THE February number of the *Geographical Journal* contains several articles of exceptional importance and interest. Sir Thomas Holdich writes on the Patagonian Andes, giving a valuable summary of his recent work in connection with the Chile-Argentina Boundary Arbitration. A paper by Prince Kropotkin, of which the first part is here published, throws much new light on "The Orography of Asia." Dr. Otto Nordenskjöld and Dr. Gunnar Andersson contribute an account of the work of the Swedish Antarctic Expedition. The completed paper "On a Flat Model which Solves Problems in the Use of the Globes," by Prof. Everett, gives a number of interesting results in addition to those contained in his letter to NATURE of July 30, 1903.

WE have received a copy of a paper by Dr. P. T. Austen, reprinted from the *Scientific American* Supplement, and bearing the title "The Chemical Factor in Human Progress." The reader will find the influence of chemical knowledge upon the development of the industries, of agriculture, of sanitation, &c., discussed in a very interesting manner, and the pamphlet is well worthy of notice.

WE have received a copy of a German pamphlet by B. Kolbe the object of which is to show the manifold applicability of the differential thermoscope and a six-fold manometer in experimental demonstrations of the phenomena and laws of heat. Thirty important experiments are described which can be carried out with the aid of these instruments, and excellent illustrations of the method of demonstration are given.

THE report of the International Committee on Atomic Weights has just been issued, and only two changes are recommended from the table of values for 1903. The value for cæsium has been changed to 132·9, and that for cerium to 140·25 (O=16). The report directs attention to the inadvisability of using glass vessels in experimental atomic weight determinations, and suggests the use of vessels of pure silica, so-called quartz-glass, in all such investigations. A redetermination of the atomic weights of gallium, indium, columbium, tantalum, mercury, tin, bismuth, antimony, palladium, vanadium, phosphorus, and silicon is regarded as necessary.

IN the December (1903) *Sitzungsberichte* of the Vienna Academy of Sciences, Prof. C. Doelter describes a form of crystallisation microscope adapted to the determination of the melting points of silicates and silicate mixtures. The attainment of high temperatures is effected by means of a small electric oven, 5 centimetres high, mounted on the object stand, and in the apparatus described a temperature of 1200° C. can be reached. The distance between the object and objective during the observation is about 27 millimetres, and by a special arrangement of asbestos plates and a spiral tube carrying ice-cold water the microscope and the objective can be kept quite cool, even when the substance under examination is subjected to a temperature of about 1200° C.

IN vol. xlv. of the *Zeitschrift für physikalische Chemie* Dr. E. Baur describes some interesting experiments on colour-sensitive silver chloride. Mixtures of the chloride and of the subchloride Ag_2Cl prepared by treatment of colloidal silver solutions with insufficient chlorine water were mixed with about 5 per cent. of gelatin. Plates prepared with the product so obtained give the spectrum in its natural colours after one hour's exposure. The phenomenon is independent of the relative amounts of chloride and subchloride in the mixture. The author inclines to the view that several colour-sensitive forms of the subchloride exist, which are transformed into one another under the influence of the different spectral rays.

THE first number of the *British Journal of Psychology*, edited by Prof. James Ward and Dr. W. H. R. Rivers, has been published by the Cambridge University Press. The scope of the *Journal* is already known from the circular previously issued; it comprises psychology in the widest sense of the term, and is pledged to "side with no school and have no predilections"; it is not a "periodical," it has no fixed time of publication; it is rather designed to be a medium for the production of original articles and reports of experimental work. The contents of the present, presumably typical, number include an article on "The Definition of Psychology," by Prof. Ward; a sketch of Telesio's psychology, by J. Lewis McIntyre; and two important contributions on the experimental psychology of vision, by Prof. C. S. Sherrington and Prof. W. McDougall. The juxtaposition of Telesio and the experimental psychologists is itself a lecture on that progress which this *Journal* will assuredly support and stimulate.

THE additions to the Zoological Society's Gardens during the past week include a Ring-necked Parrakeet (*Palaeornis torquatus*) from India, presented by Miss M. Bull; four Hybrid Silver Pheasants (between *Euplocamus nycthemerus* and *Phasianus colchicus*), presented by Mr. H. S. Gladstone; two Black-headed Lemurs (*Lemur brunneus*) from Madagascar, presented by Mr. H. C. Jenkins; a Tayra (*Galictis barbara*) from South America, a Vulpine Phalanger (*Trichosurus vulpecula*) from Australia, a Levaillant's Amazon (*Chrysotis levaillanti*) from Mexico, a Malabar Parrakeet (*Palaeornis peristerodes*), three Hardwick's Mastigures (*Uromastix hardwicki*) from India, a Pennsylvanian Mud Terrapin (*Cinosternum pennsylvanicum*) from North America, deposited; a Racket-tailed Parrot (*Prioniturus platurus*), an Everett's Thick-billed Parrakeet (*Tanygnathus everetti*) from the Philippine Islands, two Red Lories (*Eos rubra*) from Moluccas, two Blue-streaked Lories (*Eos reticulata*) from Timor Laut, a Tabuan Parrakeet (*Pyrrhulopsis tabuan*) from the Fiji Islands, two Wonga-wonga Pigeons (*Leucosarcia picata*) from New South Wales, purchased.

OUR ASTRONOMICAL COLUMN.

REPORT OF THE HARVARD COLLEGE OBSERVATORY.—In the forty-eighth annual report of the Harvard College Observatory, Prof. E. C. Pickering, the director, again directs attention to the urgent need for cooperation in the study of the greater unsolved astronomical problems, and indicates the methods of procedure whereby the greatest results might be obtained from the least expenditure. In the solution of many of these problems the numerous photographs already obtained at Harvard would, if the funds necessary for their reduction were forthcoming, be of inestimable value.

The body of the report deals with the work accomplished during the year ending September 30, 1903, the observations made with each instrument being treated separately.

More than 15,000 photometric light comparisons have been made with the East equatorial, the computed error of each set of sixteen settings only amounting to three or four hundredths of a magnitude. Photometric measurements of the light of Jupiter's satellites, whilst undergoing eclipse, have been made during fifteen eclipses. The variability of some 2000 stars, suspected by other observers, has been definitely determined, and it is estimated that the time of minimum of Algol variables can be determined to within two minutes with this instrument.

The director has made 71,992 settings of the 12-inch meridian photometer during 143 nights, and by interposing a shaded glass has found it possible to compare magnitudes of such widely different orders as those of Sirius and a twelfth magnitude star. Another modification of this instrument permitted the light of the sky during the daytime, at twilight, and at night, the brightness of various portions

of the moon and of the sky at various distances from it. to be compared, and a range of more than seventeen magnitudes was found to exist between the extreme values obtained. During the period covered by the report Mrs. Fleming classified the spectra and measured the light of 3506 stars, situated south of declination −60°, for the Southern Draper Catalogue. It is hoped that this zone will be completed shortly, and a catalogue containing nearly 4000 stars, all fainter than the ninth magnitude, published.

A large number of photographs have been obtained with the 13-inch Boyden and the 8-inch Bache telescopes at Arequipa, and a number of excellent light curves of Eros (from March 30 to August 19), showing a range of 0·5 to 1·0 magnitude, were obtained with the former instrument by Prof. Bailey. Four hundred and thirteen photographs, including eighty-seven of Eros, were obtained at the same station with the Bruce photographic telescope.

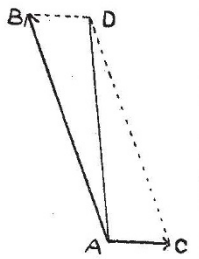
The meteorology of the upper air has been studied at the subsidiary observatory at Blue Hill, where fifteen kite flights, twelve of which were the monthly flights for the international series, were performed. The average height above sea-level attained by the meteorograph was 6450 feet, and the maximum height was 12,070 feet.

It is hoped that in a few months the Revised Harvard Photometry, containing the photometric magnitudes of all stars brighter than magnitude 6·5, about 9000 in all, together with the spectrum class of each star and its designation in other catalogues, will be published.

A set of fifty-five 8″ × 10″ contact prints from the original negatives, taken with the Harvard and Arequipa anastigmatic lenses, which cover the whole sky and contain all stars down to the twelfth magnitude, may be obtained by astronomers from the director for the sum of 15 dollars.

THE DIRECT AND RETROGRADE ROTATIONS OF THE PLANETS.—In a paper communicated to No. 3925 of the *Astronomische Nachrichten*, Prof. W. H. Pickering discusses the various theories which have been promulgated in explanation of the direct and retrograde rotations of the planets. Dismissing the theories of Laplace, Kirkwood, Faye and Trowbridge as insufficient, on the grounds that they presuppose abnormal conditions in the case of Neptune, and do not account for the perpendicular rotation of Uranus, he points out that the different motions may be explained by the tidal action of the sun in the following manner :—

Taking the case of Uranus as an example, let the line AB in the diagram represent the plane of the equator when this plane passes through the sun, let AC represent the plane of the planet's orbit and imagine the planet beyond the sun. Then the point A on the equator of the planet would, in the rotation, travel in the direction AB. The sun's attraction, in producing an annual tide, will produce a force AC acting on the particle A, with the consequence that A will travel along the resultant AD instead of along AB. This force AC will diminish during the planet's revolution until, after a quarter of a revolution, it will be zero. After half a revolution, when the plane of rotation again passes through the sun, the senses of both AB and AC will be reversed, but the effect on the planet's rotation will be the same as in the first case. This process will continue until ultimately the two planes will coincide when a direct rotation has been established.



THE "INVARIABLE PLANE" OF THE PLANETARY SYSTEM.—In No. 3923 of the *Astronomische Nachrichten*, Prof. T. J. J. See publishes the results of a detailed discussion of the accuracy of the data now available for the determination of Laplace's "Invariable Plane" of the planetary system. The elements of this plane are dependent upon the masses of the planets and the elements of their orbits, and the plane, when determined, would form a constant reference plane of great utility for the orbits of planets and comets. The transformations necessary to reduce star-places to this plane would be too cumbersome for practical utility.

Prof. See, in the first place, explains the mathematical process by which the elements of the plane are obtained when the planetary data are known, and then gives the results previously obtained. In the second part of his paper he reviews and discusses the values hitherto obtained for the mass of each of the planets, and deduces that for the mass of Jupiter, which, owing to its relatively large magnitude, acts as the most important factor of the reduction, the uncertainty does not amount to more than 0·0001 of the whole.

The elements obtained by Prof. See are as follows :—

$$\gamma = 1^\circ\ 35'\ 7''{\cdot}74,\quad 5\,\Omega = 106^\circ\ 8'\ 46''{\cdot}688$$ } Ecliptic and mean equinox 1850 Jan. 0·0 G.M.T.

where γ = the inclination of the plane, and Ω = the longitude of its ascending node on the fixed ecliptic of 1850·0.

In a subsequent table the author gives the longitudes of the ascending nodes and the inclinations of the planetary orbits on this "Invariable Plane," and, from a computation based on the relative positions of the planets at the epoch of 1850·0, he concludes that the actual shifting of the plane due to improvement in the data of the masses is not likely to exceed 1″ for γ and 1′ for Ω, a degree of accuracy approximating to that of our knowledge of the ecliptic and equator. He considers that a value for the inclination of which the probable error did not exceed ±0″·20 would suffice for all practical considerations, and points out the importance of further work on the determination of the planetary masses, which only need to be a little more certain in order to produce this ideal result.

SIMULTANEOUS SOLAR AND TERRESTRIAL CHANGES.[1]

THERE are very many cases recorded in the history of science in which we find that the most valuable and important applications have arisen from the study of the ideally useless. Long period weather forecasting, which at last seems to be coming into the region of practical politics as a result of the observation of solar changes, is another example of this sequence.

The first indications of these changes on the sun, to which I have referred, are matters of very ancient history, and so also is the origin of some of the branches of observation on which the study of them depends.

I will begin by referring to these and to the conclusions arrived at in relation to simultaneous solar and terrestrial changes previously to the last twenty-five years.

The facts that there are sometimes spots on the sun, and that there is a magnetic force which acts upon a needle, seem to have been known to the ancient Chinese. In more modern times the inquiries, with which we are now concerned, date from the times of Galileo (1564–1642) and Kepler (1571–1630).

To Galileo, Fabricius, and Scheiner we owe the first telescopic observations of the spots on the sun; to Kepler, the basis of spectrum analysis, which has not only revealed to us the chemistry of the sun and of its spots, but enables us to study daily other phenomena, the solar prominences, which will in all probability turn out to be more important for practical purposes than the spots themselves.

It is only quite recently that the importance of the study of the prominences in this direction has been indicated, so that we have to deal, in the first instance, with a long period of years in which only the spots and their terrestrial echoes were in question.

According to Prof. Wolf (as quoted by Prof. Köppen), Riccioli, in 1651, shortly after the first discovery of sunspots, surmised that some coincidence might exist between them and terrestrial weather changes (Blanford, Bengal Asiat. Soc. *Journ.*, lxv., part ii., 1875, p. 22).

In the first year of the last century, Sir Wm. Herschel directed attention to this subject (*Phil. Trans.*, 1801, p. 265). He wrote :—

"The first thing which appears from astronomical observations of the sun is that the periods of the disappearance of spots on the sun are of much greater duration than those of their appearance.

[1] Paper presented to the International Meteorological Committee at Southport, September 11, 1903. By Sir J. Norman Lockyer, K.C.B., F.R.S.