

in Ireland was in all respects a most exceptional one. Some of the migrants appeared unusually early, and all in much larger numbers than Mr. Ellison had ever before observed. On October 8 he saw the first flocks, both of starlings and redwings. On the same day, and for about a week after, immense numbers of golden plovers were passing over, flying towards the west and south-west in large V-shaped strings. This was about the usual time for starlings and redwings, but early for golden plover. On the 11th again both redwings and starlings were constantly passing. On the 16th he observed a great host of fieldfares, many thousands in number, winging their way across the sky towards the south-west. From October 17 to the beginning of November the starling migration was at its height, the flocks being much larger and more numerous than he had ever observed in former years. He saw four within a quarter of an hour on the afternoon of the 18th. At 4 p.m. on the 22nd, the largest flock he ever saw passed over. It was in the form of a column, perhaps nearly a mile long, and must have numbered thousands, spanning the sky from horizon to horizon for more than half a minute, and was followed in a short time by two smaller flocks. All the latter part of October skylarks were from time to time flying over, generally large straggling flocks or scattered individuals, flying nearly out of sight, but their call-notes being distinctly audible. Mr. Ellison hopes that those who are favourably situated for observing the arrival of winter birds will report whether they have noticed a corresponding abundance of migrant this season.

THE new number of *Mind* opens with an able and suggestive article on pleasure, pain, desire, and volition, by Mr. F. H. Bradley. Mr. J. McK. Cattell has an interesting paper on the Psychological Laboratory at Leipzig. Mr. T. Whittaker writes on individualism and State action; and Mr. D. G. Ritchie on origin and validity.

PARIS is soon to have a Museum of Religions. M. Guimet, of Lyons, who has been a great traveller, has been engaged for years past in collecting altars, priests' robes, and other objects relating to religious ceremonies. These objects he presented some time ago to Paris on condition that a building should be specially devoted to them. This building, close to the Trocadéro Palace, has just been finished, and the collection will soon be transferred to it.

THE additions to the Zoological Society's Gardens during the past week include two Spotted Ichneumons (*Herpestes nepulensis*), a — Fox (*Canis* —) from Afghanistan, presented by Lieut.-Colonel Sir Oliver B. C. St. John, K.C.S.I.; a Common Otter (*Lutra vulgaris*), British, presented by Mr. Edward Hart; a Red-throated Diver (*Colymbus septentrionalis*), British, presented by Mr. Charles A. Howell; two Greater Sulphur-crested Cockatoos (*Cacatua galerita*) from Australia, presented by Master Rankin.

OUR ASTRONOMICAL COLUMN.

BRAZILIAN RESULTS FROM THE TRANSIT OF VENUS.—M. Cruls, in a note to the Paris Académie des Sciences, states that the reports of the various expeditions sent out by the Brazilian Government to observe the transit of Venus in 1882 are almost entirely printed, and will shortly appear. Three stations were occupied, viz. S. Thomas in the Antilles, Olinda in Brazil, and Punta-Arenas in the Straits of Magellan. The Baron de Tefé was in command of the first expedition; M. J. d'O. Lacaille of the second, and M. Cruls himself of the third. The duration of the transit at Punta-Arenas was nearly the mean duration, both ingress and egress being slightly accelerated. The two more northern stations had the duration much shortened, ingress being retarded, and egress accelerated. The chief observer at each station was supplied with an equatorial of 6.3 inches aperture; and at S. Thomas two other telescopes of 4.5 and 4.1 inches

respectively were also used. At Olinda likewise there was a second telescope in use, of 4.5 inches aperture. The method of projection was employed in order to get rid of the physiological effects produced by the intensity of the solar light, and in combining the observations made with telescopes of different apertures, weights were given to them proportional to the square of the diameters of the object-glasses, in accordance with the results obtained from the experiments of MM. Wolf and André. The resulting parallax from the internal contacts is 8" 808.

THE ASTEROIDS.—Prof. Daniel Kirkwood, of the Indiana University, has just issued a short essay on the asteroids or minor planets, this group of tiny bodies being entitled on many grounds to more particular consideration than it has yet generally received. The first part of the essay gives a brief sketch of the history of the discovery of the first five asteroids, together with the names of the discoverers and date of discovery of all as yet known to us, and a table giving the elements of their orbits. Prof. Kirkwood makes it clear that the numbers of those still unknown are practically inexhaustible, for if Leverrier's estimate be correct, that the quantity of matter contained in the group cannot be greater than one-fourth the mass of the earth, it would yet require no fewer than 72,000,000 bodies as large as Menippe to make up this amount. Fortunately the rate of discovery appears limited to ten or a dozen per annum, so that there is no immediate danger of our being overwhelmed by the impossibility of following up some few millions of orbits. The second part of the work deals with questions relating to the origin of the group, and with certain relationships apparent in their orbits, particularly with regard to the irregular distribution of the asteroids in their ring, certain districts being left entirely void, viz. those where the asteroid would have a period commensurable with that of Jupiter. Prof. Kirkwood has on former occasions repeatedly shown how Jupiter would tend to eliminate bodies revolving in these positions by increasing the eccentricities of their orbits until their perihelion distances fell within the body of the sun itself, and he has accounted for the gaps in the ring of Saturn upon a similar principle. Prof. Kirkwood is of opinion that several of our periodic comets may have been originally members of the asteroid family. All the thirteen comets whose periods correspond to mean distances within the asteroid zone have direct motion, and inclinations similar to those of the minor planets, and their eccentricities are generally less than that of other known comets; whilst five of these comets have periods respectively corresponding to some of the most marked gaps in the asteroid zone.

Prof. Kirkwood makes no reference to the importance of certain members of the group as affording means for the determination of the solar parallax, which many astronomers will consider to be their most useful function, and as compensating for the enormous labour, both of observation and computation, involved in following the paths of so great a number of wanderers. And it would have been exceedingly useful if he had supplemented his other tables by one showing those asteroids which have only been observed during one opposition. Some of those theoretically the most interesting have not been observed for several years, and are practically lost to us, and it would seem a matter of more pressing importance at the present time that these should be picked up again, if possible, rather than fresh additions should be made to a list already unmanageably long.

OLBERS' COMET.—The following ephemeris for Berlin midnight, by Dr. Krueger (*Astr. Nach.* No. 2818), is in continuation of that given in NATURE for 1887 December 15:—

1888.	R.A.	Decl.	Log r.	Log Δ.	Bright- ness.
	h. m. s.	°			
Jan. 6...	16 50 20	... 1 22.7 S.	... 0.2486	... 0.3821	... 0.45
8...	16 54 8	... 1 43.4 S.			
10...	16 57 51	... 2 3.4 S.	... 0.2583	... 0.3854	... 0.43
12...	17 1 29	... 2 23.6 S.			
14...	17 5 3	... 2 41.2 S.	... 0.2679	... 0.3884	... 0.40
16...	17 8 31	... 2 59.2 S.			
18...	17 11 55	... 3 16.6 S.	... 0.2773	... 0.3910	... 0.38
20...	17 15 14	... 3 33.4 S.			
22...	17 18 29	... 3 49.6 S.	... 0.2866	... 0.3932	... 0.36

The brightness on August 27 is taken as unity. Dr. E. Lamp succeeded in seeing the comet for a short time on December 12, and concludes, from a very rough comparison with a star that the ephemeris then required a correction of + 8s. in R.A., but was practically right in Decl.

THE CLINTON CATALOGUE.—The *Sidereal Messenger* for December announces that the great catalogue of 30,000 stars, upon which Dr. Peters and his assistant, Prof. Borst, have been engaged for several years past, is virtually completed, and ready for the press, and its publication is expected during the present winter. In the prosecution of this work Prof. Borst has gathered the stars from the various astronomical publications of the last fifty years, and reduced them to the epoch of the forthcoming catalogue.

OCCULTATIONS OF STARS BY PLANETS.—Herr A. Berberich calls attention in the *Astronomische Nachrichten*, No. 2814, to the importance of observations of occultations of stars by the planets, and supplies a list of stars which may possibly be occulted by either Venus, Mars, Jupiter, or Saturn, during the course of the present year. Such observations have been extremely rare, yet they would prove extremely important, for they would throw light on the extent and density of the planetary atmospheres, and would afford a means in the cases of Mars and Venus for the determination of parallax and diameter. Herr Berberich adds that in the case of the three outer planets the occultation of a star by the primary would afford a specially favourable opportunity for the determination of the positions of the satellites, since micrometer measures of their places as referred to the occulted star would be free from many errors to which the direct comparison of the planet and its satellites is exposed.

The following stars may possibly undergo occultation during the next fortnight:—

Planet.	G.M.T. of Con- junction in R.A.		Star.	Mag.	Pl - *	Δδ	Max Duration.
	h. m.	o					
♀	Jan. 5	16 29'2	S.D. - 17 No. 4187	9.7	-0.13	6.0	
♀	9	18 1.4	18	4279	9.5 + 1.05	5.8	
♂	12	3 41.4	4	3445	9.3 - 0.18	7.4	
♂	12	8 32.3	19	4401	9.3 + 0.84	5.7	
♀	14	18 40.8	19	4441	9.5 - 0.19	5.6	
♀	15	1 31.9	20	4446	9.5 + 0.38	5.5	
♀	17	23 22.5	20	4635	9.3 - 0.57	5.4	

The maximum duration is the interval between immersion and emersion for a central occultation.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 JANUARY 8-14.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on January 8

Sun rises, 8h. 7m.; souths, 12h. 6m. 49.1s.; sets, 16h. 7m.; right asc. on meridian, 19h. 16.8m.; decl. 22° 17' S. Sidereal Time at Sunset, 23h. 18m.

Moon (New on January 13, 9h.) rises, 2h. 14m.; souths, 7h. 34m.; sets, 12h. 44m.; right asc. on meridian, 14h. 43.4m.; decl. 10° 21' S.

Planet.	Rises.		Souths.		Sets.		Right asc. and declination on meridian.	
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	
Mercury..	7 55	11 40	15 25	18 50.0	24 27	5.0	27 S.	
Venus.....	4 36	9 1	13 26	16 10.3	18 29	5.0	29 S.	
Mars.....	0 11	5 53	11 35	13 1.9	4 14	5.0	14 S.	
Jupiter...	4 16	8 38	13 0	15 47.4	19 4	5.0	4 S.	
Saturn....	17 28*	1 19	9 10	8 27.1	19 39	5.0	39 N.	
Uranus...	0 23	5 55	11 27	13 4.3	6 8	5.0	8 S.	
Neptune..	12 51	20 31	4 11*	3 42.5	17 56	5.0	56 N.	

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Occultation of Star by the Moon (visible at Greenwich).

Jan.	Star.	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image.	
					h. m.	h. m.
9	η Libræ	6	6 18	6 46	341	298
9	II	—	—	—	—	—
10	o	—	—	—	—	—

Jupiter in conjunction with and 4° 12' south of the Moon.
Venus in conjunction with and 2° 16' south of the Moon.

Variable Stars.

Star.	R.A.		Decl.	h. m.
	h. m.	o		
U Cephei ...	0 52.4	81	16 N.	Jan. 10, 22 22 m
ζ Geminorum ...	6 57.5	20	44 N.	9, 3 0 m
R Canis Majoris...	7 14.5	16	12 S.	11, 22 53 m
U Monocerotis ...	7 25.5	9	33 S.	13, 2 9 m
S Cancrī ...	8 37.5	19	26 N.	11, m
R Leonis ...	9 41.5	11	57 N.	9, 23 12 m
R Ursæ Majoris...	10 36.7	69	22 N.	8, m
T Ursæ Majoris ...	12 31.3	60	6 N.	12, m
W Virginis ...	13 20.3	2	48 S.	8, 22 0 m
δ Libræ ...	14 55.0	8	4 S.	11, 4 34 m
U Coronæ ...	15 13.6	32	3 N.	8, 0 45 m
U Ophiuchi ..	17 10.9	1	20 N.	8, 4 38 m
T Vulpeculæ ...	20 46.7	27	50 N.	Jan. 11, 0 0 m
Y Cygni ...	20 47.6	34	14 N.	12, 1 0 M
W Cygni ...	21 31.8	44	53 N.	10, 21 7 m
δ Cephei ...	22 25.0	57	51 N.	13, 21 0 m
				14, M
				8, 4 0 M
				11, 22 0 m

M signifies maximum; m minimum.

Meteor-Showers.

	R.A.	Decl.	
Near ε Virginis...	174	9 N.	January 11.
ζ Boötis ...	220	14 N.	Very swift; streaks.
β Boötis ...	222	42 N.	Very swift; streaks.

DUNÉR ON STARS WITH SPECTRA OF CLASS III. 1

I.

IN publishing a few days before his death the last part of his discoveries relating to the spectra of stars of the third class, D'Arrest pronounced the opinion that henceforward there would be nothing essential to add to the knowledge then possessed of the stellar spectra of this class in the northern heavens. When D'Arrest died, 123 well-developed objects of Class III.a were known, and counting all the objects known, 150; the stars known in Class III.b were 23. Actually, the well-developed stars of III.a are 214, and if all are reckoned, 475; the stars of III.b are 55 at least.

The number of objects in Class III. with which we are acquainted has been tripled by recent researches, but, besides, the relation between the numbers of the stars in the two lower classes has been considerably altered, considering that at present there are 8.5 stars III.a instead of 6.5, to 1 star III.b. However, we should commit a serious error if we drew the conclusion that in reality the spectra III.b were not more than nine times rarer than III.a. On account of the enormous width of the bands, one is able without any difficulty to recognize the nature of a spectrum III.b in very faint stars, which one is not able to do in III.a, unless in the rare objects of this class in which the bands are more marked and broader than usual.

I find this opinion confirmed by the fact that the researches of M. Vogel give more than 200 new spectra III.a, and have scarcely led to an acquaintance with one new spectrum III.b. It is very probable therefore that we are already acquainted with all these stars to the magnitude of 7.5 inclusive; this is rendered still more probable by the following table, which gives the number of the stars III.a and III.b belonging to different magnitudes:—

Magnituds.	Class III.a.		Class III.b.	
	Observed.	Calculated.	Observed.	Calculated.
1.0-1.9	2	1	0	0
2.0-2.9	5	3	0	0
3.0-3.9	9	11	0	0
4.0-4.9	31	28	0	1
5.0-5.9	88	90	2	2
6.0-6.9	134	380	11	8
7.0-7.9	151	—	18	24
8.0-8.9	37	—	14	—
9.0-9.9	18	—	10	—

* We have already referred generally to M. Dunér's important memoir published in the Transactions of the Swedish Academy. We now give a translation of his general conclusions.—Ed.