Planet.	Rises.	Souths.	Sets.	Right asc. and declination on meridian.	
	h. m.	h. m.	h. m.	h. m.	° ′
Mercury..	5 28 ...	10 31 ...	15 34 ...	14 22·4 ...	11 43 S.
Venus ...	10 27 ...	14 7 ...	17 47 ...	17 59·6 ...	25 7 S.
Mars ...	11 41 ...	15 34 ...	19 27 ...	19 26·1 ...	23 28 S.
Jupiter ...	8 50 ...	12 53 ...	16 56 ...	16 45·5 ...	21 54 S.
Saturn ...	22 15* ...	5 41 ...	13 7 ...	9 31·6 ...	15 38 N.
Uranus ...	3 56 ...	9 23 ...	14 50 ...	13 14·7 ...	7 15 S.
Neptune..	16 22* ..	0 7 ...	7 52 ...	3 57·1 ...	18 41 N.

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

Variable Stars.

Star.	R.A.	Decl.		
	h. m.	° ′		h. m.
S Ceti	0 18·4 ...	9 57 S. ...	Nov. 19,	*M*
U Cephei	0 52·4 ...	81 16 N. ...	,, 20,	0 47 *m*
Algol	3 0·9 ...	40 31 N. ...	,, 19,	22 11 *m*
			,, 22,	19 0 *m*
λ Tauri...	3 54·5 ...	12 10 N. ...	,, 18,	22 59 *m*
			,, 22,	21 52 *m*
ζ Geminorum ...	6 57·5 ...	20 44 N. ...	,, 18,	23 0 *m*
			,, 23,	23 0 *M*
R Canis Majoris ...	7 14·5 ...	16 12 N. ...	,, 18,	5 5 *m*
W Virginis	13 20·3 ...	2 48 S. ...	,, 23,	1 0 *M*
S Coronæ	15 16·8 ...	31 46 N. ...	,, 22,	*m*
β Lyræ...	18 46·0 ...	33 14 N. ...	,, 18,	0 0 *m*
R Lyræ	18 51·9 ...	43 48 N. ...	,, 18,	*m*
T Vulpeculæ ...	20 46·7 ...	27 50 N. ...	,, 21,	0 0 *M*
Y Cygni	20 47·6 ...	34 14 N. ...	,, 19,	2 30 *m*
			,, 22,	2 24 *m*
δ Cephei	22 25·0 ...	57 51 N. ...	,, 18,	4 0 *m*
			,, 19,	19 0 *M*

M signifies maximum ; *m* minimum.

Meteor-Showers.

	R.A.	Decl.	
Near κ Leonis	140° ...	27° N. ...	Very swift.
,, θ Ursæ Majoris ...	143 ...	50 N. ...	,, ,,
,, λ Ursæ Majoris ...	154 ...	40 N. ...	Swift ; streaks. The *Leo Minorids.*

GEOGRAPHICAL NOTES.

WE are glad to learn from Denmark that Dr. Nansen has been successful in crossing Greenland. Dr. Nansen, it will be remembered, left the ship in a boat off the south-east coast of Greenland, 65° 2′ N., on July 17. He knew his party had to sail south among the ice for twelve days before they succeeded in landing to the north of Cape Farewell in lat. 61°. As he came out at Godthaab, on the opposite coast, in October, he has taken about three months on the journey, which was made in a line about sixty miles south of that he intended to follow. The section crossed by Dr. Nansen's expedition is in the south and narrow part of Greenland, Nordenskjöld's route having been much farther north, and almost in the centre of the land. Unfortunately, Dr. Nansen just missed the last ship from Greenland to Europe, so that he will have to remain at Godthaab till May next. Until then we must wait for full details.

THE paper read at the first meeting this session of the Royal Geographical Society, on Monday night, was by Mr. H. H. Johnston, H.M. Vice-Consul for the Oil Rivers, on the Niger Delta. The "Oil Rivers," Mr. Johnston said—so called from the fact of their producing the bulk of the palm-oil exported from West Africa—are the main rivers, creeks, and estuaries lying between the eastern boundary of the British colony of Lagos and the northern frontier of the German Protectorate of the Cameroons. They are chiefly branches of the Niger, and form the Niger delta, but some few of them have sources independent of that great stream ; although close to the sea-coast, within tidal influence, the estuaries of these rivers are interconnected by a wonderful network of more or less navigable creeks. This system of natural canalization is here and there blocked with vegetable growth, sandbanks, fallen trees, or artificial obstacles constructed by quarrelsome or timid natives ; but with a relatively small amount of labour and at a moderate cost, the creeks in places might be deepened and cleared, and inland navigation rendered practicable between Dahome and the Cameroons Protectorate. Mr. Johnston then gave a graphic description of these rivers as they present themselves to one arriving on the coast from Europe. Arriving from Europe by sea, it is generally by the soundings and discoloured appearance of the water that we become aware of the near approach to land, rather than by sighting any part of the shore. When within a few miles of the mouth of one of these rivers, the low coast-line is at first indicated by isolated trees, which appear islets of forest unconnected with each other, and distorted by the mirage of each horizon. Gradually these islets, which are really the loftier trees of the fringe of coast forest, become united in one line of purple green, divided only by the imposing gate of the estuary, for which our ship is bound. The bar of the river may be—as in the case of Old Calabar and Bonny—so deep as to be without danger, or it may be relatively shallow, as at Opobo or Akasa. Once over the bar and within the estuary, we find ourselves surrounded by a lake-like expanse of smooth water, the shores of which are fringed with lofty mangroves with their ghastly white blood-streaked trunks—streaked where the bark has been torn or frayed—and their graceful poplar-like foliage of a sad, dull, yellow-green. Behind the mangroves, however, generally show the dark and dense masses of inland forest, growing where the land has acquired firmness and lies just above the limits of high tide. As far as can be seen from the ship's deck, all and everything that is not yellow water is unvarying mangrove. As you ascend the river further and further from the sea, the mangrove loses its exclusive possession of the shores, even if this possession be not here and there broken by little islets of firm land covered with varied vegetation, and generally the sites of villages. Almost before the water has ceased to be brackish, the Pandanus or screw-pine begins to oust the mangrove, and below its fantastic whorls of spiny leaves the lovely Lissochilus orchids conceal the black mud with their leaves, and rear their stout flower-stems to a height of 6 or 7 feet. As the river is ascended still further, though the banks continue marshy, the now perfectly fresh water enables a varied forest to replace the mangrove and Pandanus, and here perhaps the most extravagant development of vegetation may be seen, recalling past geological epochs rather than the poor and mediocre aspects of Nature at the present time. There is not one prominent kind of tree, but an infinite variety of kinds. There is every type of foliage and every shade of green. At the base of the forest on the water-line grow great Arums of the genus *Cyrtosperma*, with flower spathes of pale green streaked with purple red. Above the Arums gleam out the white bracts of a species of *Mussaenda*, while higher up another *Mussaenda* exhibits huge creamy-white flowers without any bracts at all, and yet another species of this beautiful genus has blossoms of a vivid scarlet. Over the lower branches of the trees hangs a thick green veil of convolvulus, dotted at intervals with large mauve flowers. The Raphia palms are also a characteristic of this river-side forest. Ascending this typical river still further, the marshy banks gradually become firm dry land, and the ground even rises from the water into wooded heights. Gradually the river narrows, and the banks increase in height, and red clay now gives place to outcropping rock. Looking interiorwards beyond the vista of the winding river is the exhilarating prospect of a faint blue range of hills. All influence of the tide has ceased, and the current becomes more rapid. It may be hours, or it may be days or weeks, before we reach the outlying spurs of the first range of hills, the first ascent to the central plateau, over the rapids and falls which mark the change from the interior to the coast region. Here you are out of the forest region of West Africa, in the great park-lands of the interior. Mr. Johnston then went on to describe in detail some of the more important places and districts comprised within the British Protectorate of the Niger Territories.

IN a paper read before the last meeting of the Berlin Geographical Society, Dr. von der Steinen described his second exploration on the Xingu, which began at Rio Janeiro in February 1887, and ended at Cuyaba, the capital of Matto Grosso, on December 31 last. The traveller summed up the main results of his journey thus : the topographical survey of the region through which he passed, numerous physical measurements, a complete grammar of the Bakairi of the Xingu, various vocabularies, and a rich collection of the most varied ethnological objects. During his long residence amongst the Xingu Indians, with whom he was on the most friendly and familiar terms, he was enabled to obtain a deeper insight into the manners and ideas of primitive man in the early stages of his culture than any other traveller. Unfortunately, a chest containing his geological specimens was lost, and many of the photographs were injured.

TO the November number of *Petermann's Mitteilungen* Herr von Hesse-Wartegg contributes a paper on Lake Tacoragua, in Northern Venezuela, one of the few fresh-water lakes in South America. The oscillation in the extent of the lake is undoubted, according to the writer. Humboldt found it 56 kilometres long, and Herr von Hesse-Wartegg only 49. Yet, while the former estimated the area of the lake at 424 square kilometres, the latter gives it at 587. The author gives many interesting details, not only about the lake, but also about the region in which it is situated. To the same number Dr. O. Krümmel contributes a paper, in which he endeavours to solve the old problem of the Euripus.

THE last supplementary issue (No. 91) of *Petermann's Mitteilungen* contains, according to its title, an account of a journey from Hankow to Soochow, and of journeys in Central and Western China between 1879 and 1881. The contents of this particular paper are misdescribed, for it contains only the record of a journey in 1875 from Shanghai to Hankow on the Yang-tsze, thence by the Han River through the Hupeh, Honan, and Shensi provinces to Lanchow in Kansu, and thence to Soochow, close to the Great Wall and the Mongolian deserts, where Herr Michaelis, the writer, remained for some time, and carried out certain explorations in the neighbourhood. Possibly another part or other parts are to follow, of which there is at present no indication. Herr Michaelis was employed in 1874 as a mining expert by the late Viceroy and General Tso Tsung Tang, who had just then chased the Mahommedan rebels out of the Shensi and Kansu provinces, and was about to begin his famous march to Kashgar. He was to investigate the region both within and without the Great Wall for mineral deposits, and especially for gold. Herr Michaelis met Count Szchenyi and his party in Soochow, and naturally a good deal of the ground he traversed has already been described by Lieut. Kreitner, who was surveyor to the Szchenyi Expedition, in his well-known book, "Im Fernen Osten." The paper is accompanied by three excellent route maps.

MOLECULAR PHYSICS: AN ATTEMPT AT A COMPREHENSIVE DYNAMICAL TREATMENT OF PHYSICAL AND CHEMICAL FORCES.[1]

IV.

§ 16. *Electrical Actions.*

IT follows from the principle of the conservation of energy that the processes which give rise to electrical excitation can themselves be called into play by electrical action.

The heating of a conductor by the passage of an electric current is easily explained on the author's theory that electrical conduction is effected by means of molecular vibrations. The electric spark he considers to be due to the separation of particles of the conductor heated in this manner.

The author explains the Peltier effect in the following manner. Let a closed metallic circuit be formed, consisting of two metals, soldered together at the points I. and II., and suppose the circuit to be traversed by a current flowing through the junction I., from the less easily excited metal A to the more easily excited metal B. The molecules of the metal A will then, by hypothesis, easily be thrown into vibration; the metal A will therefore be more heated than B, and will, moreover, be a worse conductor of heat than B. The heat excited in A at the junction I. will therefore be carried to warm the junction II. in the same direction as the current; it will then accumulate at this junction, for A, being the worse conductor, will carry away less heat from the junction II. than is carried to it through B. The junction II. will therefore be heated, while the junction I. will be cooled.[2]

The direct production of light by electrical action has already been considered in § 14 (October 11, p. 581). It is clear that secondary luminous phenomena may also come into play.

Both chemical combination and decomposition may be effected by means of electrical action. The author selects, as an example of the former, the combination of a mixture of oxygen and hydrogen to form water when traversed by electric sparks, which he considers to be due to the absorption by the molecules of the radiant electrical energy proceeding from the positive pole. The motion of the atoms would be accelerated, and the number of impacts increased, giving rise to a series of phenomena similar to those described in § 8[3] (September 6, p. 460). The internal vibrations of the newly-formed molecule will tend towards a steady state, in which the internal energy is as small as possible. Hydrogen and oxygen will unite to form water, supposing the molecules of the latter to be less electrically sensitive than those of its constituents. We should therefore conclude, from the fact that combination occurs under these circumstances, that water is only very slightly sensitive to electrical excitation, which is in agreement with the observed fact that pure water is an exceedingly bad conductor of electricity.

The decomposing action of electricity is exhibited in electrolytic phenomena. These occur in the inverse order to the chemical actions which serve to produce the current. The action is supposed by the author to take place as follows. The fluid receives electrical energy from the positive electrode, which excites electrical vibrations in the molecules immediately surrounding it. These vibrations are transmitted through the fluid according to the ordinary laws of hydrodynamics, but this would not necessarily give rise to an electric current through the liquid, for an accumulation of electricity may take place even in non-conductors. In consequence of these vibrations, however, the molecular impacts will occur more frequently, and a new steady state will be set up, provided such is possible, in which the internal energy has a smaller value than before. Decomposition will therefore take place if the separate constituents are less sensitive to electrical vibrations than when in combination, as their electrical energy will then be less than that of the compound. One of the constituents will, however, be excited to a greater extent than the other, and the one which is least excited will be attracted more strongly by the anode than the more highly excited one. The latter constituent will not, therefore, move towards the kathode with a definite velocity, but will remain where it is, and re-enter into combination with the opposite constituent of a neighbouring molecule. This would appear at first to be in contradiction with the assumption that the compound is more sensitive to electrical vibrations than its constituents, but the apparent contradiction is explained by the consideration that the internal energy lost during the decomposition of the first molecule must reappear in the form of external energy—that is to say, in the form of heat; and the heat thus set free will supply the electrical energy necessary to cause the recombination. This gives an explanation of the "migration of the ions." From particle to particle during this migration, alternate transformations of electrical energy into heat, and of heat into electrical energy, take place. A certain amount of electrical energy will be lost during the process—namely, the amount transformed into heat during the decomposition of the first molecule, and the heat developed in the solution will raise its temperature to such an extent as to cause a recombination between the products of the decomposition set free at the electrode—a result which is in agreement with observation.[1]

§ 17. *Rotation of the Plane of Polarization.*

One of the principal arguments in favour of Maxwell's electromagnetic theory of light is, that it gives an explanation of the rotation of the plane of polarization by an electric current on the assumption of the existence of molecular vortices. It is therefore of considerable importance to determine how far the author's theory is capable of explaining the same phenomenon. Suppose a right-handed spiral to be wound round the axis of X, proceeding from the origin in the positive direction. A current flowing through the spiral away from the origin will then produce a north pole at the origin and a south pole at the other extremity of the spiral. Let a ray of plane-polarized light traverse the solenoid in the direction of the axis, then every point on the axis will move in a short rectilinear path perpendicular to it. Now an electric current has been defined as consisting in a disturbance of the molecular equilibrium of the conductor, propagated along the conductor with great velocity by radiation from molecule to molecule through the intervening ether. The electrical vibrations may be assumed to take place in the conductor in every direction, as in the case of heat-waves; and, as a special case, a disturbance of equilibrium taking place in a single direction only must give rise to an electric current, so that every motion of the ether in a definite direction must be equivalent to an electric current. Motions of any great extent do not come into consideration, for every disturbance in the equilibrium of the ether must consist in vibrations; but, however small the light-vibrations may be, they must be considered,

[1] A Paper read before the Physico-Economic Society of Königsberg, by Prof. F. Lindemann, on April 5, 1888. Continued from vol. xxxviii. p. 581.

[2] In the original, some confusing misprints occur in this paragraph, viz. p. 38, second line, *besser* should be *schlechter*, and in the third and fourth lines A and B should be interchanged.—G. W. DE T.

[3] Since the oxygen and hydrogen molecules are electrically excited to different degrees, they will attract one another. A hydrogen molecule will therefore impinge upon an oxygen molecule more often than upon another hydrogen molecule, thus increasing the chemical action.

[1] See von Helmholtz's "Wissenschaftliche Abhandlungen," vol. ii. p. 958, *et seq.*