

gives the details of fourteen stars which have recently been found to have variable radial velocities, from plates taken by the D. O. Mills expedition to the southern hemisphere. The same author deduces the orbit of the spectroscopic binary ν Centauri, giving the period as 137.939 days. This star is one of a group of Class B binaries, which have periods of about 130 days. Mr. R. F. Sanford describes his investigation of the orbit of the spectroscopic binary ϵ Volantis, a star of magnitude 4.5 and of Class B₅. The new elements show a period of 14.16833 days. A note by the same author on two spectrograms of the interesting irregular variable η Carinæ indicates that the observations of 1913 and 1914 show no evidence of variation in radial velocity.

SOLAR RADIATION MEASURES IN EGYPT.—Bulletin No. 14 of the Helwân Observatory contains an account of some observations of solar radiation which have been carried out at the Helwân Observatory by Mr. Eckersley. It has been shown by Prof. Abbot that values of the "solar constant" vary from day to day, and that even at two stations as far apart as Mount Wilson (California) and Bassour (Algeria) there is a very well-marked correspondence between the values derived at these stations, so that the action of local atmospheric effects is not the cause of the fluctuations. Prof. Abbot considers the outstanding variation to be due to a real fluctuation of the solar constant. In order to investigate this question further, it was decided to make an extended series of observations at Helwân, and this was commenced at the beginning of last year. The account of these measures is given in this paper. For the statistical purpose of comparing the results obtained with those at Mount Wilson, the highest precision of individual observations is not required, but an extended series of measurements uniformly treated is of the greatest value. For this reason pyrheliometer measures of the total energy alone were made. The communication describes the method employed, the reduction of observations, and the results secured. While the value of the radiation derived from the Smithsonian Institution observations at Mount Wilson is 1.932 (mean value of 606 observations taken at Washington, Mount Wilson, and Bassour during the period 1902-1912), the Helwân mean value derived is 1.782. The latter value is considerably less than the Smithsonian mean value, and the cause of the difference is dealt with by the author in subsequent paragraphs. Finally, evidence for the fluctuation during the period of observation is dealt with, and it is concluded that while some of the deviations are probably due to real fluctuation, no conclusive decision can be reached until the Mount Wilson results can be compared.

THE BRILLIANT FIREBALL OF SUNDAY, MARCH 28

BETWEEN March 21 and 29 eight large meteors were observed, but by far the most brilliant object among them was that of March 28, 7.47½ p.m. Its flight was witnessed by many hundreds of persons from the southern parts of England, as well as from the English Channel, France, and Belgium.

As viewed from London, the meteor sailed slowly along a few degrees under the stars Sirius and Rigel, and further westwards to possibly beyond γ Eridani. Mr. H. P. Hollis saw the meteor from a place about three miles due east of the Royal Observatory, and estimated its duration of flight as between five and six seconds. He did not see the beginning, and it was difficult to trace the exact point of extinction owing to trees behind which the object passed.

Mr. G. P. B. Hallows was in his observatory at

East Howes, Bournemouth, with an astronomical friend, Mr. C. Gregory, when the meteor burst out in the southern sky. It moved from the region of α Hydra to near Rigel at about the place of ν Leporis. It passed a little above Sirius. Brilliancy far exceeded Venus, and its duration was from three to four seconds. A trail 5° or 6° long followed the nucleus, and the latter burst into fragments at the end. The front of the head was yellow, the rear part red. Diameter, about 15', or half that of the moon.

Mr. A. King saw the meteor from Scunthrope, Lincolnshire, and from this northerly position its apparent path was very low, being from about 117°-31° to 98°-32°. The brightness was estimated equal to Sirius, the colour yellow-green, and duration 7½ seconds.

Mr. H. Rollason, of Montgomery, Wales, states that the meteor flamed out on the western sky, moving from S.E. to N.W., bursting twice, and enduring altogether five to six seconds. Many other observations have been received or published in the daily papers. As usual, there are discordances, but it is not difficult to derive a real path fairly consistent with the data.

The radiant point is indicated at 192°+4°, or possibly 220°+14°, low in the eastern region of the sky. The height of the object was from about 71 to 23 miles along a path of 175 miles from over the neighbourhood of Vire in France to the English Channel, about 60 miles south of Eddystone. Velocity, 24 miles per second. The meteor seems to have been directed from a radiant comparatively unknown in March, but in April, contemporary with the Lyrids, there is a rich shower of slow and brilliant meteors from 200°+8° near α Virginis.

The recent fireball must have passed almost vertically over Jersey, and from the Channel Islands and western parts of France it created a splendidly luminous effect. As viewed from Bournemouth the apparent size of the pear-shaped head of the meteor was considered to equal half the moon's diameter, which, from the distance of the object, would imply a magnitude of nearly two-thirds of a mile. This must have enormously exceeded the actual dimensions of the stony, or metallic, material composing the meteor. When undergoing combustion, the flame and expanding gaseous vapours from meteors give a vastly exaggerated idea of their real size. It must be very rare that a fireball exceeds one or two feet in the diameter of its material.

I have ascribed a flight of 175 miles to the recent fireball, but it may have been much longer than that. Many of the observers did not detect the object until it had developed considerable brilliancy. The moon was nearing the full at the time of its appearance, but the meteoric visitor startled some of the spectators with its astonishing lustre. W. F. DENNING.

THE INSTITUTE OF METALS.

VOLUME XII. of the Journal of the Institute of Metals, representing the work of the Institute during the second half of 1914, has just appeared. This is one of the first volumes of proceedings to appear since the outbreak of the war, and it indicates that the Institute of Metals has been able to pursue its activities, except for the fact that the autumn meeting which was to have taken place at Portsmouth early in September had to be abandoned. An interesting series of papers, however, are fully discussed by correspondence in the Journal. One of the most interesting from the scientific point of view is the paper by Mr. O. F. Hudson on the critical point at 460° C. in zinc-copper alloys. Mr.

Hudson brings forward evidence, which appears to be quite conclusive, that the interpretation of this point as marking the decomposition of the β phase of brass into $\alpha + \gamma$, which has been elaborated by Prof. Carpenter in a series of papers, is erroneous, and that the β phase merely undergoes a polymorphic change from β to β_1 . A striking method of proof adopted by Mr. Hudson is that of preparing a series of alloys in a single piece of metal by the method of superposition. By superposing molten zinc on a layer of solid copper, the alloys can be formed at a temperature below 460°C. , and yet a phase which corresponds to β makes its appearance. If what Carpenter has called "apparent β " were really unstable below 460°C. , it could never be produced synthetically below that temperature.

Equally interesting from another point of view is the paper, and resulting discussion, by Mr. Arnold Philip dealing with the causes of corrosion in condenser tubes. In the recent Report to the Corrosion Committee of the Institute of Metals, Dr. Bengough and Mr. Jones had been led to reject entirely the view that particles of foreign matter, such as coke, which might set up local electrolytic effects, could thereby accelerate local corrosion and produce "pitting." Mr. Philip traverses this conclusion, and suggests that it was reached on insufficient evidence, while he adduces positive evidence to show that particles of coke can cause local pitting. While such divergence of views among those studying these matters is somewhat unfortunate from the point of view of the practical man seeking guidance for his practice, it serves to show the great need which exists for the further exhaustive investigation of such fundamental questions, and at the same time demonstrates the useful work of the Institute of Metals in encouraging such work and providing a meeting ground for full and—fortunately—dispassionate discussion.

Further papers of special scientific interest are those by Mr. S. W. Smith on the surface tension of molten metals, by Mr. Phelps on the effect of hydrogen on the annealing of gold, and by Messrs. Bengough and Hanson on the tensile properties of copper at high temperatures. In a "Note" Prof. Huntington also deals with the tensile properties of metals at high temperatures, but while Bengough and Hanson find in their results strong support for the theory that the crystals of a metal are held together by something of the nature of an amorphous cement, Huntington urges somewhat vague objections to that view.

Another "Note," contributed by Prof. Carpenter, deals with "The Extraction of Native Copper at Calumet, Lake Superior"; while in itself not uninteresting, it is difficult to understand why this note has been included in the Journal of the Institute of Metals, since it deals with a subject outside the scope of its work and coming well within that of the Institution of Mining and Metallurgy. Although unimportant in itself, such a departure from accepted limitations causes confusion when references have to be looked up.

RECENT WORK ON INVERTEBRATES.

THE journal of a college of agriculture is about the last kind of periodical in which we should expect to find descriptions of deep-sea cephalopods. Nevertheless, three out of the four articles constituting the contents of the seventh number of vol. iv. of the Journal of the College of Agriculture, Imperial University of Tokyo, are devoted to new and rare species of squids, the remaining communication dealing with the eels of the Japanese, Corean, and Formosan seas. In the first of the three articles on

squids, all of which are very fully illustrated, Mr. C. Ishikawa describes a new species of the genus *Enoplateuthis* from the Japan Sea, while in the second Messrs. Ishikawa and Wakiya treat of a number of fragments of a gigantic species taken from the stomach of a sperm-whale. The latter is identified with *Moroteuthis robusta*, of which it forms the fifth known example; in the third article the last-named writers describe a new species of the same genus under the name of *M. loennbergi*.

In an article, illustrated by one coloured and four black-and-white plates, in the February number of the *Entomologist's Monthly Magazine*, Dr. T. A. Chapman describes the larva of the butterfly *Everes argiades*, with figures, not only of the entire caterpillar, but also magnified representations of the shed skins at various stages of development. In the same issue Dr. D. Sharp continues his account of the beetles of the group *Holophorini*, dealing in this instance with the structure in the genital tube known as the *ædeagus*, which, as exemplified in *Meghelophorus aquaticus*, is described in great detail.

Aberrant modes of reproduction in certain well-known insects, such as the blue oil-beetle, the parasitic genus *Stylops*, and the vine-phylloxera, form the subject of an illustrated article by Mr. W. M. Scheyen in the January number of *Nature*. A continuation is promised.

Writing in the January number of the *Zoologist* of non-sexual reproduction in sea-anemones, as observed at the Millport Marine Biological Station, Mr. R. Elmhirst remarks that although division is usually completed in a few days or weeks, especially among the members of the genus *Anthea*, yet that he has seen instances in which "double" individuals of *Actinoloba* showed no change during a period of several months. He also records a case in which an *Actinia* with two complete discs, mouths, and rings of tentacles retained the same form for close on four years in an aquarium. Possibly, of course, the somewhat unnatural conditions in such an environment may be a factor in these cases.

In *Spolia Zeylanica*, vol. x., part 36, Mr. A. Rutherford mentions that the females of a "glow-worm" (*Dioptoma adamsi*), in addition to the usual terminal light, have a number of other luminous points, apparently arranged in ten transverse rows. Somewhat similarly situated points of light also occur in the smaller males.

In the February number of the *Irish Naturalist* Mr. A. W. Stelfox gives a list of land and fresh-water molluscs from the Dingle Promontory, Kerry. Seventy-four indigenous species are recognised.

R. L.

MINERAL STATISTICS.¹

PROBABLY the first point that will strike the student of mineral statistics when he sees the report now before us is the extreme dilatoriness of our Home Office. This report, which covers the mineral statistics of the world up to the end of 1912, was not published until the end of 1914; the Chief Inspector endeavours to excuse this delay by a reference to the lateness of the publication of official foreign statistics, but it is a significant fact that a private firm in the United States of America issued a large volume covering the world's mineral statistics for 1913 in July last, so that our own official production is no fewer than eighteen months behindhand. Statistics of mineral production are practically valueless unless they are published promptly, and all the

¹ "Mines and Quarries. General Report with Statistics for 1912." By the Chief Inspector of Mines. Part iv., Colonial and Foreign Statistics.