

On inhaling, one perceives no odour so long as this cylinder does not project beyond the inner tube; but the further it is pushed out, the larger is the scented surface presented to the entering air, and the stronger the odour perceived. The author studies mixture of odours by applying a cylinder saturated with a scented body to the end of the olfactometer, and varying the length of the two odoriferous substances. But he considers a double olfactometer better (one tube for each nostril). With this, one may easily experience how one odour will overwhelm another; rubber, *e.g.*, causing the smells of paraffin, wax, and tolu to disappear. Even with very strong excitants, there is never a mingling of sensations. Either the one or the other odour is perceived, till by careful equilibration of the two, no sensory effect at all is perceived. Sensibility is quite eliminated.

THE Verein für Erdkunde, of Halle, is arranging for a hydrographical and zoological investigation of the Lake of Ploen, in Holstein.

VIENNA and Berlin will shortly be connected by telephone.

A PRETTY and convenient celluloid paper knife is being sent by Messrs. Woodhouse and Rawson United, Limited, to their clients. No one who uses it can doubt that celluloid may for some purposes be a very good substitute for ivory.

MESSRS. WILLIAM WESLEY AND SON have issued No. 99 of their "Natural History and Scientific Book Circular." It consists of a list of works in astronomy, mathematics, and physics.

A PAPER upon phosphorus trifluoride is contributed by M. Moissan to the February number of the *Annales de Chimie et de Physique*. In a previous communication it was shown that this interesting gas could be obtained either by heating a mixture of lead fluoride and copper phosphide, or by the action of arsenic trifluoride upon phosphorus trichloride. Since that time it has been found that a regular and more rapid evolution of phosphorus trifluoride occurs when a mixture of zinc fluoride and phosphorus tribromide is gently warmed, and this appears to be by far the most convenient way of obtaining the gas in quantity. Zinc fluoride reacts much more rapidly than lead fluoride, and is best prepared by the action of pure hydrofluoric acid upon zinc carbonate. The insoluble fluoride thus obtained is washed with distilled water and dried at 200° C. It is important not to raise the temperature beyond this point, as further heating renders it much less easily attacked by phosphorus tribromide. The dry zinc fluoride is then placed in a brass tube closed at one end and fitted at the other with a double bored ordinary cork, well paraffined, and through which pass two tubes, one a delivery tube of lead, and the other a kind of dropping funnel, from which the tribromide of phosphorus is allowed to slowly fall upon the gently warmed fluoride of zinc. As soon as the temperature of the latter has begun to rise, the action becomes very energetic, and in a few moments several litres of the gas may be collected. In order to free the phosphorus trifluoride from admixed vapour of phosphorus tribromide, it is quite sufficient to allow it to bubble through a little water contained in a small wash bottle, after which it may be dried by passing through tubes containing pumice, which has been boiled in strong oil of vitriol, and heated until only the minimum quantity of sulphuric acid remains adhering to it, inasmuch as the strong acid absorbs a notable quantity of phosphorus trifluoride. The gas is finally collected over mercury. The reaction occurring during the preparation is stated to be as follows:—



Gaseous trifluoride of phosphorus as thus prepared possesses a very sharp odour, but does not fume in the air. It is very slowly absorbed by water, but is decomposed immediately by

solutions of chromic acid or potassium permanganate. As the above reaction appears to yield the gas in a very pure state, M. Moissan has made determinations of its density, and finds it to be 3.03. The calculated density of PF_3 is 3.08. When a measured quantity of the gas is heated over mercury in a closed glass vessel, it is totally decomposed by the silica of the glass, and the volume diminishes by one-fourth, four molecules of PF_3 becoming converted into three molecules of gaseous silicon tetrafluoride, SiF_4 .

THE additions to the Zoological Society's Gardens during the past week include a Ring-tailed Lemur (*Lemur catta*) from Madagascar, presented by the executors of Dr. Allen; a Vulpine Phalanger (*Phalangista vulpina* ♀) from Australia, presented by Mr. W. H. Seward; a Hamster (*Cricetus frumentarius*) from Russia, presented by Mr. Harold Hanauer, F.Z.S.; an Alligator (*Alligator mississippiensis*) from Florida, presented by Mr. A. B. Archer; a Hoffmann's Sloth (*Choloopus hoffmanni*) from Panama, deposited.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m. on February 3 = 7h. 35m. 32s.

Name.	Mag.	Colour.	R. A. 1890.		Decl. 1890.	
			h. m. s.	° ' "	° ' "	° ' "
(1) G.C. 1546	—	—	7	29	42	+35 28
(2) DM. + 14° 1729...	6	Yellowish-red.	7	35	51	+14 28
(3) β Geminorum ...	2	Yellowish-white.	7	36	36	+28 18
(4) α Canis Minoris ...	1	Bluish-white.	7	33	30	+ 5 31
(5) 89 Schj.	7	Yellowish-red.	7	2	55	-11 47
(6) S Hydræ	Var.	Reddish-yellow.	8	47	50	+ 3 29

Remarks.

(1) The General Catalogue description of this nebula is as follows:—"Pretty bright; considerably small; round; very gradually a very little brighter in the middle; mottled as with stars; almost planetary." The spectrum of the nebula has not yet been recorded.

(2) Dunér describes the spectrum of this star as a very fine example of the Group II. type. He states that all the bands 2-8 are wide and dark, especially 2 and 3, and that the whole spectrum is well developed. No mention is made of the presence or absence of absorption lines, but there is little doubt that some will be found if looked for, the predominance of the bands 2 and 3 probably indicating that the star belongs to a later species, and is therefore approaching Group III., in which line absorption is predominant. Observations of the green and blue carbon flutings are also suggested (see p. 305).

(3) This star has hitherto been described as having a spectrum of the solar type. The usual observations, as to whether the temperature of the star is increasing (Group III.) or decreasing (Group VI.) are required.

(4) Gothard classes Procyon with stars of Group IV., but the Henry Draper Memorial photograph of the spectrum seems to indicate that it would be more properly described as an early stage of Group V., differing from the solar spectrum in having the hydrogen lines more developed and the metallic lines slightly thinner. Further observations of the visible spectrum are suggested.

(5) According to Dunér the spectrum of this star belongs to Group VI., and shows the usual three absorption bands of carbon. Band 6, which appears to be the most variable, is stated in this case to be very dark, and the question is, Are there any other variations in the spectrum accompanying the condition in which band 6 is dark? It seems probable that the number and intensities of the secondary bands will be found to vary with band 6, and these should, therefore, receive special attention.

(6) This variable has a spectrum of the Group II. type, but Dunér does not give a complete description, as he probably did

not observe it at maximum. A further examination is therefore required. Bright lines should also be carefully looked for, in order to determine whether the appearance of bright lines at the maxima of stars of Group II. is general. The period is given by Gore as 256 days, and the range as from 7.5-8.5 at maximum to < 12.2 at minimum. The maximum will occur on February 24.

A. FOWLER.

SPECTRUM OF THE ZODIACAL LIGHT.—In this month's *Observatory*, Mr. Maxwell Hall gives the results of a series of observations of the zodiacal light made at Jamaica. The observations are divided into three groups, according to the angular distance from the sun of the part of the zodiacal light observed. With respect to the first group, made at a distance of 50° from the sun, it is noted that the spectrum was seen as a faint white continuous band, commencing suddenly at λ 561, and extending as far as G, where it died out very gradually. The limit was well determined by comparison with the carbon flutings at λ 470, 517, and 564. The result of the second group of observations, made at a distance of 22° from the sun, showed that the spectrum commenced at λ 561, but not so suddenly; its feeble maximum was transferred to about λ 517; from thence it was tolerably uniform to about λ 497, and then it gradually diminished and faded away at G.

The observations made at a distance of 15° from the sun gave λ 562 for the limit of the red end of the spectrum, and G as before for the violet end. But the spectrum did not commence at all suddenly: the stronger maximum was still at λ 517: it was fairly uniform from thence to λ 497, and then faded away.

Observations of twilight are needed to determine whether, as it grows more and more faint, the maximum appears to shift towards the red end of the spectrum or not; if not, the change in intensity of portions of the spectrum of the zodiacal light as observations are made at varying distances from the sun are peculiar to it, and need further investigation.

SOLAR AND STELLAR MOTIONS.—Prof. J. R. Eastman, in his address as retiring President of the Philosophical Society of Washington, delivered December 7, 1889, gave an exhaustive account of the investigations that have been made to determine the co-ordinates of the solar apex and the annual value of the motion of the solar system. His investigations into the relation between stellar magnitudes, distances, and motions, show that, in opposition to the assumption generally accepted, which asserts that the largest stars are nearest the solar system, there is an almost uniformly *increasing* proper motion as the stars grow fainter. Forty-six stars, that is, practically all those whose parallaxes have been well determined, have been tabulated and arranged in five nearly equal groups according to the magnitude of their proper motion. The following table gives the mean results found for each of the groups:—

	Number of Stars in Group.	Mean Magnitude.	Mean Proper Motion.	Mean Parallax.
1st Group	9	5.57	4.93	0.32
2nd "	9	5.59	2.33	0.20
3rd "	9	3.37	1.04	0.20
4th "	9	2.36	0.38	0.16
5th "	10	2.84	0.06	0.13

The mean magnitude of the first two groups is 5.58, and the mean proper motion is 3.63. Of the last three groups the mean magnitude is 2.86, and the mean proper motion is 0.49.

If the 46 stars investigated be arranged according to the magnitude of their parallaxes, it is found that 18 of them have a parallax greater than 0.2. The mean magnitude of these stars is 5.56, and the mean parallax is 0.34. Of the remaining 28 stars the mean magnitude is 2.89, and the mean parallax is 0.11. From this it would appear that, if any law can be formulated from the observed data, it must be that the fainter rather than the brighter stars are nearest the solar system.

DUN ECHT OBSERVATORY.—The Earl of Crawford, in a circular issued on the 29th ult., expresses his thanks for the hearty co-operation he has met with at all hands in his endeavours to advance the science of astronomy. Although some little time will elapse before all the instruments can be removed from Dun Echt to the Royal Observatory at Edinburgh, the former observatory must be looked upon as closed, and the generous donor trusts that the astronomical friends who have for years continued to enrich the library at Dun Echt Observatory with donations of books and pamphlets will extend their liberality

to the new home of the collection at Edinburgh. The important astronomical work done by the Earl of Crawford personally, and at his observatory, has contributed, in no slight degree, to the progress of astronomy, and the very generous gift to the nation of the entire contents of the observatory at Dun Echt is worthy of the man, and appreciated by all friends of the science throughout the world.

MELBOURNE OBSERVATORY.—We have received from Mr. Ellery the volume containing the results of transit circle observations made from the beginning of 1881 to the end of August 1884. The separate results for R.A. and N.P.D. have been taken directly from the transit books, and also the observer's estimates of the magnitude. The places and magnitudes of the stars given in the annual catalogues have been derived from these separate results by taking their arithmetical mean.

GEOGRAPHICAL NOTES.

AT the meeting of the Royal Geographical Society on Monday, Mr. Douglas W. Freshfield read a most interesting paper on "Search and Travel in the Caucasus: an account of the discovery of the fate of the party lost in 1838." He began by acknowledging his obligations to M. de Stael, the Russian Ambassador to the Court of St. James's, the officials at Vladikavkaz, and more particularly to MM. Jukoff and Bogdanoff, of the Russian Survey, for the facilities and assistance given to him and his companions in carrying out the object of his journey. The topographical information accumulated by the surveyors had been placed at his disposal with the greatest readiness, and part of the result might be seen in the great map (6 inches to the mile) of the central group hung on the wall. The heights of the principal peaks were now ascertained. There were eight higher than Mont Blanc, and fifteen of over 15,000 feet. The four highest are Elbruz, Koshtantau, Shkara, and Dychtau. Ushba is 15,600 feet. Mr. Freshfield briefly described the new carriage pass, the Mamison, 9400 feet, from Vladikavkaz to Kutais. Its scenery is finer than that of the Dariel, and the road has been well engineered, but it will shortly fall into ruin unless a service is organized for its maintenance. He referred to the remarkable old Ossete sanctuary of Rekom, at the foot of the Ceja Glacier, and to the tombs found at Chegem, and exhibited a collection of metal and other objects discovered mostly at Styr Degir. In many villages small settlements of "Mountain Jews" were found. There were over 20,000 of this race in the Caucasus, and a work on them has lately been published at Moscow. The author, M. Mirimissoff, states that their beliefs and superstitions are singular, and show Persian influence, but they have had for centuries no connection with the rest of their race, from which they were probably separated at a very early date. The party had crossed five high glacier passes before reaching Suanetia. Here Mr. Freshfield and Captain Powell were the guests of Prince Atar Dadish Kilia, the representative of the family who once ruled Lower Suanetia. He now spends a few months in the summer at his house at Ereri, dispensing hospitality in feudal fashion among his retainers. The population assembles every Sunday for games on the green, and the women sing ballads recounting incidents in local history or tales of love and revenge. The Leila peaks (13,400 feet) south of Suanetia were ascended for the first time. They are pre-eminent in forests and flowers. One of the glaciers falls over a cliff in avalanches into a glen which is a bed of wild roses and yellow lilies, growing often with fourteen blooms on one stalk. From Suanetia to Sukhum Kaleb the travellers forced a way with mules through an almost trackless forest, and down the deserted valley of the Kodor, the region that was once Abchasia. Strange tales are told of the forest, even by Russian officials, who declared that a wild race, without villages, arms, or clothes, haunted its recesses. No one was met, however, but a few hunters and shepherds. But considerable difficulty was met with in forcing a way through the tangle of fallen timber and finding a passage over the torrents, and the native guides employed deserted the travellers before they reached Lata, the first Russian station on the Kodor. Mr. Freshfield proceeded to relate in detail the incidents of the search undertaken by Mr. C. Dent and himself, with the aid of Mr. H. Woolley and Captain Powell, for traces of the fate of the mountaineers, Mr. W. F. Donkin, Mr. H. Fox, and two Meiringen guides, lost in August 1838. It was known, from a note in a diary left by Mr. Fox in a lower