

THE scientific portion of the *Central Zeitung für Optik und Mechanik* for January 1 contains the first of a series of articles by Prof. von Rohr on the principal points of optical systems and the graphical methods of determining images. The constructions given are those suitable for convex and concave systems of which the principal planes and foci are given. The industrial portion includes a reproduction of the new regulations under which optical workers of eight years' standing may attend shortened courses of instruction at the Government optical school at Jena and, after a qualifying examination, obtain the optician's diploma. A list of the optical and other instruments for which there is at present a demand in foreign countries is given. The wages paid to the various grades of workers in metal in the principal countries of the world form the subject of a further article. A list of the publications of the German Committee on Standards for Industry is provided, and the importance of the rapid adoption of the new standards throughout the country is emphasised. Coloured wall-charts have been prepared, so that the information may readily be placed before the eyes of designers, foremen, and workmen.

In a paper in the *Chemical Age* of February 14 Dr. Stephen Miall plots the atomic weights of the elements against their atomic numbers, and shows that all the elements lie upon a series of parallel lines of three different slopes. The atomic weights may be represented as  $bx+a$ , where  $x$  is the atomic number,  $a$  a small integer ranging from 0 to 5, and  $b$  has the value 2 for the elements from helium to nickel, 2.5 from copper to tungsten, and 3 from osmium to uranium. The first term, which contributes to the chemical character, he terms "live-weight," and the second term, which is of no influence on the chemical character, "dead-weight." Similar regularities have been previously pointed out, and, indeed, since the atomic weights for the most part conform to integral values, some such relation as the above is necessarily true. But the diagrams have a value apart from their interpretation. They suggest a novel basis for classification, and arrange the elements on parallel lines for which  $a$  and  $b$  have the same values. They may be useful to those seeking for regularities in the nuclear structure rather than in the atomic shell. Hitherto chemists have been too exclusively obsessed with the study of chemical character to the neglect of the atomic weight—an independent variable, as the study of radio-active change has made quite clear. The atomic weights, however, as the author remarks, mean something. They furnish the only present clue to the structure of the nucleus.

THE Carnegie Institution of Washington has issued another section of its monumental "Index of Economic Material in Documents of the States of the United States." The section, prepared by Adelaide R. Hasse, is the first instalment of the index relating to the State of Pennsylvania. Part i. contains the titles of collected documents, mainly printed by authority of the Senate and of the House of Representatives. Part ii. is a topical analysis arranged

alphabetically from A to E. Among the longer sections we find Agriculture, Canals, Climate, Coals, Coal-mining, and Education. The period covered is from 1790 to 1904. The new volume has been preceded by twelve similar quarto volumes, and will be followed by others, each devoted to a single State. The index undertakes to deal only with the printed reports of administrative officers, legislative committees, and special commissions of the States, and also with Governors' messages. References are given by volume and page to all material of economic importance contained in the reports and messages indexed. Under each sub-heading the arrangement is chronological. In the alphabetical part the compiler has introduced, in addition to subject entries, the names of persons who have exercised an important influence on the development of the economic life of the State. After each name there is reference to work done. The amount of material which had to be examined for the preparation of this volume must have been very great.

A SHORT but useful list of books on ornithology and oology (No. 398) has just been circulated by Mr. F. Edwards, 83 High Street, Marylebone, W.1. It contains some two hundred and fifty items, including several long runs of serials such as the *Ibis*, *Transactions and Journals of the Royal Microscopical Society of London*, *Proceedings of the Zoological Society of London*, etc. The list is sent free on application.

#### OUR ASTRONOMICAL COLUMN.

HOLMES'S COMET.—Dr. Schorr reports that the cometary object 1910f, found on two plates taken at Bergedorf by Dr. Baade on December 10, is definitely not identical with Holmes's comet, as it failed to appear on two plates taken on December 26, on which it would have been registered if it were moving in accord with the ephemeris calculated for that comet.

MINOR PLANET GM.—This is the object discovered by Senor Comas Sola on January 13, and considered for a time to be a comet. As it is the brightest minor planet discovered in recent years, it is of interest to give the elements which have been deduced at the Berkeley Observatory, California.

$$T = 1920 \text{ March } 16 \cdot 36 \text{ G.M.T.}$$

$$\begin{aligned} \omega &= 194^\circ 28' \\ \Omega &= 300^\circ 0' \\ i &= 17^\circ 59' \end{aligned} \left. \vphantom{\begin{aligned} \omega \\ \Omega \\ i \end{aligned}} \right\} 1920 \cdot 0$$

$$q = 2 \cdot 326$$

$$e = 0 \cdot 1109$$

$$\text{Period} = 4 \cdot 2315 \text{ years}$$

#### Ephemeris for Greenwich Midnight.

	R.A.	N. Decl.	Mag.
	h. m. s.	° ' "	
February 28 ...	7 25 26	0 33	11
March 7 ...	7 24 54	16 44	

NOVA IN LYRA.—Harvard Bulletin No. 705 reports the finding of another nova on the Harvard photographs by Miss Mackie. Position for 1900.0, R.A. 18h. 49m. 30s., N. decl. 29° 6.3'. Between December 4 and 6 it rose suddenly from mag. 16 or fainter to mag 6.5; on January 6 it had sunk to 8.5. Messrs. Adams and Joy report from Mount Wilson that its spectrum shows the striking nova characteristics.

The same message reports that these observers find remarkable changes in the spectrum of Mira Ceti, the bright helium and hydrogen lines being strengthened and widened towards the red.

**TIDES IN PIPES.**—In 1914 Messrs. A. A. Michelson and H. G. Gale made a preliminary investigation of the tidal changes in water-level in two pipes, each 502 ft. long, placed respectively along a meridian and a parallel, in the grounds of the Yerkes Observatory. They have now made a more refined series of observations (described in the *Astrophysical Journal* for December). The small changes of water-level are registered by photographing interference fringes produced by placing a mirror about  $\frac{1}{2}$  mm. below the surface of the water, and passing a beam of light from an electric lamp vertically down through the water-film, then reflecting it on emergence into a camera in which a sensitive film is moved by clockwork at the rate of 2 cm./hour. Some of the photographed curves are reproduced, and show a beautiful accord with the theoretical curves, which were carefully calculated by Prof. F. R. Moulton. The transition from spring to neap tides, and even the difference in height of alternate semi-diurnal tides, are obvious at a glance. The result shows that the pipe tides are 0.690 of what they would be on a rigid earth, so that the bodily tides in the earth's crust are 0.310 of what they would be if the earth were fluid. The earth tides appear to lag behind the impressed forces by  $4^\circ$ . This method avoids many of the complications that are present in the observation of ocean tides; it also appears to be capable of greater relative precision, in spite of the smallness of the quantities involved.

There appears to be a slip in the value of the rotational velocity  $\omega$  (p. 350); it is printed as  $2\pi$  sidl. day/solar day, but surely it should be  $2\pi$  solar day/sidl day, the mean solar day being the unit of time employed.

#### LUMINOSITY IN CENTIPEDES.<sup>1</sup>

AS Chilopoda have been traced back to the Carboniferous age by the palæontologists, these centipedes may be presumed to have understood their own interests pretty well in the struggle for existence. *Geophilus electricus* (Linn.) had already won the attention of Aldrovandi in the sixteenth century, and the specific name adopted for it by Linnæus was obviously based on its observed luminosity. The notes now under review state that among the centipedes only one great group, the Geophilomorpha, is known to exhibit the phenomenon.

With so long a history for the group in the modern period, it seems strange that biologists should still need to ask in regard to some of its species, which are by no means uncommon: Why are they luminous? Even those keen observers, Mr. and Mrs. Brade-Birks, after minute examination, with the aid of friends, and critical comparison of recent authorities, leave the subject inconclusively concluded. Microscopists will read with pleasure details of the contrivances by which they persuaded their many-legged, wriggling subjects, under just the friendliest squeeze, to sit for their portraits. As definite result of their careful study of *Geophilus carpophagus*, they "conclude that in the excretion which accompanies luminosity there are generally present: (i) the contents of the white glands, for [which they] propose the name of *protoluciferin*, (ii) mucin, (iii) acid." The expression "white glands" seems to be used rather vaguely, as

<sup>1</sup> Dartford Naturalists' Field Club Occasional Papers. Notes on Myriapoda. XX. "Luminous Chilopoda, with Special Reference to *Geophilus carpophagus*, Leach." By Hilda K. Brade-Birks and the Rev. S. Graham-Birks.

applying to certain white, rounded masses on the ventral parts of the specimen, these masses being "groups of pyriform, and probably unicellular, glands intimately associated with the production of light." But it is not made clear whether whiteness is a property of individual glands or only an effect of their grouping into opaque masses.

For an understanding of the debate on the value of lighting up as displayed in this very limited section of the animal world, Dr. Shipley's brief notice may usefully be quoted. He says:—"Some members of the family Geophilidæ are phosphorescent, and secrete from certain glands on the ventral surface a luminous slime; since this is produced by both male and female, and neither of them has eyes, the secretion is regarded as a means of frightening or warding off enemies. The male *Geophilus* spins a web, and drops a spermatophore in the middle of it, and the female comes and fertilises herself" ("Zoology of the Invertebrata," p. 315). The present collaborators suggest that, without specialised organs of sight, the Geophilids "may be able to appreciate light by a general absorption of its waves through the surface of the body." Though this inchoate power of vision might be otherwise of service, it could scarcely help in bringing the two sexes together, and the riddle is complicated by the fact that allied species without luminosity seem to arrange their affairs very well in its absence.

In general, experience has shown that animals, other than beasts of prey, are not frightened, but attracted, from a dark environment by illumination, so that among the alternative services of *protoluciferin* suggested by the authors any scaring property may be set aside as very improbable.

The systematist is now warned by our authors that *Stigmatogaster subterraneus* should be attributed to Shaw. So lately as last December, in Nevin Foster's list of fifty-three Irish Myriapods, they sanctioned the long-standing error of assigning the species to Leach. They acknowledge themselves baffled by the specific name of *Geophilus convolvens*, on which Fabre founded his researches. This is said to be not a phosphorescent species. Otherwise one might have supposed the name evolved from the strange account which Lucas cites out of the *C.R. Acad. médicale des sciences de Metz* in 1830. This records the frightful tortures in the head of a young Frenchwoman, which after a year were suddenly terminated "par l'expulsion d'un insecte qui, jeté sur le plancher, s'agitoit avec rapidité et se rouloit en spirale." It, however, was determined to be a specimen of *Geophilus carpophagus*. Leach. Gistel in 1850, writing of the Feuerwurm *Geophilus electricus* alludes to the story, but does not, in fact, discredit it by remarking that such a species could not penetrate the frontal cavities of a human head unless the owner of the head were asleep.

T. R. R. S.

#### THE POSITION OF THE METEOROLOGICAL OFFICE.

AT the monthly meeting of the Royal Meteorological Society, held on February 18, Capt. C. J. P. Cave brought forward a paper on "The Status of a Meteorological Office and its Relation to the State and to the Public." It was pointed out that a Meteorological Office is a practical necessity, and, since to be at all efficient it must be subsidised from public funds, it has to be under some Government Department. The work of a Meteorological Office is, however, very wide, and concerns, not one, but almost every Government Department; and if it is to be under one without adequate safeguards, there