

and should be translated to some other sphere." To the man who is interested in every detail, whether scientific or commercial, of the business, each item of knowledge is of positive value, and the more he has the better it is for himself and his employer.

ALTHOUGH the use of "invar" wire with a very small coefficient of expansion in the measurements of the base lines of geodetic surveys has rendered an accurate knowledge of the temperature of the wire of less importance than it formerly was, it is still necessary if an accuracy of one part in a million is desired to know that temperature to within 1° C. In general, the temperature of the air, determined by means of a swinging thermometer, has been taken as identical with that of the wire; but Mr. B. F. E. Keeling, in a communication to the July number of the *Cairo Scientific Journal*, shows that, under field conditions, the wire temperature is about 2° C. higher than the air temperature owing to the absorption of sunlight at the surface of the wire. His method consists in substituting for the invar wire two wires of copper and constantan of the same diameter as the invar wire soldered together, so as to constitute a thermocouple, and connected to a galvanometer. The temperature of the junction exposed under field conditions is then determined from the galvanometer deflections.

THE *Builder* for August 27 comments on the facilities provided at the Brussels Exhibition for the beginning and rapid spread of fire. The liberal employment of canvas and other textile fabrics as structural and decorative materials doubtless served to render the sections affected by the disastrous fire even more than usually vulnerable. Apart from this characteristic, there is no reason for believing the average exhibition to be much safer from fire than that which has paid so heavy a price for attempted economy. No exhibition within recent times has been better conceived from the structural point of view than the Paris Exposition of 1900, where numerous important buildings were constructed entirely in reinforced concrete so as to afford safe accommodation for artistic, historical, and other treasures beyond all price. The example thus set is one that should always be followed, regardless of cost. We must break finally with the traditional flimsy structure of wood, canvas, and plaster. Steel is quite permissible if inexpensively sheathed in fire-protective casing, and is essential in roof construction. But timber wall panels, interior partitions, floors, roof framing, and roof covering must be given up. Expanded metal, wire netting, and steel lathing can easily be stretched between the main stanchions as the basis for incombustible walls and partitions formed of cement, mortar, or fire-resisting plaster.

FOR nearly four years past, the firm of Westinghouse, Church, Kerr and Co. has had in hand an investigation of the rust-preventing properties of protective coatings for structural steel. The *Engineering Magazine* for August contains a brief account of the results in the form of a paper read by Mr. C. M. Chapman before the American Society for Testing Materials. More than 500 coatings were tested, each paint being applied to two mild steel plates of about No. 16 gauge, 2 inches wide and 6 inches long. One plate was given one coat and the other two coats. After drying, the plates were fastened to boards with galvanised iron tacks, and exposed on the roof at an angle of 45 degrees, facing south. On the day the plates were exposed, scratch marks were made with a sharp instrument across two opposite corners of each plate,

leaving bright metal exposed, so that rusting started immediately along these lines. At regular intervals each plate was examined, and a record made of its condition. The one quality which was being sought was protection against rust. The tabulated results show that with one coating the red leads take first place, both for one year's and two years' exposure. With two coatings and one year's exposure the white leads take best place; with two years' exposure the red leads are best. Red-lead primers, zinc oxides, iron oxides, carbons, and graphites also come out very good in these tests.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN SEPTEMBER:—

- Sept. 1. 8h. 3m. Venus in conjunction with Moon. (Venus $4^{\circ} 26' S.$)
14. 6h. 5m. to 7h. 23m. Moon occults ω Sagittarii. (Mag. 4.8.)
- „ 7h. 56m. to 9h. 15m. Moon occults A Sagittarii. (Mag. 4.9.)
15. Saturn. Major axis of outer ring = $45^{\circ} 36'$, minor axis = $13^{\circ} 94'$.
17. 12h. 36m. Minimum of Algol (β Persei).
20. 9h. 25m. Minimum of Algol (β Persei).
21. 11h. 30m. Saturn in conjunction with Moon (Saturn $1^{\circ} 31' S.$)
23. 10h. 31m. Sun enters Libra. Autumn commences.
23. 13h. 43m. to 14h. 5m. Moon occults κ Tauri. (Mag. 4.1.)
23. 14h. 13m. to 14h. 59m. Moon occults ν Tauri. (Mag. 4.2.)

THE PARIS OBSERVATORY.—M. Baillaud's report of the Paris Observatory, for 1909, opens with a fitting tribute to the memory of MM. Fraissinet and Paul Gautier, and then proceeds to give an account of each department of the work and its labours during the year. Among other things, he mentions that the "cercle méridien du Jardin" has been completely overhauled and made perfect, while the programme has been greatly modified; the instrument is now being employed to observe fundamental stars, and will eventually undertake observations for the large catalogue proposed at the last meeting of the Paris Conference.

When not in use for spectroscopic work, the large *coudé* equatorial was employed by MM. Puiseux and Le Morvan for photographing the moon and planets; 218 images of Jupiter were secured between February and May, and later in the year more than 1200 images of Mars were secured.

A reproduction of the spectrum of Arcturus, original size, shows how effective are the new arrangements for employing the large *coudé* for stellar spectroscopy; the definition is magnificent, and the length of the spectrum between $\lambda 4100$ and $\lambda 4800$ is 15.4 cm.

The small equatorial *coudé* was employed by Dr. Nordmann in his photometric determination of stellar temperatures, and, with M. Salet, he has undertaken the observation of 300 stars of various spectral types.

OBSERVATIONS OF COMET 1910a.—In No. 4433 of the *Astronomische Nachrichten* Dr. Karl Bohlin publishes an excellent photograph and two drawings of the great comet, 1910a, as observed at Stockholm on January 28. The photograph shows the main tail 18° long, cleft at its extremity. The two drawings show enlarged views in the neighbourhood of the head, and in the second the head appears to stand out from the general plane in the form of a half moon.

THE SUN'S VELOCITY THROUGH SPACE.—In No. 1, vol. xxxii., of the *Astrophysical Journal* Profs. Frost and Kapteyn discuss the value of the sun's velocity through space as derived from the radial velocity of Orion stars. The reasons for employing this class of stars are fully discussed, and the stars considered were taken from within a moderate distance of the apex, or the antapex; for the former, the position $\alpha = 260.7^{\circ}$, $\delta = +30.8^{\circ}$ (1875.0), was taken, and the fact is elucidated that the Orion stars are, as a rule, at a great distance from the sun. This fact may

account for the result that the velocity now determined is some 2 km. per sec. greater than that found by Hough and Halm, who employed many stars relatively near to our system; tentatively, it is suggested that these proximate stars appear to participate to some extent in the sun's motion through space.

A remarkable feature of the results is that the solar velocity, relatively to the stars near the apex, is some 10 km. per sec. less than the velocity relative to those near the antapex, separate solutions giving -18.38 km. and -28.38 km. respectively. It is suggested that this difference may be due to the stars near each point, or near both, belonging to the two great star streams. The mean value given as the definitive result of the paper is $v = -23.3$ km. per sec.

As further results, it was found that the average radial velocity of the stars, independent of the sun's motion, is -6.3 km. per sec., and that the average parallax of the sixty-one stars employed is $0.00924''$.

PARALLAX OF FOURTH-TYPE STARS.—The question of the absorption of light in interstellar space led Prof. Kapteyn to look for classes of stars of which the probable distances are very great; such stars would best indicate any existing absorption. The fact that the proper motions of fourth- and fifth-type stars are, so far as is known, insensible, suggested that such stars would have extremely small parallaxes; therefore Prof. Kapteyn calculated the probable average parallax for some 120 stars of this type from data determined by Mr. Nörlund at Copenhagen.

The result is striking, for the average parallax of these fourth-type stars is found to be extremely small, $0.0007''$, and does not exceed the probable error. Taking a previous result for the selective absorption in space, the quantity (photographic—visual magnitude) must amount, for these stars, to at least half a magnitude; it may be much greater. Therefore, to be satisfactory, any interpretation of the spectra of these stars cannot neglect the effect of the possible light-absorption in space.

For comparison, Prof. Kapteyn computed the probable average parallaxes of other types and for Orion stars of magnitude 5.0; he found the value $0.0068'' \pm 0.0004''$, which agrees satisfactorily with the value $0.0064''$ determined, by an absolutely different method, in the discussion of the sun's velocity published by him, in collaboration with Prof. Frost, in the same number of the *Astrophysical Journal* (No. 1, vol. xxxii.).

THE MAXIMUM OF MIRA IN 1909.—Two papers dealing with the maximum of Mira in 1909 are published in No. 4434 of the *Astronomische Nachrichten*. In the former Prof. Nijland discusses his observations at Utrecht, which covered the period July 20, 1909, to March 3, and finds that a maximum, of magnitude 3.1, took place on September 7, 1909. This agrees with Guthnick's ephemeris, and gives a period, since last maximum, of 336 days.

In the second paper Mr. Ichinohe discusses the observations made by him at the Tokio Observatory during approximately the same period. According to him, the maximum took place on September 3, nearly four days before the predicted epoch, and the magnitude was 3.2.

THE STUDY OF DOUBLE STARS FOR AMATEURS.—Possessors of small instruments desiring to take up a useful study will find an interesting article by Mr. G. F. Chambers in the August number of *Knowledge and Scientific News*. This is the first of a series of articles on double stars, and in it Mr. Chambers discusses the question as to what constitutes a double star, and also pays attention to the question of coloured doubles.

METCALF'S COMET, 1910b.—Further observations of, and a continuation of the ephemeris for, Metcalf's comet are published in No. 4435 of the *Astronomische Nachrichten*; the following is an extract from the ephemeris:—

Ephemeris 12h. M.T. Berlin.

1910	α h. (1910)	δ (1910°)	$\log r$	$\log \Delta$	Mag.
Sept. 2 ...	15 37.5 ...	+16 43.7 ...	0.2886 ...	0.3027 ...	10.9
„ 10 ...	15 32.4 ...	+17 3.0 ...	0.2897 ...	0.3342 ...	11.0
„ 18 ...	15 29.4 ...	+17 20.6 ...	0.2918 ...	0.3614 ...	11.2

NO. 2131, VOL. 84]

THE ROYAL PHOTOGRAPHIC SOCIETY'S EXHIBITION.

AS the New Gallery is now used for other than exhibition purposes, the Royal Photographic Society have had to return to the Gallery of the Royal Society of Painters in Water Colour, 5A Pall Mall East, and hold their exhibition earlier than usual. It is now open, and closes on September 16. The trade and professional sections have had to be omitted for want of room, and the number of exhibits in the other sections considerably reduced. The diminution in the number of exhibits may cause disappointment to many who had prepared work for the occasion; but it is not an unmixed misfortune to the visitor, for it seems to have led to a general raising of the standard of quality. The pictorial section has a certain measure of scientific interest, as the method of production of almost all the prints is stated in the catalogue. They indicate, therefore, in an intelligible way the possibilities of the various processes, and at the same time a purchaser knows what he is buying. The proportion of bromides seems to be unduly large, and to indicate that many prefer ease of production to an unassailable permanency. There are two notable oil prints in colour, a still-life subject by MM. Séeberger Frères, and "Carmencita" by Messrs. Tilney and Corke; but such work is on the very borderland of photography.

In the colour-transparency section, the large majority of the exhibits are autochromes. Some of these are of a very high standard of excellence. Mr. J. C. Warburg's "Court of Honour, Ivory and Azure," and "Grey Hound Inn, Corfe," and Mr. Ellis Kelsey's "Beachy Head, Reflections," show how truly it is possible to reproduce the effects of neutral and sober colours. The few transparencies by the Diopichrome Dufay Process are chiefly of the garish colour type, and do not serve to indicate the characteristics or possibilities of these plates. The application of colour photography to natural history and scientific purposes is illustrated by several transparencies, and several photomicrographs of polarised light effects show how well such slides can represent the actual appearances. A set of nine slides of mineral sections in polarised light by Mr. E. J. Garwood, made by the Sanger Shepherd colour process, by the side of the autochromes of similar subjects, demonstrates the superior brilliancy of the Sanger Shepherd plates, and that this process, although more trouble to work than the other, still holds its own.

In the natural history section, those exhibitors whose work we expect to see year by year continue to contribute. Mr. Douglas English shows the black ratton, the probable type of the old English black rat, and the "plague" rat of the East. Mr. William Farren shows five photographs of the "whiskered tern" (taken in Spain), three showing various phases of wing elevation in the act of alighting. When Miss Turner and Mr. E. J. Bedford exhibit rows of birds, each in the same row in a similar attitude and sometimes a strange attitude, we should like to know whether the birds were alive or dead when photographed. And this question might perhaps be asked with regard to some other exhibits. Among the entomological subjects, special note may perhaps be made of Mr. Hugh Main's series of thirteen photographs of the metamorphoses of the glow-worm in natural size, and Mr. P. J. Barrand's "queen wasp" in the attitude assumed during hibernation ($\times 6$).

The photomicrographs include many notable works. Dr. G. H. Rodman's series of fourteen photographs illustrating the life-history and structure of the stick insects, all low magnifications ($\times 3$ to $\times 14$) except the complete insects, which are half size, and Mr. J. T. Holder's low magnifications of the twelve excellent sections, prepared, we believe, by himself, showing the eyes and adjacent parts of various living creatures, deserve especial mention. Dr. Max Poser's diatoms are, of course, good, but the interest of them would be much increased if the optical conditions under which they were photographed were stated. The only apparent advantage of the enormous magnification of nine thousand diameters of the *Pleurosigma angulatum* seems to be that all that is to be seen can be seen from the other side of the room. His bacilli with flagellæ ($\times 1000$) and his trypanosome ($\times 3000$) are fine examples.