

of the pole and that given by tidal terms of long period. Consideration of the effects of ocean tides (discussed according to the dynamical theory) upon the semi-diurnal deformation of the solid earth gives the value for the rigidity of the earth as being two or three times that of steel. This value is of the same order as is required to account for the observed wandering of the pole, and also for the diurnal tide in the solid earth. Dr. Schweydar does not set much store by Dr. Hecker's differing results for the values of the east-west and the north-south elasticity, and he gives reasons for not accepting the explanations offered by Hecker and Lallemand. On one other debatable point of much importance Dr. Schweydar's results will be read with much interest. If the earth is to be regarded as consisting of an elastic core, a viscous layer, and a rind, then he decides that this viscous layer cannot be supposed to be of the fluidity of molten metal, but must be regarded as to all practical purposes solid. It need scarcely be stated here that this was the view reached on quite other grounds by the late Sir George Darwin.

IN two papers published in the *Atti R. Accad. Lincei* (vol. xxxi., ii., pp. 740 and 803) Profs. R. Nasini and C. Porlezza describe the discovery for the first time of ozone in a natural water, and discuss the possible reasons for its presence therein. The water is that of Le Bagnore of Santa Fiora, in Monte Amiata, and the ozone is not a transitory but a permanent and normal constituent, imparting a distinct odour to the water, and being present to the extent of about 0.15 c.c. per litre. The water is not radio-active, and in default of other possible explanations, the view is put forward that the presence of ozone is due to autoxidation of ferrous bicarbonate, either *per se* or brought about by the action of the so-called iron-bacteria. The water of a spring at Bagnoli, Arcidosso, also in the Monte Amiata district, possesses similar properties, but in a minor degree. Both these waters have locally a high therapeutic reputation, and the question arises whether this is due to the ozone which they contain. Further investigations will be made to decide this and other points as to which there is still some uncertainty.

WE have received a copy of the Transactions of the English Ceramic Society, part ii., session 1911-12, which, in addition to a number of papers of technical interest to potters, contains an account, which is of more general interest, of several of the principal pottery works on the Continent. In the summer of 1912 members of the Ceramic Society made a tour of inspection of ceramic works in Holland, Germany, and Belgium, and a report of the visit, admirably illustrated by photographs, covers forty pages of the Transactions. The descriptions given of the Royal Berlin Porcelain Factory at Charlottenburg, founded by Frederick the Great in 1763, and now carried on by the Prussian Government, with 660 workmen, and of the Royal Porcelain Factory at Meissen, founded in 1710, and now employing 800 hands, are of particular interest. The writer of the report expresses regret that no such institutions exist in England:—"In Germany, should a manufacturing potter have

an idea which, through lack of capital or initiative, he is unable to work out to fruition, he at once has the assistance of the State pottery to test, and, if necessary, to evolve that idea, whereas in England brains can only be utilised apparently to the accompaniment of capital and risk."

A MEMORIAL portrait of the late Capt. Scott in uniform has been published by Messrs. Maull and Fox, the proprietors of the copyright in the only photographs of the explorer in full-dress uniform. The portrait, which is a photogravure, has been approved by Lady Scott, and the publishers have undertaken to contribute an agreed proportion of the profits of the sale of the portrait to the National Fund which is being raised. The price of the portrait is 5s. each, and copies can be obtained through the usual trade channels, or from Messrs. Maull and Fox, 187 Piccadilly, London, W., or Messrs. S. Hildesheimer and Co., Ltd., 96 Clerkenwell Road, London.

OUR ASTRONOMICAL COLUMN.

SPECTRUM OF THE PLEIADES NEBULA.—Bulletin No. 55 of the Lowell Observatory contains an interesting account of the results secured by Mr. Slipher in the photography of the spectrum of the nebula in the Pleiades. This nebula, as Mr. Slipher points out, would doubtless naturally be classed as a gaseous nebula since in its prominent characteristics it resembles more the great nebula in Orion, the typical gaseous nebula, than the more numerous class of spiral nebulae. However, with the 24-in. refractor of the Lowell Observatory he made an exposure of twenty-one hours, obtaining, as he states, a perfectly legible record. This spectrum was continuous and crossed by strong hydrogen lines, H β , H γ , H δ , H ϵ , and H ζ , and fainter helium lines, those at 4026, 4381, and 4472 (combined with 4481) being recognisable. No trace of any of the bright lines seen in the spectra of gaseous nebulae was found, but the spectrum resembled a copy of the brighter stars of the Pleiades. The result suggested that the spectrum might be due to light from Merope scattered and reflected by the large objective. Exposures on the nebula of Orion and of a region near Sirius, led him to conclude that "the nebula shines by light, the spectrum of which is a true copy of that of the neighbouring star Merope and of the other bright stars of the Pleiades." It is suggested then that the nebula is disintegrated matter similar to what we are acquainted with in our solar system, as in the rings of Saturn, comets, &c., and that it shines by reflected light.

CHROMOSPHERIC (SOLAR) LINES IN THE SPECTRUM OF ϕ PERSEI.—An interesting paper by Mr. Paul W. Merrill forms part of Lick Observatory Bulletin No. 224. In the course of a survey of Class B stars having bright hydrogen lines, the author has measured a number of lines, bright and dark, between $\lambda\lambda$ 4340 and 6515 in spectrograms of this star, and connects these lines with "chromospheric" lines taken from Young's lists in Frost-Scheiner's "Astronomical Spectroscopy." It is to be regretted that the author has not employed a more recent authority. However, he considers the presence of "chromospheric" radiations in the stellar spectrum established. The star does not duplicate the solar chromosphere, for it is stated that the phenomena presented by helium, magnesium, and sodium are anomalously at variance with the chromospheric spectrum. This paper extends and confirms, apparently unconsciously, the conclusion previously arrived at by Sir Norman Lockyer and

Mr. F. E. Baxandall (Proc. Roy. Soc., vol. lxxiv., pp. 548-550, 1905), when many lines in the emission spectrum of μ Centauri (also an Orion star with bright hydrogen lines) were found to agree in wavelength with enhanced iron lines.

WHAT BECOMES OF THE LIGHT OF THE STARS?—This question Prof. Very, of the Westwood Observatory, Mass., U.S.A., places before the readers of *The Popular Science Monthly*, and proceeds to give an interesting answer in an essay, highly speculative in character, developed in eighteen pages of the March number. The author ably marshals a useful body of evidence tending to establish that there is a general absorption of light by the ether. In this transformation of energy he sees the genesis of matter, and in meteorites he finds the "appointed instruments" whereby the nascent dust is collected "into the germs of future worlds." By atomic disintegration like that accompanying the degradation of radio-active elements the cosmogonic process is made reversible.

It may be mentioned that in reference to the "transient nebulosity," which appeared around Nova Persei, the author states: "It was an electric phenomenon, an exhibition of canal rays, or positive ions, on a grand scale," and that to explain the high temperature of the helium stars, he makes the hypothesis that they "contain an exceptional amount of peculiarly unstable elements."

PUBLICATIONS OF THE STRASSBURG UNIVERSITY OBSERVATORY.—The second part of vol. iv. of the *Annalen der Kaiserlichen Universitäts-Sternwarte in Strassburg*, published under the direction of Dr. Bauschinger, contains a large number of observations of double stars, planets, satellites, and nebulae. The double stars were observed with a 49-cm. refractor by Dr. Wirtz between 1902 and 1910, and the results are compared with those obtained by other observers and with the ephemerides. The same observer is also responsible for the measures of the major planets and their discussion, in which are given the diameters and other measures, such as the dimensions of the Martian snowcaps, and the positions of the *streifen* on Jupiter; for the polar and equatorial diameters of the latter planet he finds the values $35.986'' \pm 0.028''$ and $38.254'' \pm 0.030''$ respectively.

TIDE TABLES.—From the Government Astronomer of New Zealand, Mr. C. E. Adams, we have received a report of the tide observations made at Auckland since December 1, 1908. These have now been harmonically analysed, and the results are given. There is also an interesting description of a new tide gauge designed by Mr. W. Ferguson, in which the recording pencil is moved by a clock and the paper on which the record is made is moved by the tide. The gauge has been running some months, and has given great satisfaction.

From the Government Printing Bureau at Ottawa we have received copies of the tide tables for the Canadian coast for 1913. The accompanying letterpress contains many interesting facts concerning the tides on the Pacific coast.

STARS WITH VARIABLE RADIAL VELOCITIES.—Mr. J. H. Moore, of the D. C. Mills Expedition's Observatory, Santiago, Chile, gives a list (L.O. Bulletin 224) of nine stars of about 5.0 magnitude, having variable radial velocities. In the same bulletin Prof. W. W. Campbell gives observations showing that the radial velocities of δ Andromedæ and μ Cephei respectively vary between -1.8 km. and -10.8 km., and $+15.6$ and $+29.4$. The latter also makes a correction regarding the radial velocity of i Capricorni. In L.O. Bulletin 97 this was stated to be variable. The removal of some errors of reduction leaves the velocity apparently constant at $+12$ km. per second.

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THE TEACHING OF MATHEMATICS.¹

THE papers enumerated below complete those written for the recent International Congress of Mathematicians. They deal with secondary schools, girls' school, preparatory schools, the training of teachers, technical institutes, and universities. Earlier papers in the same series were described in NATURE of March 14, 1912 (p. 44), and of May 23 (p. 305).

Secondary Schools.

No. 20 is a judicial discussion of "The Calculus as a School Subject." Mr. Jackson states impartially the questions involved, some of which can only be settled by greater experience than we now possess. Some questions are already settled, e.g. that if the calculus is to be introduced time must be found by a reduction in the drill which now prevails in algebra and trigonometry, by a frank recognition that tangents to curves and varying velocities involve the ideas of the calculus with some knowledge of the concrete ment that follows from this recognition. It is also desirable that the pupil should come to the study of the calculus, and by giving these subjects the treatment to which its methods are applicable. Mr. Jackson appears to be unaware that it is useless to point out an imperfection of proof to pupils who cannot discover the imperfection for themselves; but his pedagogy is in general so good that we feel sure he does himself injustice in this apparent ignorance.

Mr. Barnard (No. 22) frankly disapproves of the methods of teaching which have resulted from Prof. Perry's movement. He is all for thoroughness, and most of his article is taken up with a list of the blunders of text-books. We gather that he attributes these blunders to the new methods, a surprising view when we consider how few men educated in the new methods are old enough to write books.

Our conclusion is different. Writers of text-books are on the whole picked men, such as university professors and the ablest schoolmasters, and they are at present men trained on the old "thorough" methods; and if such blunders are possible for these picked men, it is indeed few of the schoolboys who are fit to profit by that training.

¹ The Teaching of Mathematics in the United Kingdom. Special Reports on Education Subjects.

No. 18. "Mathematics in the Education of Girls and Women." By Miss E. R. Gwatkin, Miss Sara A. Burstall and Mrs. Henry Sidgwick. Price $2\frac{1}{2}d.$

No. 19. "Mathematics in Scotch Schools." By Prof. G. A. Gibson. Price $3d.$

No. 20. "The Calculus as a School Subject." By Mr. C. S. Jackson. Price $1\frac{1}{2}d.$

No. 21. "The Relation of Mathematics to Engineering at Cambridge." By Prof. B. Hopkinson. Price $1\frac{1}{2}d.$

No. 22. "The Teaching of Algebra in Schools." By Mr. S. Barnard. Price $1\frac{1}{2}d.$

No. 23. "Research and Advance Study as a Training for Mathematical Teachers." By Prof. G. H. Bryan. Price $1\frac{1}{2}d.$

No. 24. "The Teaching of Mathematics in Evening Technical Institutions." By Dr. W. E. Sumpner. Price $1d.$

No. 25. "The Undergraduate Course in Pass Mathematics, generally, and in relation to Economics and Statistics." By Prof. A. L. Bowley. Price $1\frac{1}{2}d.$

No. 26. "The Preliminary Mathematical Training of Technical Students." By Mr. P. Abbott. Price $1\frac{1}{2}d.$

No. 27. "The Training of Teachers of Mathematics." By Dr. T. P. Nunn. Price $1\frac{1}{2}d.$

No. 28. "Recent Changes in the Mathematical Tripos at Cambridge." By Mr. A. Berry. Price $1\frac{1}{2}d.$

No. 29. "Mathematics in the Preparatory School." By Mr. E. Kitchener. Price $1\frac{1}{2}d.$

No. 30. "Course in Mathematics for Municipal Secondary Schools." By Mr. L. M. Jones. Price $1\frac{1}{2}d.$

No. 31. "Examinations for Mathematical Scholarships at Oxford and Cambridge." By Mr. A. E. Jolliffe and Mr. G. H. Hardy. Price $2d.$

No. 32. "Parallel Straight Lines and the Method of Direction." By Mr. T. James Garstang. Price $1d.$

No. 33. "Practical Mathematics at Public Schools." By Prof. H. H. Turner, Mr. R. C. Fawdry, Mr. A. W. Siddons, Mr. F. W. Sanderson, and Mr. G. M. Bell. Price $1d.$

No. 34. "Mathematical Examinations at Oxford." By Mr. A. L. Dixon. Price $6d.$

(London: Wyman and Sons, Lt. Edinburgh: Oliver and Boyd; Dublin; E. Ponsonby, Ltd.)