

To test the optical photographic distortion up to considerable distances from the centre, seven plates with the Pleiades photographed in the four corners have been measured. It appears that the distortion is practically insensible up to 60' from the centre, and is still small up to 80', but is not quite the same in the four corners of the plate. On examination, the character of the images in the four corners was also found to vary slightly, the coma being slightly inwards in one corner and outwards in another. The perpendicularity of the plate and object glass to the optic axis were examined and found to be satisfactory.

SOLAR OBSERVATIONS.

Observations of the sun have shown that the solar activity was fully maintained throughout the whole of 1893, the mean daily spotted area for the year being considerably in excess of that for 1892. The great spot of 1892 February still remains the largest hitherto seen in the present cycle, but in 1893 August a very fine group attained dimensions but little inferior, and the groups of 1893 November and 1894 February were very large. The characteristic of the year was, however, rather the great number of groups visible at the same time than the extent of any one of them. Thus in August and December 1893 as many as 16 or 18 distinct groups of spots were seen on the disk at the sametime.

MAGNETIC OBSERVATIONS.

The variations of magnetic declination, horizontal force and vertical force, and of earth currents were registered photographically, and accompanying eye observations of absolute declination, horizontal force and dip were made as in former years. The period was one of much less magnetic activity than last year, but there was a large increase occurring in 1894 February, at the time of the great sun-spot. Copies of the magnetic and earth current registers during the disturbances of February 20-March 1 and March 30-April 1, have been supplied to Mr. Preece for discussion in connection with disturbances on the telegraph lines.

METEOROLOGICAL OBSERVATIONS.

Meteorological observations have been made as usual. The reductions show that the mean temperature of the year 1893 was 51°·1, being 1°·6 above the average for the 50 years 1841-1890.

During the twelve months ending 1894 April 30, the highest air temperature in the shade exceeded 80° on 28 days. It was 91°·0 on June 19, 93°·0 on August 16, 94°·2 on August 17, and 95°·1 on August 18. In the 53 years since 1841 higher temperatures have been recorded only twice previously (on both occasions in July). The lowest was 12°·8 on January 5, the maximum on that day being only 19°·0 and the mean daily temperature 15°·9. The mean temperature on August 18 was 79°·6, being the highest mean value recorded in August since 1841. The mean temperature of January 5 was lower than any previously recorded since 1841, with two exceptions. The mean monthly temperature was above the average in all months excepting September, November, and January 1894. In May it was 4°·6, in August 3°·9, in March 2°·7, and in April 3°·8, above the average. In November it was 1°·5 below the average.

The number of hours of bright sunshine recorded during 1893 by the Campbell-Stokes sunshine instrument was 1454, the greatest number on record since the commencement of the registration in 1877. This is 171 hours above the average of the preceding 16 years, after allowance is made for the small difference of indication of the Campbell and Campbell-Stokes instruments. The aggregate number of hours during which the sun was above the horizon was 4454, so that the mean proportion of sunshine for the year was 0·326, constant sunshine being represented by 1.

The rainfall for 1893 was 20·1 inches, being 4·4 inches below the average of the 50 years 1841-1890. From March 1 to September 30 (the period of the great drought) the rainfall amounted to only 7·77 inches, while the average for the 50 years 1841-90 for those months is 14·22 inches.

The mean amount of cloud for the year on the scale 0-10 was 5·75. The average amount as determined by Mr. Ellis (*Quarterly Journal Royal Meteorological Society*, vol. xiv.) from 70 years' observations is 6·75.

The outlook as regards instruments and accommodation for them is stated to be fairly satisfactory; but the fact that four vacancies in a staff of twelve persons have occurred during the fiscal year has necessarily caused serious disorganisation of the work, and greatly handicaps progress.

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SCIENCE IN THE MAGAZINES.

THERE are few articles of scientific import in the magazines received by us. By this we do not mean to say that science is unrepresented in magazine literature for June, but that the articles, while affording an excellent pabulum for the omnivorous reader, lack originality of thought. They are, in fact, more descriptive than suggestive. "In the year 1887" (writes Mr. Edison, as an introductory note to an article by Antonia and W. K. L. Dickson in the *Century*) "the idea occurred to me that it was possible to devise an instrument which should do for the eye what the phonograph does for the ear, and that by a combination of the two all motion and sound could be recorded and reproduced simultaneously." The development of this idea, and its practical realisation, are well described by the authors of the article on Edison's kineto-phonograph—this being the comprehensive term given to the invention that is able to record and give back the impressions to the eye as well as to the ear. Muybridge, Marey, Boys, and others have shown what can be done in the way of instantaneous photography, but the plan used by Edison to obtain pictures of movable objects appears to differ from any previously used. After many trials, a highly sensitised strip of celluloid one and a-half inches wide has been adopted for the production of negatives, each strip being perforated on the outer edge. "These perforations occur at close and regular intervals, in order to enable the teeth of a locking-device to hold the film steady in the nine-tenths of the one forty-sixth part of a second, when a shutter opens rapidly and admits a beam of light, causing an image of phase in the movement of the subject. The film is then jerked forward in the remaining one-tenth of the forty-sixth part of a second, and held at rest while the shutter has again made its round, admitting another circle of light, and so on until forty-six impressions are taken a second, or 2760 a minute. This speed yields 165,600 pictures in an hour, an amount amply sufficient for an evening's entertainment, when unreelcd before the eye. . . . The advantage of this system over a continuous band, and of a slotted shutter forging widely ahead of the film, would be this, that in one case only the fractional degree of light comprised in the 1720th part of a second is allowed to penetrate to the film, at a complete sacrifice of all detail, whereas in the present system of stopping and starting, each picture gets one-hundredth part of a second's exposure with a lens but slightly stopped down—time amply sufficient, as any photographer knows, for the attainment of excellent detail even in an ordinary good light." The perforations in the film, referred to in the foregoing, are of assistance in establishing harmonious relations between the kinetoscope and phonograph, in making the action recorded by the one suit the word imprinted upon the other. Several reproductions of series of pictures obtained by the kinetograph accompany the article. In order that the subjects leaving their "passing moods" upon the kinetograph film may be brilliantly illuminated, a new kind of studio has been constructed. The building is pivoted at the centre, and is capable of being rotated so as to present any desired aspect to the sun. Another article in the *Century*, entitled "Field Notes," by Mr. John Burroughs, contains some interesting notes on the habits of a few common animals. This kind of contribution is very common in the magazines. "The Dog," by Mr. N. S. Shaler, and "American Game Fishes," by Mr. L. M. Yale, both in *Scribner*, belong to this anecdotal class.

Cassell's Family Magazine contains an article by Mr. J. Munro on "How I discovered the North Pole." The story is, of course, purely imaginary, but the idea upon which it is based might be developed for preliminary geographical exploration. A number of balloons are supposed to have been set free in high north latitudes, each provided with magazine cameras stocked with plates and having long-distance lenses of various focal lengths. Exposures were automatically made at regular intervals by means of clockwork, so that when the balloons were captured, they contained photographs of the tracks above which they had passed. Each balloon also carried a gyroscope mounted in such a manner that when its axis of rotation became vertical—that is, when the balloon containing it was exactly over the North Pole, cameras were brought into action and photographs taken of the earth below.

"The Spring of the Year," in *Longman's*, is an inspiring article written by Richard Jefferies, and found by Mrs. Jefferies among the MSS. left by him. Mr. A. Morgan retails some second-hand information on "Celestial Photography" in the same

magazine. In *Good Words* Sir Robert Ball gives the second of a series of articles on "The Great Astronomers," the subject of his biographical sketch being Kepler. E. M. Caillard finds an excellent article on "Matter," and manages to impart clear and accurate notions on the universal properties of extension, inertia, unity, indestructibility and structure.

We note in *Chambers's Journal* "The Science of Colouring in Animals," "The Sargasso Sea," "Spiders and their Habits," and "The Identification of Habitual Criminals." Mr. A. Binet's "Mechanism of Thought," in the *Fortnightly*, is chiefly concerned with psychology and hypnotism. Honour is done to the late Prof. Robertson Smith by Mr. J. G. Frazer in the same magazine. Prof. Victor Horsley replies in the *Humanitarian* to the paper on vivisection contributed by Bishop Barry to the April number. The seventh of Mr. Phil Robinson's articles on "The Zoo Revisited," in the *English Illustrated*, deals with the animals in the "Small Cats' House." In the same magazine, Mr. W. B. Tegetmeier briefly describes the scope of his forthcoming book on horses, asses, and zebras. The May number of the *Nautical Magazine* contains an article in which Capt. Wilson Barker points to the study of "Natural History" (a term used to cover the ground of physiography) as a recreation for sailors.

In addition to the magazines mentioned in the foregoing, we have received the *Contemporary* and *National* reviews.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Provost of King's, Mr. A. Austen Leigh, has been re-elected Vice-Chancellor for the ensuing year.

St. John's College has carried off both the Smith's prizes this year; the winners are Mr. S. S. Hough and Mr. H. C. Pocklington, third and bracketed fourth Wranglers respectively in 1892, and first class in Part II. of the Mathematical Tripos, 1893.

Candidates for the University Lectureship in Invertebrate Morphology, vacated by Prof. Hickson, are requested to send their names to the Vice-Chancellor by June 9. The stipend is £50 a year.

Prof. Foster has been re-appointed a Manager of the Balfour Studentship Fund for the ensuing five years.

Mr. J. J. Lister, of St. John's, is to occupy the University's table at the Plymouth Biological Laboratory this summer.

The first examination for Diplomas in Agricultural Science will be held on July 2. Candidates are to send their names and fees to the Registry by June 13.

The next examination for Diplomas in Public Health will begin on October 2. The names of candidates, with their certificates, are to be sent to the Registry by September 18.

Sir G. G. Stokes, Dr. Sandys, and Prof. Robinson, are to represent the University at the Bi-centenary Festival of the University of Halle, to be held next August.

The following Examiners have been nominated by the Special Board for Medicine:—In Medicine, Dr. W. H. Dickinson, Dr. J. K. Fowler, Dr. L. Humphry, Dr. J. F. Payne; in Midwifery, Dr. W. S. A. Griffith, Dr. J. Phillips; in Surgery, Mr. I. H. Clutton, Mr. F. Treves, Mr. H. Marsh, Mr. W. H. Bennett.

Mr. H. Woods, of St. John's College, has been appointed an Elector to the Harkness Scholarship in Geology and Palæontology.

SCIENTIFIC SERIALS.

American Meteorological Journal, May.—The principal article is "Meteorology and Geodesy," by Prof. C. Abbe. It contains tables showing the variations in the force of gravity over the North American continent and the Atlantic ocean and their effect on the mercurial barometer. The author points out that there is a local attraction of gravitation that is less over the continents than over the oceans, and probably, on the average, less in the northern than in the southern atmosphere; these differences must be allowed for, in combination with the effects due to the density of the atmosphere and to centrifugal force. The principal resistance to the motion of the atmosphere originates in the connective processes that force stagnant air to mix with air in motion; this convective friction is quite

independent of viscosity, which has been generally introduced into the formulæ for atmospheric motion, and it is much more effective. The most important subject for the meteorologist to study is these convective mixtures and the resistances or accelerations that result therefrom. The author considers it unnecessary to take up the minute irregularities treated of in this paper, until after the study above referred to has explained the larger part of the irregularities of atmospheric motions. The same journal contains some very useful suggestions by Prof. Abbe, on the various meteorological problems that might be taken up by mathematical students.

Bulletin de la Société des Naturalistes de Moscou, 1893, Nos. 2 and 3.—On the copulation organs of the males of the genera *Crosica*, *Melecta*, *Pseudomelecta*, &c., by General O. Radczkowsky (in French, with four plates).—Contribution to the pathologic evolution of the nervous system, by Mme. O. V. Leonova, being a description of a complicated case of total anencephaly in a human embryo.—A case of seeming hermaphroditism with *Perca fluviatilis*, by N. Iwanzoff.—The Tithonian deposits of Theodosia, Crimea, by O. Retowski (in German, with six plates). This elaborate monograph contains the description of sixty-five fossil species from those little-known beds—no less than thirty-one species and one genus being new.—Palæontological data for the vertical subdivision of the Sarmathian deposits of South Russia, by A. P. Ivanoff (in Russian, summed up in French). The following five zones are distinguished:—(1) Zone of *Cerithium mitrale*, *mediterraneum*, and *rubiginosum*; (2) *C. disjunctum* and *mitrale*; (3) *C. nodosoplicatum*, *disjunctum*, and *mitrale*; (4) *C. rubiginosum*, *nodosoplicatum*, *disjunctum*, *mitrale*, var. *bicostata*, and *nympha*; (5) *C. mitrale*, var. *bijuga*; and (6) *C. disjunctum*. The beds overlying the above are characterised by the absence of *Cerithes*, and the appearance, for the first time, of *Trochus podolicus*, and a great development of *Mastra ponderosa*. The uppermost layers of the series contain no *Trochus podolicus*, while other species of *Trochus* and *Turbo* appear in great numbers.—The birds of Moscow, by Th. Lorenz, continued.—Note on J. D. Chersky, with a complete list of his works, by A. Iwanowski.—On a new species, *Parus transcaspicus*, by N. Zaroundnoi (in French).

Memoirs of the Kazan Society of Naturalists, vol. xxvi. Nos. 4, 5, and 6.—On the theory of the root-force in the plant, by Dr. Alexis Horvath. The manometric measurements of the author prove the existence of a rarefaction within the plant, and he therefore considers the vessel of a plant as a tube, in which we should have a succession of drops of a liquid, separated from each other by bulbs of air. The heating of the gas and its expansion acts in the tube as the piston of an aspirating pump.—On the consequences of the decapitation of the plant on some of its organs, by W. Rothert.—On the supply of water to Kazan, by Prof. Stscherbakoff.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 19.—"On Variations observed in the Spectra of Carbon Electrodes, and on the Influence of one Substance on the Spectrum of Another." By W. N. Hartley, F.R.S.

Certain "lines" in Hartley and Adeney's spectrum of carbon are attributed to cyanogen in a recent paper by Eder and Valenta.¹ These lines are not produced by cyanides such as potassium cyanide or mercuric cyanide. Graphite electrodes immersed in solutions show beautiful groups of lines which coincide with the edges of certain bands in spectra of the flame of burning cyanogen. These bands can be recognised in the groups III. and IV. on the spectra photographed by Kayser and Runge.

The origin of these coincident portions of spectra, namely, from the combustion of cyanogen and from carbon electrodes in saline solutions, taken in conjunction with the fact that they are not rendered by cyanides, makes it doubtful whether the cyanogen spectrum is not due to elementary carbon, as first advocated by Marshall Watts. There are other facts and circumstances which somewhat support this doubt. First, variations have been observed in the spectrum of carbon which cannot be easily accounted for. Secondly, the effect of one substance on

¹ "Line Spectrum of Elementary Carbon and the Ultra-violet Spark Spectrum of Wet and Dry Wood Charcoal" (Vienna: "Akad. Wiss. Denkschriften," vol. 60, 1893).