Spectrum ends abruptly in the orange. The light of the brighter part is not uniform; probably it is crossed either by bright lines or by lines of absorption" (Phil. Trans. 1866). As yet we know nothing of the spectra of the components of any star cluster except in the case of the loose cluster of the Pleiades, and in that case we know that the spectra are all of the same type—namely, Group IV. It seems pretty evident that the stars of the cluster in Hercules cannot have spectra of this kind; otherwise, their integrated light would not end abruptly in the orange, and the irregularities would only be obvious in the blue end, where the thick hydrogen lines ought to be visible. The absence of red light would lead rather to the supposition of bright lines than dark ones. Further investigations, with considerable optical power, may therefore lead to interesting results. It may be noted that Vogel, in 1872, recorded simply a continuous spectrum, but his attention had probably not been directed to Dr. Huggins's statement.

(2) The question of the periodicity of the appearance of the bright lines in β Lyræ cannot yet be said to have been satisfactorily settled, and as the star will be visible for some months, further continuous observations are desirable. It is not necessary here to recapitulate all the observations which lead to the conclusion that there is a periodicity in the spectrum. Gothard has probably given more attention to the star than any other observer, and he succeeded in following the variations of the line D_3 through several periods "from a bright, almost dazzling light to complete disappearance. . . . The variation is most marked in the case of D_3; it is much less striking in the hydrogen lines, although they, and probably also the dark bands in the red, are subject to a periodical variation." The period has been provisionally estimated as 7 days, but it does not seem to depend upon the fluctuations in the brightness of the star. In my own observations I have found that the bright lines in this star are best seen when no cylindrical lens is employed, and this has also been noted by other observers. Further observations, to be of any value, should be made as frequently as possible, and over a long period.

(3) Dunér describes the spectrum of this star as one of the most magnificent of Group II., the bands 1–9 being wide and dark. He also states that there is a narrow band between bands 3 and 4. As the spectrum is a bright one, this is a good opportunity for comparing the dark flutings with the brightest flutings of manganese, lead, and magnesium. In the recently issued volume of spectroscopic observations at Greenwich, Mr. Maunder states that he has found the bright green band in α Herculis coincident with the brightest carbon fluting and possessing the same characteristics. A similar comparison should also be made with α Scorpii.

(4 and 5) These stars, according to the observations of Gothard and others, have spectra of the solar type and of Group IV. respectively. The usual more detailed observations are required in each case.

(6) The spectrum of this variable has not yet been recorded. The magnitude ranges from about 9 to <13 in a period of about 188 days. There will be a maximum about July 2.

A. FOWLER.

GREENWICH SPECTROSCOPIC RESULTS.—These results for 1888 contain observations of γ Cassiopeiæ, Mira Ceti, α Orionis, a Herculis, β Lyræ, R Cygni, P Cygni, β Pegasi, and Comets a and e 1888. On October 5, 1888, ten measures were made of a bright line in the violet part of the spectrum of Mira Ceti; the mean wave-length found was 4343·37, indicating that it was the third line of hydrogen. F and D_3 were searched for on this occasion, but without success. The spectrum of α Herculis was compared with those of carbon and manganese, as given by a Bunsen flame on several occasions, and it is noted: "The green band of the carbon spectrum accorded, both as to position and appearance, with the bright interspace or 'zone' to the blue of Band VII. (Dunér's numeration). So far as the dispersion employed would show, no accordance could be more complete, both as to the position of the edge and the gradation of the fading." The blue carbon band was also found to present an approximation in position and appearance to a bright zone in the blue. The wave-length of the brightest bands in the manganese spectrum was determined as 5579, and that of the more refrangible edge of Dunér's Band IV. as 5592, whence it is concluded that the connection of the spectrum of the star with the manganese spectrum did not appear to be made out. A bright line at 5873·92, that is, D_3, was measured in β Lyræ on August 10, 1888, was seen less distinctly a month later, and was found again to be quite distinct on September 19; two days later, D_3 was seen very bright, and C and F were also visible. D_3 was visible, but faint, on October 1; F could not be seen, and C was only suspected. On October 19, C and F were not visible as bright lines, but were first suspected as dark lines, whilst D_3 was glimpsed occasionally as a feeble bright line. R Cygni was observed on September 21, D_3 was identified with probability in its spectrum, and F with certainty; and, on October 1, ten measures were made of the F line in P Cygni. Comet a 1888 was observed on April 19, 1888; its spectrum appeared mainly continuous; two bright bands were just glimpsed, coincident with the bands in the green and yellow of the spectrum of a Bunsen flame, the band in the blue being suspected. On May 3 the spectrum was practically wholly continuous, traces of the green band only being suspected. Comet e 1888, observed on November 27, showed a local ill-defined brightening, corresponding nearly to the great carbon band, but apparently further towards the blue, otherwise it was perfectly continuous.

THE ROTATION OF VENUS.—Signor Schiaparelli has recently made an extended inquiry into the question of the rotation of the planet Venus, and has brought many facts to light concerning it (*Rendiconti del R. Istituto Lombardo*, vol. xxiii.). He finds, from observations of very definite spots, that the time of rotation of the planet is 224·7 days—that is to say, Venus, like the moon, and probably Mercury, rotates on her axis in the same time that she takes to make a sidereal revolution around the sun; the axis of rotation being nearly perpendicular to the plane of the orbit. By investigating the writings of previous astronomers who have estimated the rotation period, Signor Schiaparelli concludes that those observations which have been supposed to fix the time as about 24 hours are open to question. Domenico Cassini's observations of bright markings in 1866–67 are shown to have been wrongly interpreted, a discussion of them indicating that they also support a period of rotation of 224·7 days.

GEOGRAPHICAL NOTES.

THE Russian Geographical Society has received fresh news from M. Grombchevsky as to his attempts to penetrate into Tibet from the north. In the autumn of 1889 the expedition explored the Uprang, a tributary of the Raskem-daria, tried to enter again into Kanjut, and, having failed to do so, explored the tributaries of the Raskem river which flow from the Himalayas. On November 21, M. Grombchevsky, accompanied by two men only, crossed the Kara-korum Pass, and went to the Pahnu mountaineers, who live by sheep-breeding, and suffer a good deal from the Kanjut robbers. On December 7 the expedition was at the small fort of Shahi-dulla-hodja; the winter had come, and the thermometer fell in the nights to − 20° Celsius. Nevertheless, M. Grombchevsky, with two men only and a guide, explored the passes leading to Kara-korum across the Raskem ridge. The tent had to be abandoned, although the temperature was − 35°, and the party was soon obliged to return. On January 7, after having followed for some distance the Kara-kash river, the small party began its ascent of the steep slopes of the Tibet border-ridge. The plateau itself proved to be a desert, 17,000 feet high, upon which a few yaks, *Kulangs*, and mountain sheep were grazing. A very high ridge, called by M. Grombchevsky the Yurung-kash ridge, was crossed, the pass receiving the name of "Russian." But the horses of the expedition were quite attenuated, and on January 13 the party was brought into a perilous condition by a frightful snow-storm and a temperature of − 27°, without having either a tent or any kind of fuel. M. Grombchevsky was compelled to return, marching all day long. After having made another unsuccessful attempt at crossing the Hindu-tash Pass, the expedition went to Kilian, and thence to Polu, thus connecting its surveys with those of Prjevalsky. A telegram received from New Marghelan, in Russian Turkestan, announces that the explorer and his men have returned safely, and are making new schemes for further exploration. A map, annexed to the last issue of the *Izvestia* of the Russian Geographical Society, embodies the surveys made by M. Grombchevsky in 1888 and M. Grum-Grzimailo in 1887.

IN the course of last year the Geographical Society of Berlin published no fewer than thirty-nine remarkable maps. Three of them are reproduced from those of Mercator, now in the

town library of Breslau. Two others—a map of Europe (finished in 1554) and one of England (of 1564)—are unique. Another is the large map of the world, of which there are only two copies in existence, the second one being at the Paris National Library. The Society has agreed to publish the details of Dr. Konrad Kretschmar's journey to Rome, undertaken in the Middle Ages for purposes of research.

THE LADIES' CONVERSAZIONE OF THE ROYAL SOCIETY.

THE Ladies' *Conversazione* of the Royal Society was held on June 18, and was, as usual, a great success. Many of the exhibits were the same as those shown at the *conversazione* on May 14. Among those which had not been previously shown were the following :—

Exhibited by the Director-General of Ordnance Factories :—Magazine rifle, Mark I. The new magazine rifle now being made for the British Army. It has a calibre of 0".303, is on the bolt principle, and is provided with a detachable magazine underneath, to hold eight cartridges ; a cut-off on the right side enables it to be used as a single loader. It has two sets of sights, the ordinary ones are graduated up to 1900 yards, the long-range sights on the left side up to 3500 yards. The sword-bayonet, which is attached underneath the barrel, has a double-edged blade 12" long.

Exhibited by the Director-General of the Geological Survey :—Diagrams illustrating some of the most ancient topography of the British Isles. (*a*) Corry on Ben More, Assynt. The rough bossy ground in the middle is the Archæan gneiss, the most ancient rock in this country. Above it to the left comes the Torridon sandstone, forming a range of cliffs, and lying unconformably on the gneiss. At the summit of the Corry, on the crest of the ridge, lies the early Palæozoic quartzite, which steals across the sandstone until it rests directly on the gneiss. (*b*) Sleagach, Loch Maree. The pinkish bossy rock is the old gneiss, which rises into a group of hills that have been buried under the Torridon sandstone. By prolonged and enormous denudation of the overlying sandstone, the gneiss hills have been uncovered, and now reveal a portion of the oldest known topography of Britain. The gneiss hill to the right rises to a height of 2500 feet, and in ascending it one can walk along the ancient shore-line and traverse beach after beach that was piled up over the sinking land. (*c*) View from the south shoulder of Sleagach looking east. The bossy hills of gneiss rise towards the left hand to a height of 3000 feet above the sea. The overlying cover of Torridon sandstone, though enormously denuded, still forms a range of lofty hills, beneath which knobs of gneiss at different elevations may be seen protruding. The quartzite (coloured yellow) caps the mountains to the right until a mass of the old gneiss overlies it. This cake of the most ancient rock of the region has been torn up and thrust over the younger formation. The line of junction or "thrust-plane" between them descends into the plain, and runs for miles to the westward. (*d*) Meall a Ghubhais, Loch Maree. The upper part of the mountain is a cake of Torridon sandstone, which has been driven westward by the same gigantic terrestrial movements just referred to, and has been placed upon the quartzite group of rocks which ought really to lie above it. In the lower part of the diagram the sandstone is seen in its normal position below the quartzite. (*e*) Section of Meall a Ghubhais, to show the detailed geological structure of the mountain. It will be observed that the upper shifted mass of Torridon sandstone is traversed by several thrust-planes, and that portions of the old gneiss have likewise been driven westward underneath it.

Exhibited by Mrs. F. W. H. Myers :—(1) Platinotype photographs. (2) Photographs on fabrics.

Exhibited by Sir William Bowman, Bart., F.R.S. :—(1) Jubilee portrait of the late Prof. Donders, For. Mem. R.S., painted by Mrs. Donders (Hubrecht). Gold Medal awarded at the Exposition International, Munich, 1888. Ultimately destined for the National Museum, Amsterdam. (2) Uncompleted portrait of the same, 1873, by G. F. Watts, R.A.

Exhibited by Prof. W. C. Roberts-Austen, C.B., F.R.S. :—Measurement of high temperatures. Experimental determination of the melting-point of gold (1045° C.) and of silver (945° C.), by means of Le Chatelier's pyrometer. This consists of a thermo-couple, composed of wires of platinum and platinum alloyed with 10 per cent. of rhodium, connected with a dead-beat galvanometer. The pyrometer scale has been calibrated by heating the thermo-couple to certain known temperatures determined by the air thermometer.

Exhibited by Prof. A. M. Worthington :—An apparatus for stretching a liquid and measuring simultaneously the stress and strain.

Exhibited by Mr. P. L. Sclater, F.R.S. :—Portrait of Dr. Emin Pasha, C.M.Z.S., and original letter from him, addressed to Mr. Sclater, dated Wadelai, April 15th, 1887.

Exhibited by the Postmaster-General :—Hughes's type-printing telegraphs, working to the Continent. This apparatus is mainly mechanical, the electrical action being confined to the sending a single short pulsation of current at the instant the type-wheel is in the proper position, and only one wave of current is needed to produce a letter. The sending and receiving instruments are combined. The key-board consists of as many keys as there are letters and signs to be printed. Connecting with the keys and corresponding with them, and also with the type-wheel, is a set of pins arranged radially in a circular horizontal plate. An arm revolves over these pins without touching them until a key is depressed, when a current is sent into the line. The instruments are caused to run approximately isochronously by means of suitable adjustments, and they are afterwards maintained in synchronism automatically by the actual working. The instrument is eminently suitable for Continental message traffic, for which purpose it is largely used. The three working instruments shown were connected with Paris, Berlin, and Rome. In the course of the evening the President held communication with Profs. Helmholtz and Du Bois-Reymond in Berlin, Prof. Mascart in Paris, and Prof. Cannizzaro in Rome.

Exhibited by Mr. Walter Gardiner, F.R.S. :—(1) Specimens of aquatic fen plants and algæ occurring in the neighbourhood of Cambridge. (2) Specimens illustrating the exhibitor's paper on a new method of printing photographic negatives, employing living leaves in place of sensitive paper.

Exhibited by Dr. Pole, F.R.S. :—Diagrams in illustration of colour-blindness.

Exhibited by Dr. Karl Grossmann :—Tests for colour-blindness.

Exhibited by Prof. J. W. Judd, F.R.S. :—Specimens of a remarkable nickel-iron alloy (awaruite), of terrestrial origin, from New Zealand, and of the minerals and rocks with which it is associated. Sent by Prof. G. H. F. Ulrich, of the Dunedin University, N.Z. This curious mineral, consisting of $2Ni+Fe$, was analyzed and named by Mr. W. Skey, in 1885, having been detected by him in specimens of sands obtained from streams in the south-western part of the South Island of New Zealand. Prof. Ulrich has since been able to show that the grains of this alloy are found over a considerable area, disseminated in peridotite and serpentine rocks ; which rocks are intrusive in the metamorphic schists of the district, and form the Red Hill and Olivine Ranges. The substance which awaruite most closely resembles is the Oktibbehite meteorite, consisting of $Ni+Fe$: and the occurrence of this remarkable alloy in terrestrial rocks is comparable to the presence of nickel-iron alloys in the basalts of Ovifak and other localities in Greenland.

Exhibited by Prof. A. H. Church, F.R.S. :—A selection of Japanese sword guards, or *tsuba*, made of malleable iron, and variously decorated with chased, hammered, and pierced work, or with incrustations in gold, silver, shakudo, shibuichi, and bronze. The majority of the examples shown represent plant forms, and were executed between 1650 and 1850.

Exhibited by Prof. W. C. Roberts-Austen, C.B., F.R.S. :—Japanese art metal-work. The specimen is interesting as a modern example of flat inlaying in metals. The plate is of bronze, and the bird is of *shakudo*, or copper alloyed with a small quantity, about 2 or 3 per cent., of gold. The isolated feathers are of a darker variety of this alloy.

Exhibited by Dr. W. J. Russell, F.R.S. :—Ancient Egyptian colours discovered by Mr. Flinders Petrie in the Fayoum, and modern imitations of them ; and colours from Hawara in the Fayoum.

Exhibited by Mr. A. P. Laurie :—Colours used by the fifteenth century painters.

Exhibited by Mr. W. F. R. Weldon, F.R.S. (on behalf of the Marine Biological Association) :—Larvæ of certain food-fishes, together with other animals of interest inhabiting Plymouth Sound.

Exhibited by Prof. A. C. Haddon, on behalf of Mr.