MR. T. FISHER UNWIN has published a second edition of "Methods in Plant Histology," by Dr. C. J. Chamberlain, of the University of Chicago. The first edition of the book appeared in 1901, and was reviewed in our issue of November 28, 1901 (vol. lxv., p. 75). It is only necessary to say of the present edition that more attention has been given to the collection of materials. Prof. Kleb's methods for securing various reproductive phases in the algæ and fungi have been outlined, and methods for growing other laboratory material are more complete. New chapters dealing with microchemical tests, free-hand sections, special methods, and the use of the microscope are included.

OUR ASTRONOMICAL COLUMN.

SUN-SPOT AND CHROMOSPHERIC SPECTRA.—A paper of exceptional interest to workers in solar physics was read by Prof. A. Fowler at the April meeting of the Royal Astronomical Society.

Whilst observing the bright lines in the spectra of metallic prominences on the sun's limb, Prof. Fowler has been able to classify them into "long" and "short" lines, a fact which points to their origin being in the higher and the lower chromosphere respectively; he also states the fact that the lines emitted by the upper chromosphere, the "long" lines, are those which, speaking generally, are enhanced when passing from the arc to the spark in terrestrial spectroscopy.

Further, Prof. Fowler found that these long lines are generally *weakened* in sun-spot spectra, whilst the short lines are generally widened, or *strengthened*. The evidence for this differential treatment of "enhanced" and "arc" lines in the solar atmosphere is most conclusive for the elements iron, titanium, and chromium (the *Observatory*, No. 370).

PROPOSED DAILY PHOTOGRAPHS OF CHROMOSPHERIC RADIATIONS.—A paper by M. Deslandres, which is published in the *Comptes rendus* for May 7, discusses in detail the possibility of obtaining daily photographs of the radiations emitted by the solid and liquid particles of the chromosphere, without waiting for the rare occasions afforded by total eclipses of the sun.

In order to do this M. Deslandres proposes to employ an apparatus similar to that used by him for the same purpose during the last eclipse, and to obtain a concentrated image of the chromosphere, without the photosphere, by a special arrangement of mirrors and lenses.

If the coloured screens are insufficient, it is suggested that the spectroheliograph might be employed. By obtaining the ordinary spectroheliograms with K_1 and K_2, and then another in which the bright interspaces, *i.e.* the continuous spectrum, were projected on to the primary slit, it would be possible to separate the parts due to the particles from those parts of the chromospheric radiations due to permanent gases.

M. Deslandres further suggests that the same methods, if successful in this instance, might be employed for the analysis of the structure of other celestial bodies such as nebulæ and comets.

STARS WITH VARIABLE RADIAL VELOCITIES.—A list of four stars the radial velocities of which have been found to be variable is published by Mr. J. H. Moore in No. 3, vol. xxiii., of the *Astrophysical Journal*.

The radial velocity of τ Ursæ Majoris has been found to vary between -1 km. and -10 km., that of λ Hydræ between $+15$ km. and $+24$ km., and that of μ Ursæ Majoris between -16 km. and $+27{\cdot}4$ km. In the case of Y Ophiuchi, discovered to be a spectroscopic binary by Mr. S. Albrecht, the variation of the velocity is found to agree, in point of time, with the light variation, both having the period 17·12 days.

Four other spectroscopic binaries with variable velocities are announced by Prof. Frost in the same journal. The first two, B.D. $-1°{\cdot}1004$ and 29 Canis Majoris, are remarkable for the long range of their velocities and their short periods. In the former of these two, the radial velocity changed from $+132$ km. on February 12 to -34 km. on February 16, whilst that of the second star changed as follows:—1906 January 26, -164 km.; January 29, -3 km.; February 12, -243 km.; February 16, -92 km. Owing to under-exposure, these results are, however, slightly uncertain.

The stars μ Orionis and T Monocerotis have also been shown to have variable velocities in the line of sight.

OBSERVATIONS OF NOVA PERSEI NO. 2.—No. 96 of the Lick Observatory Bulletins is devoted to the publication of the results obtained by Messrs. Townley and Maddrill from magnitude observations of Nova Persei No. 2.

The observations extended over the period February 24, 1901, to July 5, 1902, the magnitude on the latter date being 9·4.

The table given contains the weighted, mean magnitudes of the Nova on more than one hundred nights, with notes on the observing conditions and the comparison stars and instruments employed.

OBSERVATIONS OF SHADOW BANDS.—In No. 4086 of the *Astronomische Nachrichten* Dr. M. Roso de Luna, of Madrid, briefly describes a new arrangement of screens for the observation of the shadow bands during total eclipses of the sun. Altogether he proposes to employ six screens, one horizontal, two vertical (N. and S. and E. and W.), one oriented to the azimuth of the sun at the moment of totality and another perpendicular to it, and one placed in the direction of the wind.

Such an arrangement was employed at Soria (Spain) during the last eclipse, and the following results obtained:—breadth of bands, 2 cm.; distance from one band to the next, 6 cm.; velocity of the movement of the bands, 30 metres per minute.

THE RADIAL MOTION OF β ARIETIS.—In No. 4090 of the *Astronomische Nachrichten* Herr H. Ludendorff publishes the results obtained from an investigation of the radial velocities of β Arietis during the period October 21, 1902, to December 16, 1904.

Thirty-seven spectrograms were obtained with the spectrograph No. iv. (three prisms) of the Potsdam Observatory attached to the 32·5 cm. refractor, and the range of the velocities determined was from $+60$ km. (on January 19, 1903) to -17 km. (on December 25, 1903).

From an analysis of the results, Herr Ludendorff concludes that the period of β Arietis is $321/n$ days, where n is equal to or less than 5.

PUBLICATIONS OF THE NICOLAS OBSERVATORY, ST. PETERSBURG.—We have just received vols. iii. and xiv. (series ii.) of the "Publications de l'Observatoire central Nicolas, St. Petersburg."

The former contains a catalogue of right-ascensions of the principal stars contained in the Pulkowa catalogue for the epoch 1885·0, the results being based on observations made between September, 1880, and November, 1887, with the meridian telescope. The catalogue is published in the same form as those which appeared in 1845 and 1865.

Vol. xiv. contains a part of the results of the observations made with the vertical circle of the observatory between May 1, 1896, and May 19, 1899. The remaining part of the results and the discussion of the whole are reserved for the next volume (xv.) of the publications.

THE ROYAL OBSERVATORY, GREENWICH.

THE annual inspection of the Royal Observatory, Greenwich by the Board of Visitors took place on Wednesday, May 30, when the Astronomer Royal submitted a report of the work accomplished during the twelve months May 11, 1905, to May 10, 1906. A brief summary of this report is given below.

The new working catalogue of stars of the ninth magnitude and brighter, situated between declinations $+24°$ and $+32°$, is now complete, and includes more than 12,000 stars; the star-places have all been accurately brought up to 1910 from the Astronomische Gesellschaft catalogues.

A new determination of the pivot errors of the transit instrument, made during November, showed that the errors in the form of the pivots are insensible. The determination of the co-latitude for 1905 has been delayed by the necessity

of applying the corrections to the star-places due to the variation of latitude. The value found for 1904, with Bessel's refractions, is 38° 31′ 21″·74.

The second nine-year catalogue, for epoch 1900, which was completed last year, will be divided into two sections, one containing the fundamental and zodiacal stars, the other the astrographic reference stars. For the second section the places (for 1900) of the stars within 10° of the pole have already been determined, and a comparison of these with the places given in Carrington's Redhill catalogue should discover a number of proper motions hitherto undetermined, thereby providing new material for the discussion of the solar motion.

Mr. Cowell has completed the discussion of the Greenwich meridian observations of the moon from 1750 to the present time, and has found the necessity of introducing three empirical terms, of which the third has a period of about 300 years. Because the introduction of this term renders the determination of the secular acceleration of the moon from modern observations impossible, Mr. Cowell has worked up the conditions for six ancient eclipses of which the historical records seem to be fairly authentic. By introducing accelerations of eleven seconds per century for the moon and four seconds for the sun, he found it possible to bring the conditions of every one of these eclipses into agreement with the historical records of the phenomena attending them. By treating ten of the lunar eclipses recorded in the Almagest in the same way, additional evidence for the existence of these accelerations was obtained. At first glance the acceleration for the sun was difficult to account for, and Mr. Cowell hypothecated a resisting medium through which the earth travels; but more recently he has found that a lengthening of the day by the two-hundredth part of a second per century would account for the quantity required for this acceleration. As one of the principal features of Mr. Cowell's discussion was the employment of the day as the unit of time, the lengthening of that unit would produce the apparent acceleration.

Owing to the re-mounting and re-polishing of the object glass the altazimuth was out of use from July 12 to August 30, but for the remainder of the year it was employed for observations of the sun, moon, planets, and fundamental stars. The lunar crater Mösting A was observed whenever the conditions were favourable, and, as the same kind of observations are being made at the Cape Observatory, the results will serve to determine anew the parallax of our satellite. The value obtained from the discussion of the two sets of observations should be more trustworthy than that previously obtained, which depended solely upon observations of the moon's limb, a much more difficult feature to "set on" than the crater. Mösting A was also observed with the transit circle whenever possible, and the mutual agreement of the two sets of results was very satisfactory.

Eight hundred and twenty-three double and twenty-four single observations of various stars were made with the reflex zenith tube, and the results have been reduced up to March 31.

The weather was not favourable during the year for observations of difficult double stars with the 28-inch refractor, but the time was utilised in completing the measures of neglected doubles in Struve's "Mensuræ Micrometricæ"; the total number observed was 606, of which 158 have their components separated by less than 1″·0, and seventy by less than 0″·5. The diameters of Jupiter and his satellites were also measured with this instrument. Both the polar and equatorial diameters of Jupiter were observed, first with the filar micrometer and then with the double-image micrometer, on each night, and it was found that the mean of the results of the two methods produced a very good value for the diameter. The error caused by irradiation in the filar micrometer observation is apparently exactly corrected by the error introduced in the second method by the fact that when the two images are apparently in contact they actually overlap to a slight extent.

The 26-inch refractor was employed on twenty-eight nights in obtaining seventy-two photographs of Neptune and its satellite, using the occulting shutter as in previous years. These photographs are now being measured.

A number of photographs of Jupiter's newly-discovered satellites vi. and vii. were obtained with the 30-inch reflector. This success is remarkable because it was the expressed opinion of the discoverer of the satellites that vii. was too faint to be photographed through our British atmosphere. Yet nineteen photographs of this object were secured at Greenwich on fifteen nights, and eighty-six negatives of satellite vi. were taken on thirty-six nights. The 30-inch reflector was also employed for obtaining photographs of twenty-three minor planets, five comets Nova Aquilæ, and several nebulæ.

The reduction of the Eros plates is complete, and the results have been communicated to M. Lœwy.

At the date of last year's report the measurement of the Greenwich plates for the Astrographic Catalogue was complete, but a number of the measures have been repeated, and the press copy has been prepared for the seven zones 80° to 86°. The measures of the eight zones 77° to 84° have been printed during the year, and include 46,329 separate stars covering an area of 450 square degrees of sky. The remaining 78·5 square degrees between 85° and the pole will include about 6000 stars. An interesting table given in the report shows the number of stars which have been measured, and will be contained in the Greenwich section of the catalogue, and compares it with the number shown in each of the corresponding zones of the Bonn Durchmusterung and the Astronomische Gesellschaft catalogues. Thus it is shown that the total in the Greenwich section will be about 178,380, whilst for the same region the B.D. contains only 25,184 stars. A similar table compares the number of stars shown on the Greenwich chart plates in several zones with those contained in the corresponding zones of the B.D. In the total area of 558·3 square degrees the latter contains 2259 stars of magnitude 9·0 and brighter, and 6542 altogether, whilst for the different exposures given for the Greenwich plates the following numbers are shown:—

Exposure ...	20 secs.	3m.	6m.	40m.
Number of stars...	12,019	56,921	58,393	170,180

Thus on the plates taken at Greenwich with forty minutes' exposure there are 304·8 stars per square degree, and about twenty-six times as many stars as are given in the corresponding region in the B.D. The second Greenwich volume of the Astrographic Catalogue is printed up to the end of 84°, and will soon be ready for publication. Twelve thousand photographic prints, reproducing on double scale 191 plates in zones 65° to 70°, have been made during the year, bringing the total number of plates reproduced since the work began up to 401, or rather more than one-third of those contained in the Greenwich section. During the year under report the astrographic telescope has been used to obtain duplicate plates for the chart to replace previous ones which are not entirely satisfactory for reproduction purposes.

Heliographic observations were carried out as usual, the sun being photographed on 210 days. The solar activity was very pronounced during 1905, the record for that year being about double that for 1904.

The magnetic observations were made as in former years, and the principal results for the magnetic elements for 1905 were as follow:—

Mean declination	16° 9′·9 West
Mean horizontal force	4·0173 (in British units) / 1·8523 (in metric units)
Mean dip (with 3-inch needle)...	66° 55′ 55″

There were no days of "great" magnetic disturbance, and only twelve days of lesser disturbance in 1905.

The various meteorological observations were continuously maintained throughout the year, the mean temperature being 0°·2 above, and the rainfall 1·21 inches below, their respective averages for the fifty years 1841–1890.

In the chronometer and time-service department the report follows the usual lines, but the Astronomer Royal remarks on the inferiority of the box chronometers and the superiority of the watches submitted for tests during the period covered by the report. Of fifty-nine chronometers sent in, thirty-three were rejected because they failed to attain the minimum standard of constancy. This

is a larger number of rejections than in any previous year, although the number submitted was smaller than usual.

In concluding the report, the Astronomer Royal directs attention to the serious menace to the continued efficiency of the observatory on its present site involved in the establishment in the immediate neighbourhood of large generating stations for the supply of electric power to distant districts. The most serious danger at present arises from the new power station erected by the London County Council, which is situated directly north of the observatory. Not only will the high chimneys actually prevent stars from being seen when near the northern horizon, but the heated gases arising from the buildings may seriously affect the accuracy of any results obtained. Again, the new station is but half a mile from the observatory, and the running of the engines, although their number is not yet complete, produces serious tremors on the mercury reflecting surface, on the steadiness of which the accuracy of the astronomical results is critically dependent. At present the instruments employed in the magnetic pavilion have shown no disturbance, but it is greatly to be feared that the contemplated increase of the electrical plant will also have a serious effect on the work of this department.

THE ROYAL SOCIETY OF EDINBURGH AND THE NATIONAL GALLERIES OF SCOTLAND BILL.

ON Friday last, June 1, the Secretary for Scotland received an important deputation of the Royal Society of Edinburgh regarding the claims of science in the readjustment of grants in aid and allocation of national buildings as contemplated in the National Galleries of Scotland Bill recently introduced in Parliament.

The chief point discussed was the position of the society in regard to its present occupancy of part of the Royal Institution, Princes Street. The deputation, which was very representative of science in Scotland, was introduced by Sir J. Batty Tuke, M.P. The claims of the society were presented by Lord M'Laren, vice-president; Mr. J. W. Gulland, M.P.; Principal Sir William Turner, of Edinburgh University; Principal Mackay, Dundee; Prof. Cash, Aberdeen; Prof. Gray, Glasgow; and Prof. Chrystal, secretary of the society. It was pointed out that in the National Galleries Bill, which contemplates devoting the Royal Institution, as well as the present National Gallery building, entirely to art, no provision is made for the Royal Society, which has occupied the west wing of the Royal Institution since that building was constructed seventy years ago, and for which, indeed, the building was originally designed. The deputation suggested the introduction of a clause safeguarding the position of the society, so that it shall not be dispossessed until equally good and convenient rooms have been obtained elsewhere out of public money. It will be impossible to carry on the important work of the society, especially as regards the publication of valuable and expensive memoirs, without this guarantee. Not only so, but it was urged that the Royal Society of Edinburgh should be placed on the same footing as the Royal Society of London and the Royal Irish Academy, both of which sit rent free in Government buildings, and receive grants to the extent of 1000*l.* and 1600*l.* respectively. The Royal Society of Edinburgh receives a grant of 300*l.*, which, however, is nearly all paid back to the Board of Manufactures in the form of rent. The Royal Society of London and five other scientific societies are accommodated in Burlington House next door to the Royal Academy, and it is hoped that a similar principle will be applied in Edinburgh.

The Secretary for Scotland expressed his hearty sympathy with all that had been said as to the importance of scientific work and the national character of the work done by the Royal Society. The National Galleries Bill introduced by the present Government is practically the Bill of last session with some minor alterations. The whole question has been gone into very carefully, and the conclusion is to put the National Gallery into the south building, and give to the Royal Academy the Royal Institution, part of which is at present occupied by the Royal Society. The accommodation for the National Gallery and for the Academy will thus be doubled, and ample scope will be given for future development. It is not possible to house the Royal Society and the Royal Academy in the same building. The decision has been come to after review of all the circumstances, and it carries with it the obligation to find accommodation consistent with the necessities and prestige of the Royal Society. It is the desire and intention of the Government to meet the reasonable demands of the Royal Society in a liberal spirit; and the Secretary for Scotland suggested that the Royal Society should consider the new situation which has been created, and should formulate some scheme for the consideration of the Government.

THE DISCOVERY OF MAGNETIC DECLINATION.

THE *Meteorologische Zeitschrift* for April contains an interesting article by Prof. G. Hellmann on the knowledge of the magnetic declination before the time of Christopher Columbus. Some years ago Prof. Hellmann pointed out that, independently of the discovery by Columbus, the variation must have been known on the Continent, from the construction of many pocket sundials provided with magnetic needles for adjusting the instruments to the astronomical meridian, and showing the declination by a line on the floor of the compass-box.

Dr. A. Wolkenhauer recently discovered three such sundials dating from before the time of Columbus. One of these, which is in the Ferdinand Museum at Innsbruck, and

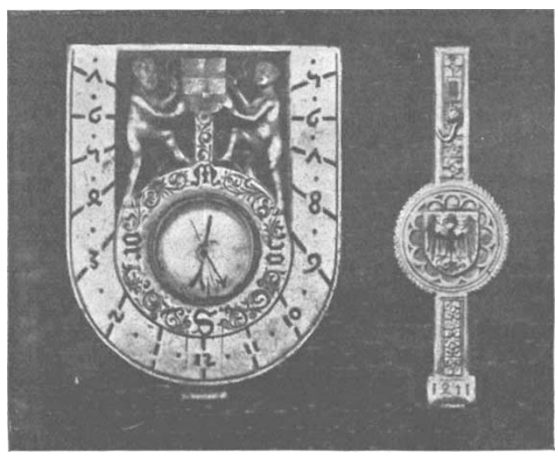

FIG. 1.—Pocket sun-dial with compass and variation line. Date, about A.D. 1451.

was probably made at Nuremberg, is shown in the accompanying photographs by Hofrath von Wieser. The glass shade and magnetic needle have been removed so that the lines on the bottom of the box might be more plainly shown. The lid or flap, which has also been removed, and which adjusts the gnomon when opened, shows the date of construction, viz. 1451, the figures 4 and 5 being in the old form (see also the hour numbers of the dial).

The rim of the compass-box shows the four cardinal points:—M. (Meridies), Oc. (Occidens), S. (Septentrio), Or. (Oriens). On the floor of the compass-box is cut the northerly-pointing bifurcated line of deviation of the magnet, showing about 11° easterly variation. This line is of the same depth and thickness as the hour lines, and a careful examination of the instrument shows that it must have been originally done by the maker. It can easily be recognised, however, that the three other marks west of the original line (two of which have arrow-heads) were roughly inserted at a later time, when probably the declination had become westerly. The short, thick stroke lying 4°–5° west of the N. S. direction has been scratched the deepest. The magnetic variation was apparently probably known before the beginning of the fifteenth century, but by whom and where it was discovered still remain an open question.