

Washington, and the presence in the country of a special expedition composed of French astronomers. Judging from the accounts published in the New York papers on May 7, observations were more or less successful in many astronomical institutions, both the first and last contacts being generally well observed, and numerous photographs obtained during the passage of the planet across the sun's disc. At Ogden, Utah, where the French astronomers were located, the clouds prevented more than imperfect observations of the first contacts; but those at egress were satisfactory. Up to one o'clock only three photographs were obtained, but subsequently as many as seventy-five were secured, and the results, as a whole, were considered satisfactory. At the observatory of Dr. Draper, Hastings, on the Hudson, a number of observers, including Prof. Holden, of Washington, availed themselves of the admirable instrumental resources, and the weather being for the most part advantageous, very good results attended their efforts: of eighteen negatives taken by Dr. Draper several were particularly perfect. In addition to observations at the U.S. Naval Observatory Prof. Newcomb and assistants made satisfactory ones at the office of the *American Ephemeris* in Washington, noting the first internal contact at 10h. 7m. 43s. A.M., according to the *New York Times*, and the second internal contact at 5h. 53m. 50s. P.M.

The following differences between the calculated and observed times of first internal contact have been obtained by comparison with Leverrier's elements, with Newcomb's value of the solar parallax; the Greenwich mean time for the centre of the earth resulting from a calculation of somewhat greater refinement than that previously introduced in this column being 3h. 16m. 12.5s.

Place of Observation.	Observed G.M.T. reduced to earth's centre.			Error of Calculation.	
	h.	m.	s.		
Antwerp	3	15	46.0	+ 26.5	Two observers.
Christiania	—	41.2	+ 31.3		" Apparent internal contact."
"	—	52.9	+ 19.6		" True internal contact."
Göttingen	—	34.8	+ 37.7		Prof. Klinkerfues.
"	—	47.7	+ 24.8		Boeddicker and Heidorn.
Josephstadt	—	48.5	+ 24.0		Three observers.
Kiel	—	38.6	+ 33.9		Planet round.
"	—	53.3	+ 19.2		" Deutlicher Lichtfaden."
Palermo	—	55.9	+ 16.6		Spectroscope.
"	—	46.1	+ 26.4		Ordinary telescopic method.
San Fernando	—	49.1	+ 23.4		Geometrical contact.
"	3	16	11.7	+ 0.8	Separation of limbs.
Washington	3	15	58.4	+ 14.1	{ Prof. Newcomb and assistants.

The Greenwich mean time of second internal contact similarly calculated is 10h. 43m. 57.3s., which, compared with Prof. Newcomb's observations at Washington, shows a difference of + 19.6s. Other observations of the second internal contact given in the New York journals are either provisionally reduced or apparently affected by typographical errors or errors of transmission.

THE ZODIACAL LIGHT AND SUN-SPOT FREQUENCY.—In a letter addressed to Gruithuisen in February, 1839, published by the latter in his *Astronomisches Jahrbuch* for 1840, Olbers remarks, "My grandson, Wilhelm Focke, Doctor of Law, who with attachment and zeal often contemplates and scrutinises the starry heavens, asserts that the zodiacal light has been observed in January and February with quite exceptional brightness;" which, Gruithuisen observes in a note, is "a new confirmation of Cassini's observation that the zodiacal light is much more brilliant when numerous and large sun-spots are present, and diminishes in brightness when the spots are few. My observations show that during January and February the sun has exhibited unusually large and numerous spots," and he adds, "viel Licht und fast immer eine grosse negative Refraction." This refers to Cassini's concluding statement in his memoir entitled "Découverte de

la lumière céleste qui paraît dans le Zodiaque." "It is a remarkable circumstance that since the end of the year 1688, when this light began to grow fainter, spots have no longer appeared in the sun, while in the preceding years they were very frequent, which seems to support in some manner the conjecture that this light may arise from the same emanations as the spots and *faculae* of the sun." In a previous part of the memoir Cassini, endeavouring to assign a possible cause for the appearance of the zodiacal light, remarks that the observations of that century had made known that the sun is not only the source of light, but also of "une matière propre à terminer, à détourner, et à réfléchir ses rayons;" and that "cette matière ne coule pas toujours de la même manière, mais qu'elle a des vicissitudes sans règle, selon lesquelles nous voyons en certain temps dans son disque des facules, qui sont plus claires que le reste de la surface, et des taches obscures qui ne sont point pénétrées par sa lumière." And he goes on to say that if the matter which is the subject of this light is of the same nature as that which forms the *faculae* and spots on the sun, it should be liable to the same changes and irregularities. However inadequate or incorrect is the explanation of the spots and *faculae* given by Cassini, his conjecture that the brightness of the zodiacal light varies with the number and magnitude of the solar spots is worthy of note, though we do not remember to have seen any allusion to it in our popular astronomical treatises.

THE INTERNATIONAL GEOLOGICAL CONGRESS

THE time of the opening of this Congress in Paris has been finally fixed by the local committee for the 29th August, and the Congress will remain in session about two weeks. Further details as to organization and place of meeting will soon be made public. Meanwhile, it is announced that from the 20th August to the 15th September, the library and reading-rooms of the Geological Society of France, No. 7, rue des Grands-Augustins, Paris, will be at the service of members of the Congress. As before, it is requested that all those who desire to take part therein will make it known to the general secretary, Dr. Ed. Jannetaz, at the above address, where, also, the subscription of twelve francs, required for each member, may be sent to Dr. Bioche, treasurer. Ladies are admitted to the Congress.

The local committee add to the above announcements:—There is reason to believe that the numerous collections of geology and palæontology, minerals, rocks, fossils, maps, sections, plans, models in relief, &c., to be found in the *Exposition Universelle*, will realise the expectations expressed in the circular of the International Committee, of an International Geological Exhibition. All exhibitors of such collections are requested to send, as above, such lists as will enable the secretary-general, Dr. Jannetaz, to prepare a special catalogue of them for the use of the Congress.

T. STERRY HUNT,
Secretary of the International Committee

A KINEMATICAL THEOREM

TAKE a plane, and, for clearness of idea, consider it as fixed horizontally. On this fixed plane lay another, and throughout the subsequent movement let the surfaces of the two planes always remain in contact. Now let the upper plane, starting from any position, be moved about in any manner whatever, making any number (N) of rotations, the points on it describing curves of any desired degree of complexity on the lower plane; and let it finally settle down again into its initial position, the curves described by the points on it being, in consequence, closed curves. Take the upper plane, and let us investigate the position on it of those points which have described curves of any given area (A) on the fixed plane.

However complex the curves described by them may be, the points will be found to form a circle on the upper plane; and if we give to A different values, the corresponding circles will be found to be all concentric. Further, if we call the circle corresponding to the value $A = 0$ the *zero-circle*, the area of the curves described by the points on any other circle of the system equals N times the ring inclosed between that circle and the zero-circle. It is remarkable that such a singular point as the centre of the circles should exist.

In the special case in which $N=0$, *i.e.*, where there has been only an oscillatory movement of the upper plane and no complete rotation, the system of concentric circles is replaced by a system of parallel straight lines, the area of the curves described by the points on any straight line of the system being proportional to the distance of that line from the zero-line.

It should, perhaps, be pointed out that the area of a figure 8 is zero, as the two halves are of opposite signs; also that when a point reciprocates on a curve the area inclosed by it in its path is zero. For example: if we take the interesting case of a circle rolling inside another of twice its diameter, every point on its circumference reciprocates on a straight line, and consequently the circumference is the zero-circle.

This theorem was suggested to me by reading a paper by Mr. C. Leudesdorf in the *Messenger of Mathematics*, where I have already enunciated it. It seems, however, to be one which, from its somewhat startling simplicity, may interest a larger class of readers than a purely mathematical one.

The proof is simple. Let P, P' be two points on the moving plane, and let A, A' be the areas described by them. Let $PP' = r$, and let the total movement of P' perpendicular to $PP' = n$.

$$\text{Then } A - A' = nr + N\pi r^2.$$

If we take P' as origin and the position of $P'P$ in which n is a maximum and equal to n' as initial line, $n' = n \cos \theta$. Thus $A - A' = n' \cos \theta \cdot r + N\pi r^2$, the equation to a family of concentric circles. Transforming to the centre, we have $A = N\pi(r^2 - a^2)$, where a is the radius of the zero-circle.

A. B. KEMPE

OLD MAPS OF AFRICA

MR. STANLEY, in the paper which he read at the Geographical Society on Monday, spoke of Africa being brought to light after an oblivion of 6,000 years. Notwithstanding the somewhat confused phraseology, Mr. Stanley's meaning is clear enough: Central Africa, with its great lakes and rivers, is now known, he means to say, for the first time. But recent investigation seems to show that the oblivion of Africa must be counted by hundreds and not thousands of years; that, in fact, it is only within two or three centuries that a knowledge of Central Africa has been allowed to lapse. A more rigorous search may show that between the fourteenth and the seventeenth centuries the great features that have been placed on modern maps within the past few years were discovered and recorded on the maps of the time.

We have recently referred, on more than one occasion, to two very curious globes that have been brought to light, one in the National Library in Paris, and the other in the Library of Lyons. On the Lyons globe, the date of which is 1701, the Congo is made to issue from a great lake, and wind its way westwards to the Atlantic, in a direction to some extent coincident with that recently discovered by Mr. Stanley. As a sort of preparation for the work of the great traveller, so soon to be issued, some account of the *data* on which these maps may have been constructed, may not be uninteresting. Our information is based on an article in *La Nature*, and on a report by a commission of the Lyons Geographical Society, ap-

pointed to investigate the value and origin of the Lyons globe.

The discovery made at Lyons is, in reality, no surprise to those who know the history of geographical exploration. Not only in the seventeenth century, does the Zaire-Congo appear on most of the maps with the direction definitely assigned to it by Stanley, but nearly all old documents, from the fifteenth century—and the date should be noted—make the great river issue from a considerable mass of water far in the interior of the African continent.

Already, in the year 1500, the famous *mappemonde* of Juan de la Cosa, the pilot of Christopher Columbus, gives the same indications; the picturesque *mappemonde* known as that of Henry II., repeats them with some variations, as also the master-work of Mercator (1569), the founder of modern geography. All the old geographers, or nearly all, repeat the same data:—Forlani (1562), Castaldi (1564), Sanuto (1588), Hondius (1607), Nicolas Picart (1644), Blœu (1569), Sanson, &c. Therefore there need be no surprise to find on a globe of the eighteenth century information which for more than 200 years previously had been registered on the map of Africa.

Whence, however, came this knowledge which our fathers had of certain regions in Central and Equatorial Africa? The reply is simple: from the Portuguese, who, since the fifteenth century, undertook not only extensive maritime voyages, but several times crossed Africa from west to east and from east to west. It is even very possible that they discovered the sources of the Nile, the great equatorial lakes; thus, in the midst of the simplicity and incoherence of their tracings we find, in their old parchments, the great lines of African geography almost as science now represents them. Most of these Portuguese, with the exception of some missionaries, were but poorly educated; they travelled much oftener as traders than as experienced explorers; nevertheless, we have almost the certainty that before the year 1500 they had furnished very precise information on the centre of Africa. In nearly all these maps, and in that of Lyons, the Congo flows in a nearly straight line from Lake Zaire or Zembre to the Atlantic; it bends only a very little to the north, and does not pass the equator, as we now know it does.

As a sort of exception, there has been found among the riches of the National Library at Paris, a Spanish globe of copper (without date, but probably between 1530 and 1540), which is not content with presenting the same data, but which reproduces, with wonderful closeness, the course of the Congo as discovered by Stanley. The river issues from a lake, flows towards the north, describes a large curve well to the north of the equator, then turns west-south-west to the Atlantic. This is indeed a summary of the last journey of the intrepid American correspondent. Fig. 1 gives a perfectly accurate idea of a portion of this valuable globe.

From all this it must not be concluded that Stanley has discovered nothing new. These discoveries of the ancient travellers, if genuine discoveries they were, seem to have been forgotten as soon as they were recorded; and although the maps referred to above have been known for generations, no one ever seems to have taken them as trustworthy guides to the lines of African exploration. Indeed, it is only now that Stanley has made a discovery never to be forgotten that these old maps have come to have a real interest, for we suspect that till now geographers regarded the tracings as having their basis in the cartographers' imaginations. The glory of being really the first discoverers of the two Nyanzas, Nyassa, Tanganyika, Bangweolo, and the course of the Congo cannot be taken away from Speke and Baker and Burton and Livingstone and Stanley; or if so it must be by some ancient Arab or possibly Egyptian, many, many centuries ago, for there can be no doubt that long before Europe