THE additions to the Zoological Society's Gardens during the past week include two Lions (*Felis leo*, ♂ ♀) from North-east Africa, presented by Mr. C. A. Osborne; two Globose Curassows (*Crax globicera*, ♂ ♀) from Central America, presented by Mrs. Sedgwick; a Whinchat (*Pratincola rubetra*), a Redstart (*Ruticilla phœnicurus*), a Blackcap (*Sylvia atricapilla*), a Swallow (*Hirundo rustica*), British, presented by Mr. John Young; a Cape Viper (*Causus rhombeatus*) from South Africa, a Rufescent Snake (*Leptodira rufescens*) from East Central Africa, presented by Mr. F. V. Kirby; a Smooth Snake (*Coronella lævis*), European, presented by Mr. A. E. T. Jourdain; two Hairy Armadillos (*Dasypus villosus*) from La Plata, a Peba Armadillo (*Tatusia peba*) from South America, deposited; two Maguari Storks (*Dissura maguari*) from Chili, three Laughing Gulls (*Larus atricella*) from North America, purchased; two Collared Fruit Bats (*Cynonycteris collaris*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL SOCIETY OF WALES.—We have received the *Journal* of this Society for September, and find it contains some useful information for amateurs. Besides current notes and some short contributions from various members, a brief description is given of the conditions under which Mars is now visible. This is accompanied by some illustrations, among which is an excellent map of Mars, by Schiaparelli. We notice in the table given at the end, describing "The Heavens" for October, that the period of the variable star η Aquila is given as two days nine hours; this is evidently incorrect, being the time from a minimum to a maximum. A variable star period is generally reckoned either from minimum to minimum, or from maximum to maximum, and its length in the case of this star is, roughly, seven days four hours.

THE ELEMENTS OF COMET 1885 III.—Both Messrs. W. W. Campbell and Gallen Müller have calculated the elements of the orbit of this comet, discovered by Mr. W. R. Brooks at Phelps, New York, on August 31, 1885. These computations were made independently of one another. Mr. Campbell's work led us to believe the orbit of this comet to be an ellipse, with a period of revolution of 495·7 years; while Mr. Müller gave us two orbits, one elliptical with a period of 403·2 years, the other a parabolic orbit. It seems that the observations used as a basis for the calculation, both include one made at Dun Echt by Dr. Copeland on October 5. This observation forms the last placed position in both calculations. On this the value of the eccentricity obtained entirely depends. Owing to this uncertainty, the observation has been replaced by three observations by M. Bigourdan, which had not been published when the calculations were commenced. These latter observations get rid of this difficulty, and give us the means of ascertaining whether the eccentricity is real or not. The computation has been undertaken by Mademoiselle Klumpke, at the request of Prof. Schulhof, and is published in the *Bulletin Astronomique* for September. The investigation shows that the new elements deduced give a period of revolution of 247·5 years. This period is, as Mademoiselle Klumpke says, with certainty relatively short. It takes a fifth place among those comets, the time of revolution of which is greater than a hundred years. Mademoiselle Klumpke further suggests that the theory of the capture of comets would attribute the elliptical character of this orbit to the action of Jupiter, the minimum distance between the two orbits being 0·22. The following are the elements finally deduced:—

Final Elements.

$$\begin{aligned} T &= 247^\circ\ 36'\ 57''\!\cdot\!65 \\ \Omega &= 204\ \ 45\ \ 24\cdot52 \\ i &= 59\ \ 6\ \ 35\cdot43 \\ \log q &= 9\cdot8745682 \\ e &= 0\cdot9822627. \end{aligned}$$

THE LEANDER MCCORMICK OBSERVATORY.—The *Alumni Bulletin* of the University of Virginia contains an account of the principal work in hand at the Leander McCormick Observatory. At present the chief work is the observation of the relative positions of the satellites of Saturn, and the discussion of the measures for the purpose of improving our knowledge of their motions.

The orbits of Titan and Japetus are fairly well known, so special attention is given to the remaining satellites. All of these are faint, and a powerful telescope is needed to observe them accurately. The most easily observed are Rhea, Dione, and Tethys, and a fine series of relative positions of these has already been secured, from which it is hoped to obtain greatly improved orbits of those bodies. Mimas, the satellite nearest to the ring, is very faint, so that it can be observed only under favourable atmospheric conditions, and only when near the points in its orbit where its apparent distance from Saturn is greatest. As a result the inequalities in its motion are not at all well known, and further observation is desirable. The same is true to a less extent of Enceladus, the next satellite beyond Mimas. The orbits of both these satellites are useful in determining the mass of Saturn's ring. Hyperion is also extremely faint. The motion of this satellite is greatly affected by the attraction of Titan, and the determination of its orbit involves difficulties that render it one of the most interesting problems of the solar system.

The observations of these satellites are being published from time to time in the *Astronomical Journal*. Their discussion has occupied the attention of the Director during a large portion of the past year. The investigation is of great importance, and the results obtained will lead to the gradual solution of the mechanical problems involved in the motions of the Saturnian system.

THE SOLAR ROTATION.—The great amount of material that we now possess with regard to solar phenomena has led many to form theories of the rotation of the sun, which differ among themselves both in the method of treatment employed and in their value. Of those more recent, that which we owe to E. J. Welczynski, is published in the current number of the *Astrophysical Journal* (August 1896). The author commences by forming the hydrodynamic equations of Lagrange, by assuming the coordinates of any point of a fluid, and the position of this point at a certain time ($t = 0$). A fourth equation is obtained further by differentiating with regard to the time, the product of the density of the fluid at the initial position, and a determinant containing (in rows) the differential of the coordinates of the first point to those of the second. He then proceeds to rotate the whole mass round the axis of z, where ω is the angular velocity of rotation depending on the coordinates of the point $t = 0$. The equations then become simplified, and it is found that the square of the angular velocity is a function of the distance of the moving point from the axis of rotation, or, in other words, ω depends only on the value of r. The equations of Lagrange thus become further simplified, and conditions are inserted for the case in which the fluid is a gas, and the absolute temperature not constant throughout. The equation arrived at finally is

$$4\pi\rho + c\Delta T + c\Delta \log \rho = 2\omega^2 + r\frac{d\omega^2}{dr}.$$

Welczynski then identifies this rotating mass with the sun, which he assumes spherical. Since ω depends on r, he imagines the sun's axis the common axis of a series of cylinders, so that the velocities of points on the surfaces of each of these would be constant for each cylinder, the surfaces rotating as if they were solid. "But from one cylinder to another ω changes according to a certain law, $\omega = f(r)$, which, according to (10) [equation given above] depends upon the distribution of temperature and pressure in the sun's interior. Since we know nothing of these qualities it is impossible to deduce theoretically a formula for the solar rotation." He remarks further that it is important to note that "if $\omega = f(r)$ is known from observation, equation (10) gives a condition which the temperature and density of the solar interior must satisfy. If it were possible to find a second condition of this kind, it would be possible to find the laws according to which these quantities vary from point to point." He suggests that such an equation would follow if the periodicity of the sun-spots be a hydrodynamic phenomenon. The paper concludes with a reference to the position of the faculæ with reference to these spots. The faculæ being further from the centre of the sun than the spots, the former, even on the same heliographic latitude, would move faster, as the velocity of rotation increases the greater the distance from the sun. In fact a means is afforded here of determining the difference in the altitude of spots and faculæ, this difference being stated to be "considerable, almost 1/60 of the solar radius."