we learn that during 1886 Mr. Percy Smith continued the measurement of position-angles and distances of double stars, 88 sets of measures having been secured. These stars have been divided into three categories for future re-measurement, viz. rapid binaries, to be observed every year; slower binaries, to be observed every 4 years; and long-period binaries, to be observed every 10 years. Mr. Seabroke himself has continued the measurement of the motion of stars in the line of sight with the spectroscope on the reflector, and has completed 100 sets of measures. These observations, together with the corresponding ones for previous years, have been published in the January number of the *Monthly Notices*.

DISCOVERY OF A NEW COMET, 1887*d* (BARNARD 2).—A new comet was discovered on February 15 by Mr. E. E. Barnard, Nashville, Tennessee. It was very faint, and was moving rapidly in a north-westerly direction. At midnight (local time) its position was R.A. 8h. 4m., Decl. 16° 10′ S.

PROBABLE NEW VARIABLE.—We learn from Circular No. 15 of the Liverpool Astronomical Society, that Mr. Backhouse finds 28 Andromedæ to be probably variable within small limits. The observations yet obtained are insufficient to fix the period, which must, however, be short. It is possible that the star is of the Algol type.

NAMES OF MINOR PLANETS.—Herr J. Palisa has named Minor Planet No. 256 Walpurga.

BRIGHTNESS AND MASS OF BINARY STARS.—The current number of the *Observatory* contains an article on this subject by Mr. W. H. S. Monck, in which he attempts to deduce the relative brilliancy of those binaries for which the orbits are best determined. Assuming that the mass of the companion-star is very small as compared with that of its primary, he shows that the relative brilliancy of any two pairs of binaries may be found by the following formula:—

$$\frac{k_1}{k_2} = \left(\frac{I_1}{I_2}\right) \cdot \left(\frac{P_1}{P_2}\right)^{\frac{4}{3}} \cdot \left(\frac{a_2}{a_1}\right)^2,$$

where I_1 I_2 stand for the total amount of light, as determined photometrically, which we receive from the two pairs respectively; P_1 P_2 for their periods; and a_1 a_2 for the angular radii of their orbits. By, apparently, a printer's error, the index of $\left(\frac{P_1}{P_2}\right)$ is omitted in the formula in the *Observatory*. Adopting ξ Ursæ Majoris as his unit of comparison, Mr. Monck finds the brilliancy of γ Leonis 93·29; of Castor, 38·24; δ Cygni, 35·52; of Sirius, 7·17; 42 Comæ, 2·79; 6 (*p*) Eridani, 0·20; and 61 Cygni, 0·08. It is noteworthy that Prof. E. C. Pickering, in a paper which appeared in the Proceedings of the American Academy of Arts and Sciences, vol. viii. No. 1, obtained very similar results for many of the same stars, but by a somewhat different process. In both lists γ Leonis figures at the head, followed by Castor and δ Cygni, whilst the smallest values are found for *p* Eridani and 61 Cygni. The weak point in Mr. Monck's computation is the assumption that the mass of the smaller star is comparatively insensible; the near equality in magnitude of many of the binaries selected would seem to indicate that the assumption was not a safe one. Mr. Monck repeats Prof. Pickering's suggestion that series of careful measurements should be made between each component of the binary systems and some neighbouring stars, so that the ratio of the masses of the two components may be determined. It is to be hoped that some double-star observers may be induced to take up this interesting subject, now that attention has again been called to its importance. The research might also possibly supply us in some cases with a determination of the distance of the binary.

THE LIVERPOOL ASTRONOMICAL SOCIETY.—The Pernambuco branch of this Society now numbers more than eighty members, and has been accorded permission to elect a local executive. The Emperor of Brazil has been elected a member of the Society.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1887 *FEBRUARY* 27—*MARCH* 5

(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 February 27

Sun rises, 6h. 52m.; souths, 12h. 12m. 56·0s.; sets, 17h. 34m.; decl. on meridian, 8° 21′ S.: Sidereal Time at Sunset, 4h. 3m.

Moon (at First Quarter March 3) rises, 8h. 50m.; souths, 15h. 30m.; sets, 22h. 21m.; decl. on meridian, 7° 9′ N.

Planet	Rises	Souths	Sets	Decl. on meridian
	h. m.	h. m.	h. m.	° ′
Mercury ...	... 7 17 ...	13 13 ...	19 9 ...	1 36 S.
Venus ...	... 7 34 ...	13 31 ...	19 28 ...	1 23 S.
Mars ...	... 7 19 ...	13 1 ...	18 43 ...	4 11 S.
Jupiter...	... 22 48* ...	3 49 ...	8 50 ...	12 8 S.
Saturn...	... 12 30 ...	20 39 ...	4 48* ...	22 25 N.

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

Occultations of Stars by the Moon (visible at Greenwich)

March	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image
			h. m.	h. m.	° °
2 ...	Aldebaran	... 1 ...	17 47 ...	18 4 ...	182 210
4 ...	130 Tauri ..	... 6 ...	2 30 ...	2 38 ...	43 25

March	h.	
3 ...	3 ...	Mercury at least distance from the Sun.
5 ...	11 ...	Mercury at greatest elongation from the Sun, 18° east.
5 ...	14 ...	Saturn in conjunction with and 3° 29′ north of the Moon.

Variable Stars

Star	R.A.	Decl.			
	h. m.	° ′		h. m.	
U Cephei	0 52·3 ...	81 16 N. ...	Mar. 2,	19 57	*m*
Algol	3 0·8 ...	40 31 N. ...	Feb. 28,	2 54	*m*
			Mar. 2,	23 43	*m*
U Monocerotis ...	7 25·4 ...	9 33 S. ...	Feb. 28,		*m*
T Canis Minoris...	7 27·7 ...	11 59 N. ...	,, 28,		*M*
S Cancri	8 37·5 ...	19 26 N. ...	Mar. 2,	23 26	*m*
R Leonis	9 41·5 ...	11 57 N. ...	,, 2,		*m*
U Virginis	12 45·4 ...	6 10 N. ...	,, 5,		*m*
W Virginis	13 20·2 ...	2 48 S. ...	,, 4,	0 0	*m*
S Boötis	14 19·3 ...	54 20 N. ...	,, 2,		*M*
δ Libræ	14 54·9 ...	8 4 S. ...	,, 3,	0 5	*m*
U Coronæ	15 13·6 ...	32 4 N. ...	Feb. 27,	21 2	*m*
U Ophiuchi... ...	17 10·8 ...	1 20 N. ...	Mar. 3,	1 8	*m*
		and at intervals of		20 8	
W Sagittarii ...	17 57·8 ...	29 35 S. ...	Mar. 3,	4 0	*m*
R Scuti	18 41·5 ...	5 50 S. ...	,, 3,		*M*
β Lyræ...	18 45·9 ...	33 14 N. ...	,, 5,	20 0	*M*
R Lyræ	18 51·9 ...	43 48 N. ...	Feb. 28,		*M*
δ Cephei	22 25·0 ...	57 50 N. ...	Mar. 2,	23 0	*M*

M signifies maximum; *m* minimum.

Meteor-Showers

Amongst the meteor-showers of the season are the two following:—Near δ Virginis, R.A. 192°, Decl. 1° N; near ξ Sagittarii, R.A. 280°, Decl. 17° S. The latter radiant gives very swift streak-bearing meteors.

GEOGRAPHICAL NOTES

TWO letters have been received in Vienna from Dr. O. Lenz, dated, one from Lake Tanganyika in September, and the other from the River Shiré in December. This indicates that the Austrian Expedition has taken an unexpected route to the east coast. When Lenz and his companions left Kasonge, on the Upper Congo, on June 30, they made for Tanganyika, arriving at Capt. Hore's station on the west shore on August 7. Crossing to Ujiji, Dr. Lenz found that it was impossible to proceed northwards to the Albert Nyanza and Emin Pasha, on account of the Arab raids and the state of things in Uganda. Instead, therefore, of proceeding eastwards to Zanzibar, he travelled, by land apparently, to the south end of Lake Tanganyika, along the Stevenson road to Lake Nyassa, down that lake to the Shiré, and thence by the Zambesi to Quillimane. The two letters will be published in the next number of the *Mitteilungen* of the Vienna Society, and will doubtless contain a good deal of information of interest.

TIPPOO TIP, about whom we have heard so much recently in connection with the Emin Pasha expedition, seems to be rather an intelligent man, and even finds time in the midst of his ivory raids to attend to the interests of science. He recently came upon a remarkable tribe on the Congo, to the north of Nyangwé, who do a great deal of work in copper, and whose inlaid work in that metal is of a highly artistic character. He sent several specimens to an English friend at Zanzibar, who has brought them with him to this country. Still more interesting is the discovery by Tippoo, among the same people, of what may be regarded as the first steps towards a currency. Spears are naturally among the most valuable articles which such a people possess, and, as a matter of fact, the value of everything is reckoned by them in terms of spears. Not only so, but they have actually reached the stage of a conventional currency. Enormous spear-heads of very thin copper are made, some six feet in length, which are passed from hand to hand, just as bank-notes are with us. These spears, for example, in the purchase of ivory, are valued at £200—their intrinsic value being probably not so many pence. We are glad to know that a specimen is likely to be deposited in the British Museum. Readers of Schweinfurth's "Heart of Africa" will remember that among the Niam-Niams hoes are used for a similar purpose, only after a reverse fashion; tiny hoes, what we should call mere toys, are in common use as money.

THE principal article in the new number of *Petermann's Mitteilungen* is a summary of the journey across Africa from Mossamedes to Quillimane, by the Portuguese travellers, MM. Capello and Ivens in 1884-85. The most valuable geographical work accomplished by the travellers was the exploration of the interesting region lying between the Upper Zambesi and Lake Bangweolo. The important north-east tributary of the Zambesi, the Kabompo, was traced to its source in the closest proximity to the sources of the Lualaba, one of the most important contributories to the Congo. From here a zigzag was made eastwards and southwards, across the head-waters of many affluents of the Zambesi, until that river was reached about 16° S. and 29° E. MM. Capello and Ivens took very numerous astronomical and meteorological observations during their journey, as well as observations for terrestrial magnetism. The complete narrative of the journey, with ample supply of maps and scientific appendixes, has just been published in Portuguese. The same number of the *Mitteilungen* contains a large collection of barometric data on the hypsometry of South America, mainly Peru and Bolivia.

PROF. L. BODIO sends to the *Bollettino* of the Italian Geographical Society for December 1886 an important paper on Italian emigration, which he divides into two categories—permanent and temporary. The latter, which is essentially of a periodical character, varies from 80,000 to 100,000 persons yearly, and consists chiefly of stonemasons, bricklayers, navvies, and other day-labourers from the northern provinces of Piedmont, Lombardy, and Venice, who seek casual employment on the public works in Austria, France, Germany, Switzerland, Corsica, and elsewhere. They generally leave their homes in the spring, returning with their earnings towards the close of autumn, and enjoy the reputation of sober, steady, intelligent workmen. The permanent movement, which alone constitutes emigration properly so called, has already risen during the last twenty years from less than 20,000 to about 80,000 annually, and is directed from the same northern provinces, and from Liguria and parts of Naples, almost exclusively to the Argentine States and some other parts of the New World. The emigrants, who sail either directly from Genoa, Naples, and Palermo, or from the French ports of Marseilles, Bordeaux, and Havre, comprise between 60 and 80 per cent. of male adults, the small minority consisting of women and children. They represent nearly all social conditions, the peasant class, however, largely predominating in South America. For the year 1885 the returns show 57,827 to the Argentine Republic; 15,485 to the United States; 12,311 to Brazil; and 1477 to Uruguay. The chief inducements to leave their native land and settle abroad appear to be poverty, the desire to better their fortunes, and the direct encouragement of friends and relatives who have prospered in their new homes across the Atlantic. Very few ever return to reside permanently in the mother country.

THE Germans are losing no time in making themselves acquainted with the section of New Guinea which they have annexed. The Empress Augusta River, close to the western boundary of the German territory, was recently navigated by Admiral von Schleinitz and Dr. Schrader, in the steamer *Ottilie*, for a distance of 224 miles. It being the dry season, the river was too shallow for further navigation by the steamer. The ship's steam-launch, however, proceeded 112 miles further, to a point situated in 4° 16′ S. and 141° 50′ E.; judging from the quantity of water in the river the voyage could have been continued 50 miles further, but fuel ran short. For over 200 miles from its mouth the river flows through extensive plains; then its course suddenly changes, and it assumes the character of a mountain stream, forcing its way through hills of gneiss, mica-slate, and quartz; but the velocity of its current remains uniform. The settlements on its banks were only found at long intervals.

ON THE CONSTITUTION OF THE NITROGENOUS ORGANIC MATTER OF SOILS

THE organic matter of soils, the residue of the limited oxidation of vegetable and animal matter, has appeared a subject so complex and obscure, and promising the investigator so little of definite result, that it has received but scanty attention. The researches made have been chiefly confined to a study of the non-nitrogenous humic acids, the nitrogenous organic bodies present in soil have been scarcely at all investigated. The agricultural chemist has indeed not unfrequently spoken and written as if such investigation was superfluous, holding that the nitrogenous organic bodies contained in humus were not capable of serving as food for farm crops until they had undergone a further change into ammonia, and finally into nitric acid. A valuable paper, "Sur les principes azotés de la terre végétale," by Berthelot and André, which appeared in the *Comptes rendus* of December 6, has called attention to this neglected subject, and has done much to clear up our ideas respecting the constitution of the nitrogenous organic matter contained in soils. Like many other epoch-making treatises, the paper in question brings forward facts which have, in part, been already established by earlier investigators; but in no earlier investigation, as far as I am aware, have the facts appeared in such a striking aspect, nor have the conclusions which flow from them been clearly set forth.

Berthelot and André conclude that the nitrogenous matter of soils is mainly composed of insoluble amides;[1] these amides are decomposable by the action of acids, alkalies, and to a less extent by water, into ammonia and soluble amides (amido-acids), in the same manner as other bodies of the same class with which the chemist is already quite familiar. The behaviour of soil towards hydrochloric acid furnishes the main facts on which the French chemists base their conclusions. They find that when a soil tolerably rich in nitrogen (0·174 per cent.) is treated with dilute hydrochloric acid, a quantity of ammonia is found in the solution, which is greater as the strength of the acid is increased, as the time of its action is lengthened, and especially as the temperature is raised; two hours' boiling produces, in fact, with various strengths of acid, four, five, and six times as much ammonia as five days' action in the cold. Besides ammonia, there is found in the acid solution a considerable quantity of some nitrogenous organic body, the amount of which rises and falls with the quantity of the ammonia. In cases in which the action of the acid was carried farthest, the nitrogen of the soluble organic body bore to the nitrogen of the ammonia a proportion of about 3 to 1. The extent to which the nitrogenous matter of the soil was attacked by the hydrochloric acid was very considerable; boiling 200 grammes of soil for two hours with 400 cubic centimetres of water, and 100 cubic centimetres of strong hydrochloric acid, resulted in the solution of 31·8 per cent. of the soil nitrogen, and the conversion of 7·1 per cent. of it into ammonia. The nature of the nitrogenous organic matter found in solution in the hydrochloric acid has apparently not been particularly investigated by Berthelot and André, but the whole reaction is so characteristic of the splitting up of an amide that their view of the constitution of this body becomes highly probable.

Investigations earlier than those of Berthelot had shown that hydrochloric acid dissolves nitrogenous matter from the soil. Loges has pointed out that this solution contains a nitrogenous body precipitable by phospho-tungstic acid. The nitrogen and carbon in this precipitate had a relation of about 1 to 6·2. My own experiments show that a nitrogenous body precipitable by phospho-tungstic acid is also extracted from soil by a cold

[1] The presence of amides in soil was long ago inferred by S. W. Johnson ("How Crops Feed," p. 247), from the reactions of soil with which chemists were then acquainted.