

as a test for nitric acid. The lists are most complete, and so far as we have been able to refer to them are accurate, and are not confined to recent work; *e.g.* Beale's carmine stain and injection fluids are given. The volume will be of the greatest service in the chemical and the biological laboratory.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR SEPTEMBER:—

- Sept. 8. 20h. 46m. Jupiter in conjunction with the Moon (Jupiter $4^{\circ} 56' N.$).
 10. 17h. om. Saturn at quadrature to the Sun (90° distant).
 „ 20h. om. Venus in the ascending node.
 „ 22h. 14m. Uranus in conjunction with the Moon (Uranus $3^{\circ} 35' N.$).
 14. 20h. om. Juno in conjunction with the Moon (Juno $0^{\circ} 20' N.$).
 15. 0h. 48m. Moon eclipsed, invisible at Greenwich.
 16. 3h. om. Mercury in superior conjunction with the Sun.
 22. 4h. 2m. Saturn in conjunction with the Moon (Saturn $6^{\circ} 59' S.$).
 23. 3h. 53m. Sun enters Sign of Libra; autumn commences.
 „ 8h. 22m. Mars in conjunction with the Moon (Mars $5^{\circ} 6' S.$).
 25. 0h. 7m. Neptune in conjunction with the Moon (Neptune $5^{\circ} 0' S.$).
 27. 8h. 34m. Venus in conjunction with the Moon (Venus $1^{\circ} 21' S.$).
 29. 16h. 46m. Sun eclipsed, invisible at Greenwich.
 30. 12h. om. Saturn stationary.
 „ 13h. 2m. Mercury in conjunction with the Moon (Mercury $2^{\circ} 36' N.$).

THE SPECTRA OF THE STARS.—After many years of patient labour by such pioneers as Rutherford, Secchi, Huggins, Vogel, Pickering and his co-workers, Lockyer and McClean, the subject of stellar spectra has attracted during the last decade the attention of an ever-increasing number of students in astronomy, astrophysics, physics, and chemistry. This is no doubt thanks in a great measure to the enormous number of spectra classified in connection with the Draper catalogue, but also largely to the simple nomenclature developed by Miss A. J. Cannon, further simplified by the suggestions of Dr. Hertzsprung. Although classification merely has received a great amount of attention of recent years, perhaps partly due to the prominence given to the matter by the Solar Union making it the work of a special committee, yet many important pieces of work have been accomplished beyond. Such are Campbell's and Kapteyn's work on the relations between radial velocities and type of spectrum, the similar work of Lewis Boss on the relation between proper motion and type, the work of Pickering and others on the distribution of stars of particular type of spectrum with reference to the Milky Way, &c. It is perhaps fitting that the importance of the subject should have led to the publication of a summary in the *Memoirs of the Society of Italian Spectroscopists*, No. 6, from the pen of Signor G. Abetti. It is, however, passing strange that this writer makes no mention of the work of Rutherford, Huggins, Lockyer, or McClean, except perhaps that some of them may be referred to in an "&c." Signor Abetti does not deal at all adequately with the literature on the chemical constitution of the stars. He does state, however, that titanium stars are on a level nearer to the helium stars than are the iron stars—a statement for which we know no justification.

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EXHIBITION OF THE ROYAL PHOTOGRAPHIC SOCIETY.

THE Royal Photographic Society's annual exhibition at the Gallery of the Royal Society of British Artists, Suffolk Street, Haymarket, is well worth a visit by anyone interested in photography and its applications before it closes on October 4. Besides an excellent collection of works that are notable for their pictorial quality, and that will be examined by technicians as illustrations of the possibilities of the processes that they represent, there is a larger than usual number of colour transparencies, and also exhibits that are of specially scientific interest. The colour transparencies are chiefly autochromes, but there are many on the new Paget plate and a few "Dufays," both of which latter will quite well bear comparison with the autochromes for the quality of their colour and detail. In the scientific section, Lt.-Col. J. W. Gifford shows a large number of original photographs of spectra of the metals taken with a quartz optical train of large aperture. Mr. G. Reboul shows that cuprous chloride, produced by exposing a polished copper plate to chlorine gas, will furnish photographs by treatment somewhat similar to that employed in the production of daguerreotypes. The insecurity of intaglio plate printing for monetary documents is again demonstrated by Mr. A. E. Bawtree in his copies of stamps, the genuine stamp and the forgeries being indistinguishable. The photo-micrographic section is particularly strong. The method of discovering a difference in the colloids present in jams, and of detecting various adulterations, is excellently shown in a series of low-power photo-micrographs by Mr. E. Marriage. Of other series, the "Histology of the Optic Nerve of Sheep," by Mr. J. T. Holder; the "Corpuscular Elements of Human Blood," by Dr. D. H. Hutchinson; and Mr. J. M. Offord's "Diatoms under High Power," deserve special notice. There is a fine collection of radiographs by Dr. Bela Alexander, Dr. G. H. Rodman, Dr. Gilbert Scott, Dr. Robert Knox, and Dr. Thurstan Holland, some taken in a small fraction of a second. In this direction the most novel work is by M. Pierre Goby, who by the use of ultra-soft rays secures quite full details in the most delicate transparent membranes, such as insects' wings, at the same time as showing the internal structure of the insect. But more wonderful are his micro-radiographs, made by using the fine pencil of Röntgen rays that passes through a small hole in a lead screen. The detail in parts of small vertebrates only a fraction of an inch in length, is so well reproduced that a fifteen or seventeen times enlargement would be considered excellently sharp for a direct radiograph. M. Goby applies his method to foraminifera and other minute objects with similar success. Among the other exhibits there are a process with examples of a method of producing colour transparencies by the absorption of dyes in fish-glue, by Mr. Bawtree, and good collections of natural history photographs, lantern slides, and stereoscopic transparencies.

THE ARCHÆOLOGICAL INVESTIGATIONS IN THE MISSISSIPPI REGION.¹

IN the publication referred to below Mr. Clarence B. Moore gives us another of his very careful descriptions of the systematic excavations he is undertaking in the Mississippi valley, and, as usual, it is profusely illustrated with most excellent photographs and coloured plates. By these investigations and the superb way in which he publishes his results, Mr. Moore is laying a sure foundation for future general-

¹ "Some Aboriginal Sites on Red River." By Clarence B. Moore. *Journ. Acad. Nat. Sci., Philadelphia*, xiv., 1912.

isations. The last year's work covered 519 miles of the Red River from its confluence with the Mississippi. Few burial places were found in Louisiana, as these were mainly in the often flooded level ground, and the artificial mounds were erected for places of residence; since most of the finds are obtained from graves the spoil was not very large, and as many of the mounds are now utilised they could not be satisfactorily investigated.

Along the Red River in Arkansas the conditions in the main are different; mounds containing burials, some of them richly endowed with artifacts, are fairly abundant, and further northward the lavish use of pottery with burials has often been described. It seems probable that the Arkansas mound burials were those of people of consequence. The pottery of Arkansas is as a rule tempered with fine gravel or sand, or with small bits of pottery, though kitchen vessels are often shell-tempered. The ware is thin and carefully modelled. There are few unusual shapes, grotesque or life forms were very rarely attempted, though they occur in the region to the north. Many vessels bear a high polish, and nearly all have incised designs filled in with red or white pigment. Circles, often series of concentric circles (probably sun-symbols), form a frequently recurring design. Decoration in polychrome was very exceptional, though common



FIG. 1.

more to the north. A remarkable feature—indeed, it is unique—in connection with some of the mounds is the depth of the grave-pits; one reached 15.5 ft. in depth. Among several interesting pipes, two types have not been met with hitherto. One form, from Haley Place, is of earthenware, the truncate conical bowl of which occurs at some distance from the end, the terminal continuation of the stem being hollow; one is nearly 23 in. long. The other, from Gahagan, is moulded to represent a kneeling man; there is a communication between the bowl and the open mouth of the figure, so that smoke can be made to emerge from it when the pipe is in use (Fig. 1). A number of beautiful useful and ceremonial stone implements were found, and various interesting pendants, some of which have the form of a lizard; one was formerly coated with sheet copper, as were also the large circular ear-plugs of limestone. It is, however, impossible to point out all the items of interest in this memoir.

Dr. Hrdlička adds a notice on the human remains. He says the skeletons from Haley Place and the McClure mounds probably may be safely ascribed to an extension of the Natchez people; the skulls exhibited deformation of the "Flathead" variety.

A. C. HADDON.

MAGNETIC STORMS AND SOLAR PHENOMENA.¹

IN the publication referred to below only the first thesis is printed. It deals with the relations between magnetic storms and solar phenomena. The thesis shows the nimbleness of mind one hopes to see in those who have taken high mathematical degrees at Cambridge, accompanied by a knowledge of terrestrial magnetism most unusual in British seats of learning. There are, it is true, researches bearing on the subjects investigated of which the author seems unaware, but his knowledge of foreign writings, including theoretical work by Kelvin, Larmor, Birkeland, Störmer, and Schuster, and observational work by Walker, Airy, Ellis, Maunder, Hale, and many others, is highly commendable. Also the attitude he adopts towards the work he criticises is generally philosophical. Thus, taking Kelvin's attempted demonstration that solar action cannot be the proximate cause of magnetic storms, Bosler points out that there are possibilities not considered by Kelvin making much smaller demands on the sun's stores of energy, and that in the light of modern knowledge no one can say what is a reasonable limit to solar expenditure. On the other hand, he recognises that Kelvin's work directed attention to a point apt to be overlooked.

Dr. Bosler regards his countryman Marchand (1887) as the first to claim a connection between the occurrence of magnetic storms and the presence of individual sun-spots or faculae near the sun's central meridian, but he regards Maunder's observations on the recurrence of storms in the solar rotation period as the strongest evidence yet advanced in favour of this view. He seems to be unaware of Broun's early work. He apparently accepts Sabine's deduction of an eleven-year period—corresponding to the solar period—in magnetic disturbances, but while recognising the strength of the evidence adduced—especially that of Maunder—in favour of solar jet theories, he considers Dr. Schuster to have demonstrated the impossibility of swarms of any kind of electrified particles sticking together all the way from the sun to the earth. The view he inclines to is that earth currents are the immediate cause of most, if not all, magnetic disturbances. The evidence he advances in favour of this view is derived from comparisons of records of magnetic storms at Parc St. Maur and Greenwich—especially those known as "sudden commencements"—with corresponding records of earth currents. This from an observational point of view is probably the most important part of the thesis, though only partly novel.

The author thinks earth currents may be produced by movements of electrified matter—associated with protuberances, spots, or faculae—on the sun. Taking the case of a cable of 0.25 cm.² section, made of copper of resistivity 1600, enclosing a circle 8000 km. in perimeter, he calculates that the current induced in the cable by a magnetic field of amplitude 10⁹ and period 10 sec., normal to the plane of the circle, would at a distance of one metre from the wire produce an alternating magnetic field of amplitude 1250⁷. This is adduced as an illustration of how a small field originating in the sun might be amplified on the earth. The idea may be worth considering, but the problem treated seems somewhat too remote from actuality. The magnetician will find a variety of other interesting matter in the thesis.

C. CHREE.

¹ "Thèses présentées à la Faculté des Sciences de Paris pour obtenir le grade de Docteur en Sciences Mathématiques." By M. J. Bosler. Pp. 96. (Paris : Gauthier-Villars, 1912.)