South Africa, presented by the Trustees of the South African Museum; two Schalow's Touracous (*Turacus schalowi*), four Cape Turtle Doves (*Turtur capicola*) from South Africa, presented by Mr. W. L. Sclater; a Vulturine Eagle (*Aquila verreauxi*) from South Africa, presented by the Rev. D. Kolbe; a Tawny Eagle (*Aquila noevioides*) from South Africa, presented by Mr. Claude Southey; a White-tailed Gnu (*Connochaetus gnu*, ♂) from South Africa, presented by Mr. C. D. Rudd; two Mandrills (*Cynocephalus mormon*, ♂ ♂), two White-collared Mangabeys (*Cercocebus collaris*, ♂ ♀), a Tantalus Monkey (*Cercopithecus tantalus*, ♂), a Lucan's Crested Eagle (*Lophotriorchis lucani*) from West Africa, a Spring-Bok (*Gazella euchore*, ♂) from South Africa, a White-tailed Ichneumon (*Herpestes albicauda*) from the Atbara River, a Yellow-headed Conure (*Conurus jendaya*) from South-east Brazil, four Lesser Pin-tailed Sand-Grouse (*Pterocles exustus*), a Black-headed Partridge (*Caccabis melanocephala*) from Arabia, deposited; a Roi Rhe-Bok (*Cervicapra fulvo-rufula*, ♂) from Maryland, Schombie Station, Cape Colony, a Gannet (*Sula bassana*), British, purchased.

OUR ASTRONOMICAL COLUMN.

HOLMES' COMET (1899 *d*).

Ephemeris for 12h. Greenwich Mean Time.

1899.	R.A. h. m. s.	Decl. ° ′ ″
Nov. 23 ...	2 13 55·17 ...	+47 40 0·2
24 ...	13 6·67 ...	32 36·4
25 ...	12 20·16 ...	25 1·7
26 ...	11 35·67 ...	17 16·9
27 ...	10 53·25 ...	9 22·5
28 ...	10 12·94 ...	47 1 19·5
29 ...	9 34·75 ...	46 53 8·4
30 ...	2 8 58·72 ...	+46 44 50·0

COMET GIACOBINI (1899 *e*).—Several observations of this comet having been obtained, Herr S. K. Winther continues his ephemeris in the *Astronomische Nachrichten* (Bd. 150, No. 3600):—

Ephemeris for 12h. Berlin Mean Time.

1899.	R.A. h. m. s.	Decl. ° ′	Br.
Nov. 23 ...	17 52 33 ...	+10 17·6	
24 ...	54 12 ...	10 34·0 ...	0·50
25 ...	55 52 ...	10 50·5	
26 ...	57 32 ...	11 7·0	
27 ...	17 59 12 ...	11 23 6	
28 ...	18 0 52 ...	11 40·2 ...	0·48
29 ...	2 33 ...	11 56·9	
30 ...	18 4 13 ...	+12 13·7	

During the week the comet passes from the northern part of Ophinchus into Hercules, about 6° east of α Ophinchi.

REFRACTION EFFECT OF COMET SWIFT (1899 I).—Prof. C. D. Perrine, during May and June 1899, made several attempts to determine if any appreciable refraction was caused by the body of Swift's comet on a ray of light passing through it, and contributes his conclusions to the *Astronomische Nachrichten* (Bd. 150, No. 3602). The observations were made with the 36-inch Lick refractor, and consisted of determining accurately the position angle and distance of two stars, (1) when one or both of them were seen enveloped in the mass of the comet; (2) when quite free from the cometary matter. The diameter of the head of the comet was computed to be about 174,000 miles, and the extent of matter traversed by the light from the stars about 163,000 miles. The greatest range of variation in the measured distance of the stars was 0″·26, which the author thinks in all probability accidental, as no systematic variation was detected; so that from these experiments the conclusion is that the mass of a comet causes no appreciable effect of refraction on light passing through it.

PREDOMINANCE OF SPIRAL NEBULÆ.—In the *Astronomische Nachrichten* (Bd. 150, No. 3601), Prof. J. E. Keeler describes the preliminary results of his inquiry into the structure of nebulæ. The discussion is based on photographs obtained with the Crossley reflector of the Lick Observatory, and the author finds that in addition to confirming the spiral structure of the nebulæ catalogued by the Earl of Rosse, so many others possess the same characteristic form that their being put in a special category loses its significance; in fact, any small compact nebula not showing evidence of spiral structure, appears exceptional. He finds gradations leading to the belief that the elongated spindle-shaped nebulæ of Herschel also really belong to this class. The author concludes by stating that if numerous exceptions prove that spirality in nebulæ is not an universal law, it may perhaps be regarded as the usual or normal accompaniment of contraction in cosmical masses, and any departure from it may be explained as the result of special conditions, tending to suspend or weaken causes which are generally in operation.

BULLETIN ASTRONOMIQUE.—The *Bulletin Astronomique* for November 1899 contains an illustrated article by M. Camille Flammarion on the "Eclipses of the Twentieth Century visible at Paris." Forty-three eclipses of the sun will be visible, two of them being total, and thirty-three presented in good positions for observation. The particulars of each are given, with a diagram showing maximum phase. The same author describes the observations of 339 Perseids made at Juvisy from 10–13 August 1899, with illustrations showing the plotted paths. The mean position of the radiant was RA = 3h. 3m.; Decl. +56°.—M. Souleyre concludes his article on the "Distribution of rain on the earth's surface."—M. A. Benoit contributes a very interesting article on "Transneptunian planets," giving particulars respecting a proposed instrumental equipment for a systematic search for such bodies.

THE FITTING OF THE CYCLE TO ITS RIDER.[1]

THE present time is opportune to notice some points in cycle riding which have received our attention during the last three years. Every intelligent rider of a cycle must have at some time compared his powers as a human motor with the motors that drive the motor-cars which he now so frequently meets in the streets. He naturally wishes to study the question of most efficient propulsion, including that of his own mechanical efficiency as a motor driving his cycle. The design of the modern cycle was so far developed by 1896 that a standard type then became the rule, most cycles having a 45-inch wheel base, two wheels of equal diameter 28 inches, cranks 6½ inches long, and a ratio of gear varying between 59 to 80 inches, the sole difference made between cycles intended for tall riders and those for short ones consisting in varying the height of the frame. In 1896 the writers, being urged thereto by Mr. Otto Blathy, the well-known engineer of Budapesth, had their attention called to the necessity of varying the crank length to suit the varying length of leg of the rider. A series of experiments was carried out for cranks up to 9½ inches long, and the results obtained were very remarkable. It may now be taken as admitted that a very large proportion of the riders who have tried cranks of increased length have found great benefit from their use, but although they feel strongly how tangible these advantages are, some difficulty has been felt in satisfactorily explaining them.

All that has been written on cycle riding in the past has been confined to the style of riding which has been gradually elaborated on cycles fitted with the standard 6¼-inch to 6½-inch cranks, but this is little or no assistance to us when we attempt to investigate the subject through wider limits of muscular movement.

When mechanical engineers measure the efficiency of any form of mechanical motor they confine themselves generally to the consideration of the fuel that it consumes, but do not, as a rule, when considering its efficiency, take into consideration the cost of keeping it in repair, or include with it the cost of feeding and maintaining the driver; but the food which is the fuel of the cycle rider has not only to perform the same duties as the fuel of the mechanical motor, but has in addition to supply the nerve waste and repair the muscle waste which answers to the repairs to the mechanical motor, and from the same supply to maintain the brain power of the driver. The food energy of the cyclist has, therefore, to be distributed through three distinct channels: the first in importance is that which is required

[1] Abstract of paper read before the Cycle Engineers Institute at Birmingham, by R. E. Crompton and C. Crompton.