

This solution was then submitted to distillation at the temperature of the water bath and under the reduced pressure of 68 m.m. of mercury. The distillate was received in two-fractions, boiling at  $71^{\circ}$ - $81^{\circ}$  and  $81^{\circ}$ - $85^{\circ}$  respectively. The first fraction contained 44 per cent.  $H_2O_2$ , while the latter was found to contain no less than 90.5 per cent. Upon again fractionally distilling the latter product, a large proportion distilled at  $84^{\circ}$ - $85^{\circ}$ , and this fraction proved to be practically pure  $H_2O_2$ , containing over 99 per cent. of the peroxide. The liquid thus isolated is a colourless syrup which exhibits but little inclination to wet the surface of the containing vessel. When exposed to the air it evaporates. It produces a prickly sensation when placed upon the skin, and causes the appearance of white spots which take several hours to disappear again. As regards the much-discussed and disputed question of the reaction of hydrogen peroxide towards litmus, Dr. Wolfenstein finds that even when the pure liquid is made strongly alkaline with soda and again distilled, the distillate exhibits strong acid characters, so that the acid nature of hydrogen peroxide must be regarded as fully established. It is finally shown that the use of ether in assisting the concentration is by no means essential. Ordinary commercial 3 per cent. peroxide can be immediately subjected to fractional distillation under reduced pressure, and a fraction eventually isolated, consisting of the pure substance boiling at  $84^{\circ}$ - $85^{\circ}$  under a pressure of 68 m.m.

THE additions to the Zoological Society's Gardens during the past week include a Common Fox (*Canis vulpes*), British, presented by Mr. Harold von Löhr; a Spotted Ichneumon (*Herpestes nepalensis*) from India, presented by the Misses Violet and Sylvia Brockelbank; two Curlews (*Numenius arquata*), British, purchased.

#### OUR ASTRONOMICAL COLUMN.

SECULAR VARIATIONS OF THE INTERIOR PLANETS.—As far back as 1859, Leverrier discovered that the movement of the perihelion point of the orbit of Mercury was greater than could be accounted for by the action of all the known planets, and he attributed this to the effect of a group of unknown bodies circulating between the orbit of Mercury and the sun. Prof. Newcomb has recently gone over the ground again, and the results of his work are given in *Comptes-rendus* of December 10. A brief statement of the tentative conclusions arrived at was given in these columns on November 29 (p. 114). From a discussion of a vast number of observations he has re-determined the secular variations for the orbits of Mercury, Venus, the Earth, and Mars, and he has computed the masses of Mercury, Venus, and Jupiter from the periodical perturbations which they produce; the adopted value of the earth's mass is deduced from the parallax  $8''$ .80, and for Mars the adopted mass is that derived from observations of the satellites. It is then shown that with these masses the calculated values of the secular variations differ from the observed ones, the divergences being especially great in the movements of the perihelia of the orbits of Mercury and Mars, and of the node of Venus. Two explanations of the differences are open to us: (1) It may be supposed, as suggested by Prof. Asaph Hall, that the law of gravitational attraction is not strictly true, and that the attractive force of the sun varies inversely as the distance raised to the power of approximately  $2.0000001574$ ; (2) they may be attributed to the influence of unknown masses of matter.

At first sight, the second hypothesis seems preferable, as it involves no departure from an accepted law, and because it is the only one which will explain all the secular variations, while on the first hypothesis the perihelia would alone be affected. If there are unknown bodies between Mercury and the sun, Prof. Newcomb shows that in order to produce the observed effects, their mass must be great enough to produce a sensible ellipticity in the sun's figure; and as this has not been detected, he prefers to place these unknown bodies between the orbits of Mercury and Venus. He has computed the elements of an orbit which would reduce all the discrepancies between observed and calculated values of the secular variations to less than the

probable errors, the mean distance being 0.48, and the mass  $1/37,000,000$  that of the sun. At the same time, Prof. Newcomb regards this result more as a curiosity than as a reality, as it seems improbable that such a group of bodies should have escaped discovery.

Returning to the other hypothesis, he finds that if we accept Hall's modification of the law of gravitation, which accounts for the movements of the perihelia, the variations of the other elements can all be explained by slightly changing the value of the earth's mass. The new value corresponds to a solar parallax of  $8''$ .77. Although by no means regarding the latter hypothesis as established, Prof. Newcomb is inclined to adopt it provisionally.

IRREGULARITIES IN VARIABLE STARS.—In a summary of the observations of variable stars of long period, made by W. Maxwell Reed at Harvard College Observatory and the Abbot Academy (*Astron. Journ.* No. 330), the importance of studying the irregularities in the light curves is strongly insisted upon. The observations indicate numerous "stand-stills," or notches in the light-curves, and these are believed to be secondary phases produced by additions of light at those points. "A record of over ten years for T Cephei gives ten more or less well-defined stand-stills. The mean period is about twenty days less than that of the variable (about 383 days)." From studying these and other variables, Mr. Reed is inclined to believe that "the light-curve, in some cases at least, is the sum of two or more curves—each component curve having a different range, period, and character from the others. By such a hypothesis one can account for the changes in period and range of a variable, and the presence of "stand-stills" and secondary phases. Unfortunately, there is not enough evidence yet to give the elements of the two or more component curves for T Cephei." It will be remembered that Mr. Lockyer has also seen the necessity for supposing more than one source of variation in many cases, and some of his examples of the peculiar curves produced by integrating two perfectly regular ones were given in our columns four years ago (*NATURE*, vol. xlii. p. 550). With Mr. Reed we regret that less attention has been given by observers to the character of the light-curves of these variables, than to the determination of the maxima and minima.

THE RADCLIFFE CATALOGUE.—The new star catalogue recently issued by Mr. Stone contains the positions of 6424 stars for the epoch 1890, deduced from observations made with the transit circle at the Radcliffe Observatory between January 1, 1881, and December 31, 1893. Up to 1887 a considerable number of observations were made for the determination of systematic errors of the instrument and for errors of the refraction tables. Since then the observations have been more exclusively directed to obtaining the positions of stars for well-distributed zero-points between the equator and N.P.D.  $115^{\circ}$ , in continuation and completion of the work carried out under Mr. Stone's direction at the Cape of Good Hope between the years 1870 and 1879. The catalogue gives the positions of all stars down to seventh magnitude between the equator and N.P.D.  $115^{\circ}$ , except those in clusters; of fainter stars to fill existing lacunæ; and of many stars of greater N.P.D. than  $115^{\circ}$  for comparison with the Cape catalogue of 1880. Many stars north of the equator are also included. The Cape catalogue and the present one together give a series of well-distributed zero-points for the whole southern hemisphere. With reference to future meridian work, Mr. Stone remarks: "From the facilities which photography affords for the rapid filling in of the positions of the fainter stars on a photographic plate, when those of a sufficient number of zero-points on the plate have been otherwise fixed, it would appear that the efforts of meridian observers will, for the future, be most advantageously directed to this class of stellar work." The catalogue includes estimates of proper motions as well as the usual constants, and there are also copious notes relating to the double and variable stars. The early appearance of a catalogue entailing such a vast amount of computation does great credit to the very limited staff of the observatory.

"L'ASTRONOMIE."—The decease of this monthly journal of popular astronomy is announced in the December number. For thirteen years M. Flammarion has conducted *L'Astronomie*, and has used it to popularise, and extend the study of, astronomical science, and now it dies from "difficultés d'administration." The Société Astronomique de France proposes to attempt to fill the gap by issuing their *Bulletin* monthly instead of quarterly, as heretofore.