

Lambayeque. Lastly, in *Boletín* No. 54 Mr. G. Klinge gives the mineral statistics of Peru for the year 1906. The production included 79,969 tons of coal, 70,832 tons of petroleum, 20,226 tons of salt, 2598 tons of borates, 1830 tons of sulphur, 230 tons of silver, 13,474 tons of copper, 2568 tons of lead, 2304 kilograms of mercury, and 1247 kilograms of gold.

M. A. PELLETAN, in the October number of the *Journal de Physique*, expresses his regret that in France there is so much difficulty in finding persons capable of determining the elements of an optical instrument by any of the modern methods. It seems singular that in a country through which a knowledge of mathematics is more widely spread than elsewhere, that knowledge should find fewer practical applications than it does in almost any other country. M. Pelletan suggests the formation of a Government office to which engineers whose knowledge or leisure would not allow them to cope with mathematical difficulties might bring their problems for solution. In the meantime, he gives a clear *résumé* of the general methods of treating geometrical optics which have been developed from Hamilton's characteristic function. These methods are not so well known in this country as they deserve to be, and we have not yet risen to the point of regretting our want of knowledge of them.

THE measurement of the angle between the optical axes of a biaxial crystal has always played an important part in the identification of the crystal, and several methods of making the measurement are in common use. There has, however, been little comparative or critical study of the accuracy of the different methods under different conditions. A considerable portion of the *American Journal of Science* for October is devoted to such a study from the pen of Mr. F. E. Wright, of the Carnegie Institution. During the course of his experimental work, Mr. Wright has constructed a double-screw micrometer ocular with the screws at right angles to each other which he uses to determine the position of any point on the interference figure produced when a thin plate of the crystal is examined in plane polarised convergent light. By this means he is able to obtain more accurate results than were possible with the ordinary micrometer in Becke's method. He advocates the use of the stereographic projection in preference to any other.

AN interesting account of the processes recently devised for liquefying air on an industrial scale, and for extracting oxygen directly from the liquefied product, is contained in an article by Prof. E. Mathias in the *Revue générale des Sciences* (Nov. 17, p. 1097). Particular attention is directed to the method of liquefaction developed by Claude in which the principle of expansion with the performance of external work has been adopted with remarkable success. The process patented by Thrupp in 1898, and that described by Linde in 1901, are also described. The problem of separating air into its constituents oxygen and nitrogen, which has formed during the past few years so prominent a goal for the endeavours of engineers of all countries, is dealt with at somewhat greater length, the many schemes suggested being considered in detail. Such success has attended the efforts made to separate the gases of the air industrially by liquefaction that the expenditure involved in preparing 1 kilo. of pure nitrogen on the large scale has fallen below a penny. The article is illustrated by nineteen drawings showing the principle of the various types of plant in use.

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A SEVENTH and enlarged edition of the translation by H.R.H. Princess Christian of Prof. Friedrich Esmarch's "First Aid to the Injured," with additional illustrations, has been published by Messrs. Smith, Elder and Co., at 2s. net.

NEARLY half of the thirteenth edition of Mr. W. H. Harling's illustrated catalogue of mathematical drawing instruments is new matter. Every requirement of the architect, draughtsman, and student appears to be anticipated. The needs of teachers of practical mathematics have been borne in mind, and considerable space is given in the additional pages to particulars concerning instruments for measuring with precision lengths, angles, and other dimensions.

MR. H. K. LEWIS has published a third edition of "Hygiene and Public Health," by Dr. Louis C. Parkes and Prof. Henry R. Kenwood. The present work grew out of Dr. Parkes's "Hygiene, or Public Health," which appeared in 1899, and was reviewed in *NATURE* of January 30, 1890 (vol. lxi, p. 290). A certain amount of new matter has been introduced into the present edition, but some parts of the previous issue have been compressed and abbreviated. The size of the page, too, has been slightly enlarged.

A FIFTH edition of the late Prof. P. G. Tait's well-known "Properties of Matter" has been published by Messrs. A. and C. Black at 7s. 6d. The work appeared first in April, 1885, and was reviewed at length in our issue of August 6, 1885 (vol. xxxii., p. 314), by Lord Rayleigh. The present edition has been edited by Prof. W. Peddie, of the University College, Dundee. The recent advance of physical science has necessitated some additions, but these have in every case been placed within brackets and initialed by the editor, so that the original plan of the book has been preserved.

OUR ASTRONOMICAL COLUMN.

A NEW COMET.—A telegram from the Kiel Centralstelle announces the discovery of a new comet by Mr. Mellish on October 13. Its position at 16h. om. (Madison-Wisconsin M.T.) on that date was R.A. = 8h. 31m., dec. = 9° 24' S., and the comet was moving slowly in a north-westerly direction.

This position lies between one-quarter and one-third the distance from α C Hydrae, and the comet is apparently travelling towards Canis Minor. At present it rises a little to the south of east at about 2 a.m., and crosses the meridian at 7 a.m.

SUN-SPOT SPECTRA.—At the June meeting of the Royal Astronomical Society, Prof. Fowler announced that he had found a terrestrial origin for the numerous short, hazy lines, known as "band" lines, in sun-spot spectra which have hitherto remained unoriginated. These lines, it now appears, are part of an extensive "fluting" spectrum ascribed by Liveing and Dewar, in 1881, to a compound of magnesium and hydrogen (Proc. Roy. Soc., vol. xxxii., p. 190), and investigated by Sir Norman Lockyer.

The brightest fluting begins near λ 5211, and fades off towards the violet; a second includes the well-known hazy spot lines at $\lambda\lambda$ 5163.2, 5160.1, 5156.8, &c., whilst others begin at λ 5620 and on the violet side of H β . A comparison of the laboratory wave-lengths obtained by Prof. Fowler with those observed in the sun-spot spectrum places the identification beyond doubt, and it is estimated that probably several hundreds of the sun-spot "band" lines will be found to agree, in position, with those occurring in the laboratory spectrum (Monthly Notices R.A.S., vol. lxxvii., p. 530, June).

THE RED SPOT ON JUPITER.—Mr. Stanley Williams publishes his observations of the Great Red Spot during the most recent opposition of Jupiter in No. 4202 of the *Astronomische Nachrichten* (p. 23, September 30). He records the spot as being as faint as ever it was, and the observing conditions, especially at the commencement of the opposition, were very poor. The rotation period satisfying the observations is 9h. 55m. 42.27s., from 594 rotations, and the longitude is $20^{\circ}.87 \pm 0^{\circ}.23$.

Mr. Williams directs attention to the abbreviated rotation-period which obtained between the oppositions of 1905-6 and 1906-7; during the former it was 9h. 55m. 41.46s., whilst in the interval it was 9h. 55m. 36.25s. This difference is too great to attribute to errors of observation, and indicates a real change in the spot's position. Observations lead to the conclusion that this change of position is in some way due to the large mass of dark material known as the Pyramid Spot, or South Temperate Disturbance, for on three occasions such changes of position have synchronised with the passage of the Disturbance past the Red Spot. The general discussion of a large number of observations of this phenomenon may, as Mr. Williams suggests, throw considerable light on the nature, and possibly the mass, of the Red Spot.

THE PROPER MOTIONS OF STARS IN THE CLUSTER MESSIER 92.—In No. 4165 of the *Astronomische Nachrichten*, Dr. K. Bohlin compared some measures of the stars in the cluster Messier 92, made on an astrographic plate taken at Stockholm in 1898, with those made by Schultz at Upsala in 1873, and found discordances which were attributed to proper motions during the intervening twenty-five years.

Prof. Barnard has had this cluster under observation, with the 40-inch Yerkes refractor, for some time past, and in No. 4202 of the same journal he discusses his observations with the view of testing the theory of proper motions. A comparison of the three sets of measures leads him to the conclusion that the existence of actual proper motions is very doubtful, for the cases of agreement are practically equal in number to those in which the measures do not agree. In a second paper he compares the definite measures made by Schultz of the stars in the bright part of the cluster with those made by himself, and definitely expresses his confidence in the opinion that the discordances are not due to proper motion, but rather to the uncertainty of the measured positions. The knowledge that such uncertainty existed led Prof. Barnard to undertake visual micrometer measures of various clusters with the 40-inch refractor, and he hopes to publish the results of the work in the course of the next twelve months.

THE DOMINION OBSERVATORY, OTTAWA.—From notes in the current Journal of the Royal Astronomical Society (Canada), vol. i., No. 4, p. 264, July-August, it is evident that valuable results may be expected from the investigations now being carried out at the Dominion Observatory, Ottawa. The new spectrograph is performing very satisfactorily, and with the one prism gives spectra of first-type stars, in which $H\beta$, $H\delta$, $H\epsilon$, and $H\gamma$ are accurately measurable; $H\gamma$ was the only hydrogen line usable on the earlier spectrograms. Seven spectroscopic binaries are under regular observation, and, in addition to the results already published for α Draconis and ι Orionis, it is hoped that the provisional elements of four other binaries will soon be completed. A new method, a modification of Hartmann's, has been applied to the reduction of the plates with considerable accuracy and a great saving of labour. Experiments, having for their object the production of a flatter field, are being carried out, and it is hoped to obtain a field of 8° , instead of the 2° or 3° at present available. A 6-inch first-quality plane grating has been supplied by Dr. Brashear for use with the coelostat telescope in solar research. Dr. R. G. de Lury, Mr. R. M. Motherwell, and Mr. J. N. Tribble have been appointed to the staff for work on solar research, micrometer observations, and radial-velocity determinations respectively.

THE PERSEID METEORS.—A watch for Perseids was kept at Greenwich from August 10 to 13, but very few brilliant

meteors were seen, the display, on the whole, being considered a very poor one. The actual numbers of meteors bright enough to be plotted were twenty-seven on August 10-11, sixty-four on August 11-12, and eight on August 12-13. On the last-named night clouds interfered with the observations, but the other two nights were quite cloudless (*Observatory*, No. 387, p. 366, September).

BOTANICAL CONGRESS AT DRESDEN.

THE German Botanical Society has this September celebrated its twenty-fifth anniversary at Dresden under the presidency of Prof. Sawadener, who justly emphasised the promptness of publication and value of the contents of the society's journal. Owing possibly to the wording of the invitation to members to contribute papers to the meeting, only one communication was made, by Dr. Winkler, on parthenogenesis in plants. The same botanist aroused great interest, and a short but lively discussion, by exhibiting a growing plant obtained by grafting *Solanum nigrum* with a tomato variety, and by encouraging, to the exclusion of other buds, a composite bud, arising at the point of contact and fusion of the two plants. The resulting shoot shows, from node to node upwards, especially well seen in the leaves, alternately, right and left, the characteristics of each plant. The term "graft-bastard" proposed was objected to by many. No doubt more will be heard of the specimen if it forms flowers. Prof. Bower and Colonel Prain were elected honorary members of the society.

In the earlier part of the week (September 8-15) the Society of Applied Botanists and that of the Systematists held their meetings. The applied botanists were present in force, and many important papers were read. The society by resolution agreed to urge on the Government the necessity of making better provision in many of the technical colleges for botany in its various branches. A few weeks previously the professors in the universities and technical colleges met to form a union, one object of which is to secure greater freedom of action and less Government interference, without, however, loss of Government funds.

Ule's finely illustrated account of the flora of the Brazilian province of Bahia, Hiltner's soil-bacteria investigations, and Lindner's beautiful mould cultures, were outstanding features of this part of the meeting. The systematists made a delightful excursion to the Bohemian Mountains (Rollberg, &c.) to compare their varied flora with the more uniform flora of the Elbe sandstone. On the basaltic Rollberg *Asplenium septentrionale*, *Woodсия Ilvensis*, *Ribes alpinum*, *Allium strictum*, and many other interesting alpine plants were obtained.

In the following week the German Society for the Advancement of Science and Medicine met also in Dresden. The botanical section was strongly represented under the presidency of Prof. Pfeffer, who contributed a paper on sleep movement in plants, Wettstein one on the phylogeny of the angiosperm flower, Molisch one on ultra-microscopic organisms, while Prof. Drude gave a demonstration in the botanic garden of his cultural work on *Cucurbita Pepo*. He showed a well-established hybrid between *C. Pepo* and *C. instittitia*, the fruit having the mottled colour of the latter, the size and form of the former. Throughout Prof. Drude and his assistants, Drs. Schorler, Naumann, and Schwede, did everything possible to ensure the comfort of visitors and the success of the meetings. The forestry school and arboretum at Tharandt were visited; but, owing to sudden illness, Prof. Neger was unfortunately absent. Nobbe's Seed Station, formerly at Tharandt, is now at Dresden under Dr. Simon's direction. The botanical garden at Dresden, though small, shows many interesting features. There are groups illustrating geographical distribution, e.g. plants characteristic of South Africa, Australia, &c. The illustrative plants throughout the garden are kept small to economise space. By using differently coloured labels, the periods of introduction into European cultivation of our garden plants are indicated.

T. J.