Future observations are likely to produce only very slight alterations in the above values. Thus the period is not likely to be in error by more than one tenth of a year, and the error in the eccentricity can hardly surpass ± 0.005 . Indeed the orbit of ξ Ursae Majoris is practically all that can be desired in the present state of double star measurement. In order to effect any further improvement of the orbit astronomers will need to take every precaution against systematic errors; and rough measures by inexperienced observers are unlikely to prove to be of any considerable value.

We remark, however, that continued observation of this star is desirable, because the micrometrical measures

of skilled observers will be valuable in throwing light upon the question of the existence of dark bodies or other disturbing influences, and in proving with all possible experimental accuracy that the force which retains the companion in its orbit is directed exactly towards the central star.

ξ Ursae Majoris, like ζ Herculis, has a large proper motion in space, and this circumstance in connection with the brilliancy of the components conduces to the belief that the system is comparatively near the earth. Measurement for parallax has never been attempted, but if suitable comparison stars could be found effort in this direction would be likely to prove successful.

The University of Chicago, 1895 Aug. 24.

T. F. F. See.

Researches on the orbit of γ Coronae Australis.

By *T. F. F. See.*

This celebrated southern binary was discovered by Sir John Herschel at the Cape of Good Hope, June 20, 1834 (Results of Observations at Cape of Good Hope, p. 274). During his sojourn at Feldhausen he made careful measures of the object with the seven-foot equatorial, and on two occasions swept over it with the twenty-foot reflector. In sweep 461 he saw the pair under specially favorable conditions and estimated the distance of the components at 3". This value is therefore adopted in the table of observations instead of the distance (1".23?) indicated by the micrometer, which was vitiated by troublesome hitching of the threads and had to be rejected as worthless. Herschel showed from his observations that the system had a considerable retrograde motion, and hence it was subsequently followed by Jacob, Powell, Russell, Tebbutt and other southern observers. At the present time the arc described amounts to 238° , and even if the observations are not

very numerous they are sufficient, both in point of quantity and quality, to give an orbit which will undoubtedly prove to be substantially correct.

The components are nearly equal in magnitude, and, as they are never closer than $1''.42$, the pair is always comparatively easy; and even if difficulties arise in the measurement of distance, there will be practically no difficulty, as Herschel remarks, in determining the angle with the necessary accuracy. In dealing with the orbit of a bright pair with equal components, it is clear that unusual weight should be given to the position angles, and especially when the stars are fairly wide but the measured distances are affected by relatively large errors. The orbit of this star is therefore based mainly on the angles, but the distances have been of no small service in the final definition of the elements. Some of the orbits which have been published by previous investigators are as follows:

P	T	e	a	Ω	i	λ	Authority	Source
100.78	1863.08	0.602	2".549	$352^\circ.2$	$53^\circ.6$	$266^\circ.4$	Jacob, 1858	M. N. XV. p. 208
55.58	1882.77	0.6989	2.400	229.15	111.45	—	Schiaparelli, 1876	A. N. 2073
54.98	1883.20	0.6974	2.44	227.4	69.3	283.95	Downing, 1883	M. N. XLIII p. 368
81.78	1886.53	0.322	1.885	45.4	47.43	141.0	Gore, 1885	M. N. XLVI p. 103
78.80	1887.40	0.324	1.85	41.0	50.5	—	Wilson, 1886	Gore's Catalogue p. H.
93.34	1885.19	0.303	2.034	49.3	48.8	153.4	Powell, 1890	Gore's Catalogue p. H.
121.24	1879.33	0.331	2.191	57.95	35.62	181.1	Sellers, 1892	M. N. LIII p. 45
154.41	1876.84	0.4244	2.55	77.23	35.6	175.3	Gore, 1892	M. N. LII p. 503

An investigation of all the observations has led me to the following elements of γ Coronae Australis:

$$\begin{aligned}
 P &= 152.7 \text{ years} \\
 T &= 1876.80 \\
 e &= 0.420 \\
 a &= 2".453 \\
 \Omega &= 72^\circ.3 \\
 i &= 34.0 \\
 \lambda &= 180.2 \\
 n &= -2^\circ.3575
 \end{aligned}$$

Apparent orbit:

$$\begin{aligned}
 \text{Length of major axis} &= 4".906 \\
 \text{Length of minor axis} &= 3.661 \\
 \text{Angle of major axis} &= 72^\circ.2 \\
 \text{Angle of periastron} &= 252.1
 \end{aligned}$$

$$\text{Distance of star from centre} = 1".033.$$

Comparison of computed with observed places.

t	θ_o	θ_c	ϱ_o	ϱ_c	$\theta_o - \theta_c$	$\varrho_o - \varrho_c$	n	Observers
1834.47	37°1	37°1	3" $\pm$	2"80	$\pm 0^{\circ}0$	$+0^{\circ}20$	1	Herschel
1837.42	32.7	32.7	2.66	2.66	± 0.0	± 0.00	4	Herschel
1847.32	14.1	14.6	2.30	2.20	-0.5	$+0.10$	1	Jacob
1850.51	5.9	5.9	2.29	2.03	± 0.0	$+0.26$	4	Jacob
1851.48	4.4	4.4	2.26	2.00	± 0.0	$+0.26$	6	Jacob
1852.27	3.4	2.3	1.89	1.96	$+1.1$	-0.07	3	Jacob
1853.61	358.8	358.2	1.91	1.90	$+0.6$	$+0.01$	6 $\pm$	Jacob; Powell 4-1
1854.52	355.9	355.5	1.71	1.86	$+0.4$	-0.15	6-3	Jacob 3; Powell 3-0
1856.44	349.5	349.3	1.67	1.78	$+0.2$	-0.11	11-10	Jacob 8-7; Jacob 3
1857.43	347.3	345.5	1.61	1.73	$+1.8$	-0.12	8	Jacob 5; Jacob 3
1858.20	343.4	342.6	1.53	1.70	$+0.8$	-0.17	3	Jacob
1859.72	338.1	336.8	1.5 $\pm$	1.64	$+1.3$	-0.14	4-2	Powell
1861.69	328.8	328.5	1.5 $\pm$	1.58	$+0.3$	-0.08	4-1	Powell
1862.27	325.3	325.8	1.5 $\pm$	1.56	-0.5	-0.06	5-1	Powell
1863.84	318.1	319.0	—	1.52	-0.9	—	4	Powell
1870.19	286.1	287.0	—	1.44	-0.9	—	2	Powell
1871.22	281.9	281.3	—	1.43	$+0.6$	—	1	Powell
1875.65	257.4	258.1	1.45	1.43	-0.7	$+0.02$	4	Schiaparelli
1876.64	253.1	253.0	1.67	1.43	$+0.1$	$+0.24$	—	Stone
1877.53	247.5	247.9	1.47	1.42	-0.4	$+0.05$	9-7	Schiaparelli 5; Stone 4-3
1878.49	242.6	243.0	1.36	1.43	-0.4	-0.07	2	Stone
1880.57	232.7	232.0	1.24	1.43	$+0.7$	-0.19	2	Russell 1; Hargrave 1
1881.72	225.5	226.1	1.42	1.43	-0.6	-0.01	3-2	H. C. Wilson
1883.62	217.7	216.3	1.66	1.43	$+1.4$	$+0.23$	4-1	H. C. Wilson
1886.64	201.9	200.6	1.44	1.44	$+1.3$	± 0.00	7	Pollock 6; Russell 1
1887.71	196.4	195.2	1.42	1.46	$+1.2$	-0.04	8-5	Pollock 4; Tebbutt 4-1
1888.66	188.6	190.6	1.46	1.47	-2.0	-0.01	7-3	Tebbutt 6-3; Laevenworth 1
1889.62	185.4	186.1	1.70	1.49	-0.7	$+0.21$	8-3	Burnham 4-3; Tebbutt 4-0
1890.62	181.6	181.6	1.61	1.51	± 0.0	$+0.10$	10-4	Tebbutt 4; Sellors 6-0
1891.53	176.9	177.0	1.68	1.54	-0.1	$+0.14$	3	Burnham
1892.64	172.9	172.3	1.65	1.57	$+0.6$	$+0.08$	5-2	Tebbutt
1894.80	165.5	163.5	1.62	1.65	$+2.0$	-0.03	5-6	Tebbutt
1895.73	159.2	159.9	1.59	1.69	-0.7	-0.10	2	See

It will be seen that my orbit is quite similar to that found by Gore. Though the period is not defined with the greatest accuracy, it does not seem probable that the value given above can be uncertain by more than five years. The eccentricity will certainly be in the immediate neighborhood of the value here assigned, and an error exceeding ± 0.02 is very improbable. The orbit of γ Coronae Australis is therefore comparatively well determined, and yet as great accuracy in the orbits of double stars is ulti-

mately desirable, southern observers will find this system worthy of constant attention. The following is a short ephemeris:

t	θ_c	ϱ_c
1896.50	157°4	1"71
1897.50	154.0	1.76
1898.50	150.6	1.80
1899.50	147.2	1.85
1900.50	143.8	1.90

The University of Chicago, 1895 Oct. 18.

T. F. F. See.

Rauchkeil-Beobachtungen von η Aquilae.

Frau General v. Prittwitz in Berlin hat in den abgelaufenen Monaten einige Beobachtungsreihen mit dem Rauchkeil-Photometer gewonnen, die sie dem Vorstande der Vereinigung von Freunden der Astronomie freundlichst mitgeteilt hat. Die kleine Reihe über η Aquilae erschien mir der Prüfung besonders werth. Sie umfasst von 1895

Mai 25 bis Oct. 5 im Ganzen 38 Beobachtungen, wovon ich aber 11 herauswerfen musste, die im Original des Wetters wegen stark verdächtig waren. Es bleiben 27, wovon jede aus mehreren Anschlüssen an θ und 58 Aquilae besteht; die Grössen von η sind daraus abgeleitet auf Grund von Pritchard's Uranometrie: $\theta = 3.26$; 58 Fl. = 5.74.