

structure of thin plates, or one of fine lines. There are two papers on leaves from the cutting of the Ship Canal, one giving a general description, and the other, by Dr. Schunck, F.R.S. showing that the green colouring-matter, which has proved to be so permanent, is due to a modified form of chlorophyll; spectroscopic examination of the colouring-matter showed it to be identical with that produced by the action of dilute hydrochloric acid on ordinary chlorophyll.

THE Middlesex Natural History and Science Society has issued a volume containing its Transactions during the session 1888-89. The volume opens with an interesting Presidential address by Prof. Flower, on the Natural History Museum, Cromwell Road, and some recent additions thereto. Mr. E. M. Nelson has an illustrated paper on diatom structure; and Mr. J. A. Brown contributes a paper, also illustrated, on working sites and inhabited land surfaces of the Palæolithic period in the Thames Valley.

THE fourth volume of "Blackie's Modern Cyclopædia" has been issued. It begins with the word "fire" and ends with "Ilorin." The work, as we have said on former occasions, is admirably edited by Dr. C. Annandale. The articles are necessarily brief; but, so far as we have been able to test them, they are clear and accurate. There is no falling off in the present volume.

MESSRS. WARD, LOCK, AND CO., have added to their "Minerva Library of Famous Books" a reprint of Dr. A. R. Wallace's fascinating "Narrative of Travels on the Amazon and Rio Negro." A biographical sketch of the author is contributed by Mr. G. T. Bettany, the editor of the series; and the volume includes a portrait of Dr. Wallace, a map, and full-page illustrations.

HAZELL'S Annual for 1890—the fifth issue—has been published. It is edited by Mr. E. D. Price. An immense quantity of information, alphabetically arranged, has been packed into this useful volume. Many articles which the editor describes as "new and important" have been inserted in the present issue.

A SCIENCE CLUB has been formed among the students of the University of St. Andrews for the purpose of developing the interest already taken in scientific pursuits. Prof. W. C. McIntosh, F.R.S., has been elected Hon. President for the session 1889-90.

ANOTHER important paper by M. Henri Moissan upon the perfected mode of preparation and upon the density of fluorine, is contributed to the current number of the *Comptes rendus*. Since the appearance of his paper of two years ago, M. Moissan has employed an electrolysis apparatus of much larger size, and has added to it an accessory apparatus by means of which the gas may be obtained quite free from vapour of hydrofluoric acid, which, as described in NATURE last week, is the cause of the destructive action upon platinum. The platinum U-tube of the new apparatus has a capacity of 160 c.c., and contains during the electrolysis 100 c.c. of hydrofluoric acid. The exit tube at the positive side, from which the fluorine is liberated, is continued into a small platinum spiral condenser immersed in a bath of methyl chloride at -50°C ., where all but the last trace of hydrofluoric acid is retained. From this the gas is led through two platinum tubes filled with fragments of sodium fluoride, a salt which combines with hydrofluoric acid with great energy, forming hydrogen sodium fluoride. By these means the fluorine is obtained perfectly pure, and is quite invisible in dry air, no trace of fuming being apparent, as is the case before purification. In order to determine the density of the gas, a couple of ingeniously constructed platinum flasks have been employed. Each of these flasks is closed by a cylindrical stopper also of platinum; to the side of the neck a side tube is attached on a

level with the centre of the stopper. Through the stopper an aperture is bored in such a manner that, when the stopper is rotated into a certain position, connection is established between the interior of the flask and the side tube. A vertical tube also passes through the stopper and penetrates to near the bottom of the flask; this tube is also closed at its upper end by means of a platinum stopper. The stoppers are finely polished and adjusted with great care. Each flask weighs about 70 grams and has a capacity of about 100 c.c. In the density determinations the two flasks were counterpoised on the two pans of the balance. One of them was then filled with pure dry nitrogen gas, which was subsequently displaced by the pure fluorine, the electrolysis apparatus being connected with the upper end of the vertical tube of the density flask by means of flexible platinum tubing. The fluorine was allowed to pass through the apparatus for five minutes after cold silicon was readily ignited by the gas issuing from the side exit tube. The stopper of the flask was then rotated through half a revolution, so as to completely shut off the exit tube, and the stopper of the vertical tube replaced. The flask was again weighed against the other flask containing air, and the difference of weight noted. The amount of residual nitrogen was estimated by opening the stopper of the vertical tube under water, when the fluorine instantly decomposed an equivalent of water, liberating oxygen and forming hydrofluoric acid. The mixture of oxygen and the residual nitrogen was then collected, and the oxygen absorbed by pyrogallic acid and potash. Three determinations yielded, for the density of fluorine compared with that of hydrogen, 18'27, 18'26, and 18'33. These values appear to indicate that the number 19, usually taken as representing the atomic weight of fluorine, is slightly too high, and this view is confirmed by the low numbers obtained in former determinations of the density of phosphorus trifluoride.

THE additions to the Zoological Society's Gardens during the past week include a Malayan Bear (*Ursus malayanus* ♀) from Malacca, a Gold Pheasant (*Thaumalea picta* ♀) from China, presented by Captain Bason; a Common Squirrel (*Sciurus vulgaris*), British, presented by Mr. W. Aubrey Chandler; a Mexican Deer (*Cariacus mexicanus* ♂) from Peru, a Grey-breasted Parrakeet (*Bolborhynchus monachus*) from Monte Video, deposited; an American Bison (*Bison americanus* ♂) born in the Gardens.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m., December 12 = 3h. 27m. 9s.

Name.	Mag	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ' "
(1) G. C. 768	—	—	3 39 39	+23 14
(2) D.M. + 71° 201 ...	7	Reddish-yellow.	3 18 56	+71 29
(3) ε Eridani	3	Yellow.	3 27 5	- 9 51
(4) ζ Eridani	4	White.	3 10 5	- 9 14
(5) 27α Schj.	7	Red-yellow.	3 32 21	+62 18
(6) R Lacertæ	Var.	Orange.	22 38 23	+41 48

Remarks.

(1) The General Catalogue description of this nebula is as follows:—!!! Bright; very large, irregular figure. According to Tempel, this is a variable nebula, and its spectrum, which has not yet been recorded, will therefore have a special interest. Continued observations may, very probably, give a clue to the origin of the variability.

(2) Dunér classes this with stars of Group II., but states that the spectrum is only feebly developed. Further observations are necessary before it can be placed in position on the "tem-

perature curve." As I have previously pointed out, the "feebly developed" stars of the group are probably either early or late species, as the bands would be weak in either case. If it be an early star, the bands in the blue will be most strongly developed; while, if it be a late star of the group, the bands in the red will be strongest. In the latter case, lines would probably also be seen.

(3) Konkoly classes this with stars of the solar type. As in former stars of this class which have appeared in these columns, observations are required to decide whether the star belongs to Group III. or to Group V. (For criteria, see p. 20.)

(4) This is a star of Group IV., of which observations of the relative intensities of the hydrogen and metallic lines are required, so that the star may be arranged in a line of temperature with others.

(5) This is a star of Group VI., which Dunér describes as having a spectrum consisting of three zones, band 2 being probably also present. Particular attention should be given to the intensity of the band 6 as compared with the others. Other subsidiary bands should also be looked for, as they are seen in several stars of lower magnitude, and it is important that we should know whether their presence is dependent solely upon the brightness of the star, or really indicates a difference in the condition of the star itself. (For notation of bands, see p. 112.)

(6) The maximum of this variable will occur on December 27. The period is 315 days, and the magnitude varies from < 13.5 at minimum to 8.6 at maximum. The spectrum has not yet been recorded.

Note.—Some of the comets of which ephemerides have recently appeared in NATURE may possibly be bright enough for spectroscopic examination. It is not likely that, at their present perihelion distances, their temperatures will be very high, so suggestions for comparison spectra may be confined to those suitable for low-temperature comets. The probable sequence of spectra as a comet leaves aphelion is as follows:—(1) The spectrum of a planetary nebula, as in the comets of 1866-67, observed by Dr. Huggins. This consists of a single line in the position of the chief nebula line near λ 500. (2) The low-temperature spectrum of carbon, consisting chiefly of three flutings near λ 483, 519, and 561. (3) The high-temperature spectrum of carbon, consisting mainly of flutings near λ 564, 517, and a group of five flutings extending from 468 to 474. The most convenient comparison to begin with will be the flame of a spirit-lamp, which will give the hot carbon spectrum. If this does not show coincidences with the cometary bands, a comparison with the bright fluting in the spectrum of burning magnesium should be made. This will determine the presence or absence of the chief nebula line. If neither shows coincidences, the positions of the bands relatively to the hot carbon flutings may roughly indicate the presence or absence of cool carbon. As the two less refrangible flutings of cool carbon fall very near to two of hot carbon, the best criterion for cool carbon is the fluting at λ 483, which is about one-third of the distance from the fluting commencing at 474 towards that commencing near 517. Any variation of the form of the least refrangible cometary band from the corresponding carbon fluting should be noted, as this varies with the temperature (see Roy. Soc. Proc., vol. xlv. p. 168). A. FOWLER.

PHOTOMETRIC INTENSITY OF CORONAL LIGHT.—The observations made by Prof. Thorpe during the solar eclipse of 1886 (Phil. Trans., vol. clxxx., p. 363, 1889) show that the diminution in intensity of coronal light at different distances from the sun's limb does not vary according to the law of inverse squares. The following measurements make this apparent:—

Distance in Solar Semi-diameters.	Photometric Intensity.	
	Observed.	Law of Inverse Squares.
1.6	0.066	0.066
2.0	0.053	0.042
2.4	0.043	0.029
2.8	0.034	0.022
3.2	0.026	0.016
3.6	0.021	0.013

The brightness of the brightest measured part of the corona (1.55 solar semi-diameters) was 200 times less bright than that of the surface of the moon, or about 0.06 candle, whilst the furthest spot at 3.66 solar semi-diameters was only 1/800 of the brightness, or 0.015 candle. The results obtained will be useful in comparing the brightness of the corona on this occasion with that of other eclipses, and determining what connection the sun-spot periods have with the coronal phenomena.

CORONA OF JANUARY 1, 1889.—Prof. Tacchini, in the *Atti della R. Accademia dei Lincei* (p. 472), gives a note on the corona as shown in a positive copy, on glass, of one of Mr. Barnard's negatives taken during this eclipse. The corona extends, according to Prof. Tacchini, from +64° to -68° on the west limb of the sun, and from +53° to -68° on the east limb, these being about the limits of the zone of the maximum frequency of protuberances derived from his own observations. Two of the protuberances on the photograph were observed at Rome and at Palermo.

MINOR PLANET (12), VICTORIA.—Dr. Gill has issued the ephemeris of this planet for the opposition of 1889, computed from elements which have been corrected from the observations of 1888.

Observatories co-operating in the meridian observations of Victoria should compare their results with this ephemeris, employing 8".80 for the solar parallax.

Dr. Auwers has undertaken the discussion of the meridian observations, so the detailed results should be forwarded to him as soon as possible.

COMET SWIFT (*f* 1889, NOVEMBER 17).—The following ephemeris is given by Dr. R. Schorr (*Astr. Nachr.*, No. 2937):—

1889.	R.A.	Decl.	1889.	R.A.	Decl.
	h. m. s.			h. m. s.	
Dec. 12...	23 47 28	+19 6.7	Dec. 22...	0 19 7	+21 49.4
13...	50 31	19 23.6	23...	22 24	22 4.8
14...	53 36	19 40.4	24...	25 43	22 20.1
15...	56 42	19 57.1	25...	29 2	22 35.2
16...	59 50	20 13.6	26...	32 23	22 50.1
17...	0 2 59	20 29.9	27...	35 44	23 4.8
18...	6 10	20 46.1	28...	39 6	23 19.3
19...	9 22	21 2.2	29...	42 30	23 33.6
20...	12 35	21 18.1	30...	45 54	23 47.7
21...	15 50	21 33.8	31...	49 18	24 1.5

The brightness of the comet = 0.81 (December 12) and 0.57 (December 31), that at discovery being taken as unity.

Comptes rendus, No. 23 (December 2, 1889), contains observations of this comet extending from November 20 to November 27. It is noted that the comet is very feeble and diffuse.

PERIODIC COMETS.—Several short-period comets return to the sun in 1890, and their ephemerides will be furnished as soon as issued. The perihelion passage of Brorsen's comet will occur about February 25, Denning's comet may be expected to return to perihelion in May, and D'Arrest's comet about the third week in September. The orbit of Barnard's comet has not yet been sufficiently defined to enable the date of perihelion passage to be stated.

THE ECLIPSE PARTIES.—The following telegram relating to the eclipse parties has been received:—"Loanda, December 7.—The United States corvette *Pensacola*, Captain Arthur R. Yates, with the Solar Eclipse Expedition on board, arrived at St. Paul de Loanda to-day. The voyage down was very smooth, with delightful sailing. The astronomers were at work on the instruments all the way, and are all ready for the eclipse. The time is now so short that it is inadvisable to attempt to take the party and all their instruments inland, so the Expedition will locate at Cape Ledo immediately, and send one or two branch parties inland, with such instruments as are not bulky or heavy, and can quickly be set up and adjusted. The European eclipse observers are beginning to arrive here. Mr. Taylor, of the Royal Astronomical Society, London, has already arrived with a small outfit of apparatus. None of the French or German astronomers are yet here. Cape Ledo turns out to be in every way the most favourable point for locating the American Expedition. Not only are the meteorological conditions likely to be better, but the party can live for the most part on the *Pensacola*, as she will lie at a safe anchorage near the shore. The health of the members of the party is thus insured. The eclipse is several seconds longer there than at Muxima, and chances for clear afternoon skies appear to be rather better. If nothing is heard from the Expedition for the next few days, it may either be taken that the Eclipse Station is finally located at Cape Ledo, or that the semi-cannibal Quissamas have cleared out the whole Expedition."

RECENT INDIAN SURVEYS.

THE "Statement exhibiting the Moral and Material Progress and Condition of India," recently issued, devotes, as usual, a section to the survey work of the past year, of