. 32s. local mean time, and continuing 1m. 41s. with the sun at an altitude of 19°. The partial phase began at oh. 56m. and ended at 3h. 24m. The Fulda annalist has "post horam nonam" for the time of the eclipse, but the times we have found cannot be very much in error. The sun rose at Fulda on this day at 7h. 12m. apparent time, or at 6h. 57m. mean time, so that the ninth hour from sunrise would be 4 P.M. To reconcile this difference, Dr. Hartwig, of Leipsic (who calculated the eclipse in 1853 from the best data then available, without finding it quite total at Fulda), conjectured that the author of the Chronicle might have reckoned his time from the commencement of twilight at the beginning of the month. However this may be, our elements, which may be expected to be pretty near the truth, have indicated a very measurable duration of totality at Fulda. Calculating now for London (St. Paul's), we again find a total eclipse commencing at 1h. 16m. 20s. mean time, and ending at 1h. 18m. 10s., or with a duration of 1m. 50s. If any reader should have the curiosity to examine the track of totality further, the following formulæ will assist him. Putting l for the geocentric latitude of place, and L for its longitude from Greenwich, reckoned positive eastward, t for Greenwich mean time—

$$\text{Cos. } w = 136{\cdot}5500 - [2{\cdot}13760] \sin. l + [1{\cdot}70924] \cos. l, \cos. (L + 155^\circ\ 31'{\cdot}7)$$
$$t = 1\text{h. } 17\text{m. } 15\text{s.} \mp [1{\cdot}76081] \sin. w - [3{\cdot}32433] \sin. l - [3\ 91281] \cos. l, \cos. (L + 109^\circ\ 10'{\cdot}4)$$

Upper sign for beginning of totality, lower one for ending; the quantities within the brackets are logarithms.

The Rev. S. J. Johnson found no other total eclipse in London during the long interval from 878 to 1715, and we are able to confirm his inference that there is not likely to be another one visible in the metropolis for five hundred years from the present time. Less than seven years after the eclipse of 878, or on June 16, 885, a very great eclipse passed over Scotland and Ireland. By a similar accurate computation to that detailed above, it is found to have been total not far from Nairn, and the duration of totality was little less than five minutes, a most unusual length for so high a latitude. In *Chronicon Scotorum* we read, "The stars were seen in heavens."

ENCKE'S COMET.—The ephemeris of this comet for the present appearance, communicated by Dr. von Asten, of Pulkova, to the St. Petersburg Academy, not having been yet transferred to the *Astronomische Nachrichten*, where such matters are commonly looked for, we continue our reduction of the places to 8 P.M. Greenwich time for the period when the comet is likely to be most easily found in these latitudes :—

	R.A.	N.P.D.	DISTANCE
	h. m. s.	° ′	from Earth.
March 20	1 19 27	75 0·0	1·433
,, 22	1 25 58	74 32·8	
,, 24	1 32 43	74 6·7	1·350
,, 26	1 39 41	73 42·3	
,, 28	1 46 50	73 20·4	1·258
,, 30	1 54 8	73 2·1	
April 1	2 1 28	72 48·8	1·156
,, 3	2 8 42	72 42·4	
,, 5	2 15 37	72 45·3	1·042
,, 7	2 21 53	73 0·5	
,, 9	2 27 1	73 31·9	0·918

The distance from the earth is expressed, as usual, in parts of the earth's mean distance from the sun.

VARIABLE STARS.—Next week we shall give the times of maxima and minima of the better known variable stars for two or three months in advance, calculated from the elements in Prof. Schönfeld's last catalogue. It does not appear that an ephemeris for 1875 has been circulated as in several previous years.

THE FRENCH TRANSIT EXPEDITION TO NEW CALEDONIA

WE have received the following interesting communication from a correspondent :—

The French Transit of Venus Expedition to New Caledonia was the result of an after-thought on the part of the French Academy, which only took a definite form in the shape of active preparations for the great event in May last, months, if not years, after the other stations had been fixed on and the construction of the necessary instruments commenced. The New Caledonian observers were consequently at a great disadvantage, being obliged to complete all their arrangements within the short space of ten weeks, and to start for this *Ultima Thule* of civilisation in the middle of July. Everything, however, was got in readiness at home with so much care and despatch that nothing of the slightest importance, either in the astronomical or photographic department of the expedition, has been found wanting. The observatory has been fitted up and the observations made with as much completeness as if the centre of France, and not a convict settlement at the very opposite extremity of the

world, had been the scene of operations, and the results, though not all that could be desired, are nevertheless well worthy of the time and money expended in obtaining them.

M. Andrè, of the Paris Observatory, a well-known French astronomer, was appointed director of the expedition, whilst to M. Angot, Professor of Physics in the Normal School, Paris, the photographic portion of the work was entrusted. The instruments to be used consisted of five telescopes of various powers; a very complete photographic apparatus which will be described hereafter; a meridian instrument; an apparatus for producing an artificial transit, with electric chronograph carrying four pens attached; and lastly, two instruments for accurately determining the magnetic inclination and declination of Nouméa, which up to the present time have never been exactly known. The largest of the telescopes (7·5 in.), as well as three others (5 in.), was provided with an objective silvered by M. Foucault's process, the fifth having an unsilvered lens of $3\frac{3}{4}$ in. diameter, and of extremely good definition. All the instruments were equatorially mounted, three of them being connected with the chronograph, whilst the other two obtained their time by means of clock and chronometer. The telescope used for the photographic part of the work had an objective of 5 in. diameter and 13 ft. focal length, and was firmly fixed in a horizontal position on stone pillars, the image of the sun being directed along the axis by a large silvered mirror placed outside and moved at will from the interior by means of long wooden rods on either side of and parallel to the telescope. During the transit an assistant stood near this mirror, and at every command "*Découvrez*," removed the cover (placed on the mirror to prevent it becoming heated, and thereby causing distortion of the sun's image), and replaced it immediately after the plate had been exposed. With this apparatus, the daguerreotype process of sensitising a silvered plate of copper by means of iodine and bromine, developing in a mercury bath and fixing with hyposulphite of soda, was alone employed, and with the greatest success.

Though the day was somewhat cloudy, considerably over 100 very well-defined pictures of Venus during the Transit were obtained, together with 130 others, rendered less distinct by the intervention of clouds. When it is known that for several days previous to the 9th, the weather had been so bad that all hopes even of a glimpse of the transit of the planet were abandoned, and that dense clouds hung over the whole sky, and heavy showers of rain fell up to within four hours of the first contact, M. Angot may well be congratulated on the success of his labours. These daguerreotype pictures are not quite $1\frac{1}{2}$ in. in diameter, and were obtained by exposures of the plates varying from $\frac{1}{100}$ to $\frac{1}{50}$ of a second in duration. M. Janssen's method was not employed, but a very simple plan was adopted of placing the sensitised plate in a frame fixed at the focus of the chemical rays, and causing the exposure by sliding in front of it a metallic screen with a slit in it, whose width of course varied with the time necessary for exposure. A clock connected electrically with the sidereal one in the main observatory was placed in a convenient position above the telescope, and the instant of each exposure accurately noted. The assistants in this work, four in number, were all convicts, who performed their share with the neatness and readiness for which Frenchmen, whatever their position in life may be, are so remarkable; and, indeed, nothing has struck me more during the progress of the work here than the aptitude which seems innate in the French race for work of this kind; and it is no disparagement to English soldiers to say that it would have taken them days to learn to read chronometers with the accuracy which their French brethren-in-arms acquired in a few hours and apparently without the slightest difficulty. The main features in all the telescopic observations are the $3\frac{1}{2}$ minutes' difference between the estimated and observed times of first contact, the absence of the drop, and, in the case of the instruments furnished with silvered objectives, the clear tangential contact of the planet and the sun's limb, which enabled four out of the five observers to obtain the instant of second contact with very great accuracy. With these objectives, which appear to be especially well adapted for observations of this nature, the planet was seen to pass clear and distinct on to the sun's disc, without any appearance of distortion or cloudiness whatever; but with the unsilvered objective an appearance was observed as if a drop, such as those described by English astronomers, was about to form. Without forming, however, it changed almost imperceptibly into a tremulous haziness, which rendered it impossible to say when the actual contact took place, and compelled the observer to note two instants, one when this haziness first appeared, and the other when it had so far disappeared in the increasing brightness in the rear of the planet that he was confident that Venus was fairly on the solar disc. These two instants are separated by an interval of thirty-four seconds, and their mean corresponds within two or three seconds with the instant of tangential contact observed with the other instruments. Whether the slight cloudiness of the sky, or a constant error peculiar to all unsilvered objectives, or the fact that the latter telescope was focussed on a spot much nearer to the sun's limb than the other instruments, is to be put down as the cause of this difference or not, seems at present a matter of doubt only to be cleared up when other observations with unsilvered lenses are recorded.

The third and most important contact in New Caledonia was not observed, owing to a cloud which, much to our chagrin, strayed over the sun's face some 6′ before the estimated time of egress, and completely shut out our view for about 20′, after which the fourth contact was observed, but with a considerable degree of uncertainty, on account of the undulatory appearance of the sun's limb.

I may mention, in conclusion, that the times of duration of the whole transit, *i.e.* the interval between the first and fourth contacts, obtained by three of the observers, differed by only 8″, but these were considerably at variance with the estimated duration of the transit as given in the *Nautical Almanac*. Besides MM. Andrè and Angot, three French officers, Capts. Derbés, Bertin, Ribout, and Mr. Abbay, took part in the observations. A.

On board the *Rangatira*,
Jan. 5, 1875

SCIENTIFIC REPORT OF THE AUSTRO-HUNGARIAN NORTH POLAR EXPEDITION OF 1872–74 *

THE real object of the expedition was not particularly that of reaching high latitudes, but rather the investigation of the large unknown sea north of Siberia; the explorers thought they might eventually reach Behring's Straits, without cherishing very sanguine hopes on this point. When during 1871 Lieut. Weyprecht made a preliminary expedition into those regions, he found the whole large sea between East Spitzbergen and Nowaja Semlja so completely unknown, that in spite of his stopping six weeks at Tromsö, and making inquiries of all Finnmark skippers and whalers, he could not learn anything definite as to the conditions of climate and ice in those parts; few vessels had succeeded in reaching the 76th degree of north latitude. During the two Austrian expeditions this unknown sea has been investigated from 40° to 70° East long. (from Greenwich), and beyond the 79th degree of latitude on the west side and the 80th on the east side; an extensive, hitherto unknown tract of land has been discovered, and Lieut. Julius Payer has made sledge journeys into this land, reaching very nearly 83° N. lat.

In 1871 the explorers had found the sea completely free from

* Die 2. Oesterr.-Ungarische Nord Polar Expedition unter Weyprecht und Payer, 1872–74. (Petermann's Geogr. Mittheilungen, 1875; heft ii.)