and it seems that the immediate cause was the contamination of the water supply of Philadelphia, where he had been living, and where about a thousand cases of typhoid fever appeared at nearly the same time. Prof. Lewis was only in his thirty-fifth year. An excellent portrait of him accompanies Mr. Upham's paper.

AT the meeting of the University Experimental Science Association, Dublin, on December 13, Mr. J. Joly read a paper on a resonance method of measuring the constant of gravitation. A simple pendulum of small mass is hung in a tall glass tube, rendered vacuous. In close proximity two massive pendulums, one at either side, are maintained in a state of vibration for any desired period of time. The times of vibration of all these pendulums are alike. The observations consist in observing the amplitude, or the increase of amplitude, of the central pendulum, after a known number of vibrations executed by the exterior pendulums. Several modifications, carrying out the same principle, were suggested. It is proposed to test the method in the vaults of the physical laboratory.

THE Central Meteorological Observatory of Mexico, which is situated at 7489 feet above the sea, has published a summary of meteorological results for each month of twelve years ending 1888 (excepting January and February 1877). The coldest month is January, the mean temperature of which is 54°, and the warmest month is April, the mean temperature of which is 64°. The absolute maximum in the shade was 89°, and the minimum 28°·9. The wettest month is August, in which the mean rainfall is 5·4 inches, and the driest month is February, with an average of 0·4 inch. The greatest fall at one time was 2·5 inches. The prevalent direction of the wind is north-west.

THE *Essex County Chronicle* of January 10 says that on Tuesday, the 7th inst., two slight shocks of earthquake were noticed at Chelmsford. The first occurred at 12.30, when a low rumbling sound like thunder in the distance was heard, accompanied by a vibration of the ground and a rattling of the windows. The shock was observed in several parts of the town. The more pronounced shock was, however, at 1.25 p.m., when the rumbling, moaning sound was intensified, there being a heavy throbbing in the air like the pulsation of an engine. At many houses there was a violent shaking of the windows, and two cases are reported of things trembling on the tables. Some men working for Mr. Norrington heard the sound, took it to be the rumble of a heavy wagon, and went out to see it. Nothing was in sight. Several people recognized the shock as being similar to the forerunner of the 1884 earthquake, and rushed out of their houses. Mr. Arthur E. Brown, writing to us from Brentwood, says that the shocks were noticed there. They were attributed by the people in his house to the firing of guns at Woolwich. They rattled the doors violently.

A CORRESPONDENT writes that during the thunderstorm which prevailed over the greater part of Scotland early on Monday morning, January 6, a slight shock of earthquake was felt in a district of Perthshire. "This," he says, "is somewhat similar to what took place at Argyll on the evening of July 15 last year, and might lead one to suppose that atmospheric influence has something to do with the production of seismic disturbances."

AT a meeting of the Royal Botanic Society on Saturday, attention was called to a specimen of the double cocoanut, or *coccoloba de mer*, now known to come from the Seychelles. For some hundreds of years these nuts have been occasionally found washed up by the sea, and their extraordinary appearance, large size, and mysterious origin have given rise to many stories of miraculous virtue in the cure of diseases. Some are even said to have been sold for their weight in gold. This specimen belonged to General Gordon, and was given by him to General Gerald Graham, by whom it has been presented to the Society.

THE Transactions of the Congrès pour l'Utilisation des Eaux fluviales, held last summer in Paris, have just been issued. The volume contains a great number of engravings.

A BOOK on the Congo State, by E. Dupont, the Director of the Natural History Museum of Brussels, has just been published. He presents the scientific results of his travels, devoting especial attention to geological questions.

MESSRS. GEORGE PHILIP AND SON have published the second issue of their valuable "Educational Annual." The work has been enlarged, revised, and to some extent rearranged; and it ought to be of great service to all who are for any reason especially interested in educational institutions.

MESSRS. PERKEN, SON, AND RAYMENT have produced a projecting optical lantern, which is likely to be of considerable service. When enlargements are required, a condenser of 10-inch diameter is available; but when a magic-lantern entertainment is to be provided, a condenser of 4-inch diameter can be substituted. The apparatus consists of a mahogany-body lantern with a long bellows-camera adjusted by the patent quick-action rack and pinion, and lighted by the refulgent three-wick lamp.

ON January 21, and the three following evenings, Dr. E. Symes Thomson will deliver, at Gresham College, a course of lectures on influenza or epidemic catarrh. In the first lecture he will present a historical sketch of the subject. The remaining lectures will be on influenza as it affects the lower animals, the causes and consequences of influenza, and diagnosis and management.

THE additions to the Zoological Society's Gardens during the past week include four Leopard Tortoises (*Testudo pardalis*), three Well-marked Tortoises (*Homopus signatus*), a Rufous Snake (*Ablabes rufulus*), six Gray's Frogs (*Rana grayi*) from South Africa, presented by the Rev. G. H. R. Fisk, C.M.Z.S.; two Spur-winged Geese (*Plectropterus gambensis*) from West Africa, presented by Mr. C. B. Mitford; six Red-bellied Waxbills (*Estrela rubriventris*), five Crimson-eared Waxbills (*Estrela phœnicotis*), seven Grenadier Waxbills (*Uraginthus grantinus*, 6 ♂ 1 ♀), three Paradise Whydah Birds (*Vidua paradisæa*), three — Weaver Birds (*Euplectes* —) from Benguela, West Africa, presented by Mr. T. W. Bacon; a Bluish Finch (*Spermophila caerulea* ♂) from Brazil, presented by Mrs. Mayne; a Green Turtle (*Chelone viridis*) from the West Indies, presented by Mrs. Harris; a Chattering Lory (*Lorius garrulus*) from Moluccas, presented by Captain Bason, P. and O. s.s. *Bombay*; three Yellow-winged Sugar Birds (*Carea cyanea*), two Yellow-fronted Tanagers (*Euphonia flavi-frontis*) from South America, deposited; four Tufted Umbrellas (*Scopos umbrellæ*) from Africa, a Geoffroy's Terrapin (*Hydraspis hiliarii*) from the Argentine Republic, purchased; a Koala (*Phascolarctus cinereus* ♀) from Australia, two Indian Cobras (*Naia tripudians*), an Indian Python (*Python molurus*) from India, received in exchange.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m., January 16 = 5h 45m. 8s.

Name.	Mag.	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ' "
(1) G.C. 1185	—	—	5 30 7	— 5 20
(2) 119 Tauri	4	Reddish-yellow.	5 25 46	+18 31
(3) ♂ Orionis	4	Whitish-yellow.	5 33 12	— 2 40
(4) γ Orionis	2	White.	5 19 12	+ 6 15
(5) 64 Schj.	8	Very red.	5 38 29	+24 22
(6) R Ceti	Var.	Yellowish-red.	2 20 24	— 0 40
(7) U Ceti	Var.	Reddish.	2 28 26	—13 37

Remarks.

(1) This is described in Herschel's general catalogue as "a remarkable object, very large, round, with tail, much brighter in the middle." The spectrum has not yet been recorded, but it promises to be one of great interest, as the nebula is apparently one of the cometic ones. The meteoritic hypothesis suggests that these are produced by a condensed swarm moving at a high velocity through a sheet of meteorites at rest, or a swarm almost at rest surrounded by a moving sheet. In the former case the collision region would be behind the swarm, and would be spread out like a comet's tail, the angle of the fan and length of "tail" depending upon the velocity of the moving swarm. Observations for variations of spectrum between nucleus and tail will also be valuable.

(2) This is a typical example of stars of Group II. Observations similar to those suggested for 20 Leporis, U.A., last week, are required.

(3) Konkoly classes this with stars of the solar type. The usual differential observations, as to whether the star belongs to Group III. or to Group V., are required.

(4) In Gothard's list of star spectra this is described as Group IV. The usual observations are suggested.

(5) Dunér describes the spectrum of this star as Group VI., but his description is not complete. The characters of the different bands, especially of Band 6, require further observation. It may be remarked in connection with these stars of small magnitude, that the observations are by no means so difficult as in the case of small stars with spectra consisting of fine lines. The bands are broad and generally dark, so that the continuous spectrum is broken up into zones.

(6) This variable has a period of 167 days, and ranges in magnitude from about 8 at maximum to 13 at minimum. The spectrum is of the Group II. type, and, as in other variables of the same group, bright lines may appear at maximum. Dunér states that the bands are very wide and dark, but he does not state what bands are present. Maximum on January 18.

(7) The spectrum of this variable has not yet been recorded, but the colour indicates that it is probably either Group II. or Group VI. The period is 228 days, and the range from 7 at maximum to 10 at minimum. The maximum will occur on January 18.

A. FOWLER.

THE TEMPERATURE OF THE MOON.—Prof. Langley, by means of the bolometer, made some measurements of the heat from different parts of the eclipsed moon on the night of September 23, 1885 (*Phil. Mag.*, January, 1890). These measurements were made in connection with a much more extended study on the temperature of our satellite. The following particulars are given:—The diameter of the lunar image was 28.3 millimetres, and of this only a limited portion (0.08 of the whole) fell upon the bolometer. As the penumbra came on, the diminution of heat was marked, being measured by the bolometer even before the eye had detected any appearance of shadow. The heat continued to diminish rapidly with the progress of the immersion in the penumbra. At one hour before the middle of the total eclipse, the deflection in the umbra was 3.8 divisions. Fifty minutes after the middle of the eclipse, it had diminished to approximately 1.3 divisions, this being less than 1 per cent. of the heat from a similar portion of the uneclipsed moon. The rise of the temperature after the passage of the umbra was apparently nearly as rapid as the previous fall. The most important conclusion drawn by Prof. Langley from his researches is that the mean temperature of the sunlit lunar soil is most probably not greatly above zero Centigrade.

ON THE ORBIT OF STRUVE 228.—The *Monthly Notices* of the Royal Astronomical Society, December 1889, contains a note, communicated by Mr. J. E. Gore, on this binary star. Recent measures show that, since Struve discovered the star in 1829, it has described about 120° of its apparent orbit. The following provisional elements have been computed:—

Elements of ζ 228.

P = 88.73 years.	$\Omega = 84^{\circ} 49'$
T = 1906.03	$\lambda = 51^{\circ} 36'$
$e = 0.5311$	$a = 0''.98$
$i = 70^{\circ} 59'$	$\mu = +4''.057$

According to this orbit, the distance between the components will gradually increase during the next few years up to a maximum of about $0''.55$, and then diminish again as the companion approaches the periastron. The minimum distance will not be

reached until the position angle is 180° (after the periastron passage), when the components will probably be separated by less than $0''.2$. The binary lies a little preceding 62 Andromedæ, the position for 1890.0 being approximately—

R.A. 2h. 6m. 59s., Decl. + $46^{\circ} 58' 4''$.

The magnitudes of the components are about 6.7 and 7.6.

ORBIT OF SWIFT'S COMET (V. 1880).—The orbit of this comet has been computed, by Gibbs's vector method, by Messrs. W. Beebe and A. W. Phillips (*Astr. Journ.*, Nos. 207, 208). This method is found to possess advantages over those of Gauss and Oppolzer. Below are given elements which have been computed from eight observations ranging from October 25, 1880, to January 7, 1881, and compared with these are the elements computed from three observations by Gibbs's method. Both are referred to the ecliptic and mean equinox of 1880.0:—

Eight observations.				Three observations.			
$i =$	5°	$23'$	$3''8$	$i =$	5°	$22'$	$2''03$
$\pi - \Omega =$	106°	$13'$	$4''.1$	$\pi - \Omega =$	106°	$13'$	$19''.17$
$\Omega =$	296°	$42'$	$55''.1$	$\Omega =$	296°	$52'$	$2''09$
$\log e =$	9.8163726			$\log e =$	9.8146985		
$\log a =$	0.4905937			$\log a =$	0.4873065		
T =	1880 Nov. 7.786610			T =	1880 Nov. 7.782810		
Periodic time =	1988.33 days.			Periodic time =	1965.88 days.		

ON THE VARIABILITY OF R VULPECULÆ.—Schönfeld, from a discussion of the observations from 1859 to 1874, found that a uniform period left systematic deviations outstanding which exceeded seven or eight times the uncertainty of the single maxima, but that a quadratic term, corresponding to a shortening of 0.12 days from epoch to epoch, brought them within the range of the probable errors. The divergence from observation, however, soon began, and rapidly widened, until in 1885 it amounted to 106.5 days. Mr. Chandler (*Astr. Journ.*, No. 208) gives a table showing the maxima and minima observed since 1807, with the deviations from the elements of his catalogue. It is seen that, whereas the difference between the observed and the calculated maxima and minima, using Schönfeld's elements, are very considerable, the elements given by the author differed from those observed only in a very slight degree.

ON THE ROTATION OF MERCURY.—Nearly a century has elapsed since Schröter published his first observation of the physical aspect of Mercury, and assigned to the planet a period of rotation; but it has been left to that perspicacious observer, Signor Schiaparelli, to demonstrate the fact by a series of remarkable observations given by him in *Astronomische Nachrichten*, No. 2944. The observations extend from 1882 to the end of last year. As many as 150 drawings have been made of the markings upon the planet with respect to the best positions for observation. It is noted that one of the finest drawings was made on August 11, 1882, when Mercury was only $3'' 2'$ from the sun's limb. The markings that are visible on Mercury when observed at the same hour on consecutive days are identical in their aspect, and this being so, three hypotheses have been propounded (*Astr. Nach.*, 2479) regarding the rotation of the planet, viz.:—

That (1) the time of rotation is about 24 hours.

(2) The planet makes two or more rotations in the same interval.

(3) The time of rotation is so slow as to be inappreciable when observing the markings during a few days.

Schröter decided in favour of the first hypothesis, and Bessel, from a discussion of this observer's data, determined the time of rotation to be 24h. om. 52.97s. Schiaparelli's observations support the last of these hypotheses, and are opposed to the rotation period determined by Schröter.

Following a series of dark markings, shown in the figure which accompanies the article, it was found that—

Mercury revolves round the sun in the same manner that the moon revolves round the earth, always presenting to it the same hemisphere; hence, since the planet's periodic time is 87.9693 days, this must be the time of rotation on its axis.

The dark markings observed appear extremely faint, and are not easily recognized. On good occasions the colour may be seen to be reddish-brown, and always differs from the general colour of the planet's disk, which is a bright rose changing to copper.

This most interesting and important communication from Milan Observatory must be read in detail in order that it may be appreciated.