Researches on the orbit of Σ 3062.

By Dr. *T. J. J. See.*

This double star was discovered by Sir William Herschel Aug. 25, 1782. He measured the angle and repeated his observation the following year, without finding any sensible change. Beginning with 1823, Struve followed the star for ten years; and from the measures thus secured he discovered that the system is a binary in rapid orbital motion. Since Struve's time the star has been carefully measured by many of the best observers, so that there is abundant material upon which to base an orbit which seems likely to be substantially correct.

Having collected all the published observations of Σ 3062 from original sources, I have formed for each year a mean position which is the arithmetic mean of the mean results obtained severally by the best observers. In accordance with the experience of Struve, Otto Struve, Dembowski, and Burnham these yearly means may be held to furnish the most trustworthy basis for the elements of an orbit. The following is a table of the orbits hitherto published for this star:

P	T	e	a	☊	i	λ	Authority	Source
146.83	1834.01	0.57536	0″9982	77°35	38°6	42°2	Mädler, 1847	Die Fixst.-Syst.
105.64	1836.60	0.4151	1.446	47.6	46.3	93.87	von Fuss, 1867	—
112.644	1835.196	0.50090	1.310	32.2	29.97	97.52	Schur, 1867	A. N. 1636
104.415	1834.88	0.4612	1.27	38.6	32.2	92.1	Doberck, 1877	A. N. 2156
102.943	1835.508	0.4472	1.270	39.15	32.2	92.1	Doberck, 1879	A. N. 2277

By the method of Klinkerfues we find the following elements of Σ 3062:

$P = 104.61$ years ☊ $= 47°15$
$T = 1836.26$ $i = 43.85$
$e = 0.450$ $\lambda = 90.90$
$a = 1''3712$ $n = +3°441355$

Apparent orbit:

Length of major axis = 2″526
Length of minor axis = 1.984
Angle of major axis = 45°7
Angle of Periastron = 138.4
Distance of star from centre = 0″446.

It will be seen that these elements are very similar to those derived by von Fuss in 1867. The following comparison of the computed and observed places shows that the above elements are highly satisfactory, and that the true elements of this remarkable binary will hardly differ sensibly from the values here obtained.

t	θ_o	θ_c	ϱ_o	ϱ_c	$\theta_o - \theta_c$	$\varrho_o - \varrho_c$	n	Observers
1782.65	319°4	315°7	—	1″44	+3°7	—	2	Herschel
1823.81	36.7	45.3	1″25±	1.16	−8.6	+0″09	1	Struve
1831.71	85.7	85.1	0.82	0.72	+0.6	+0.10	2	Struve
1833.73	108.6	105.3	0.56	0.61	+3.3	−0.05	3	Struve
1835.66	132.6	130.5	0.41	0.55	+2.1	−0.14	5	Struve
1836.61	146.4	143.8	0.47	0.55	+2.6	−0.08	5	Struve
1840.55	186.7	188.8	0.72	0.71	−2.1	+0.01	7.6	*OΣ*, 4; Da., 3.2
1841.72	193.5	197.6	0.92	0.79	−4.1	+0.13	9	Mä., 7; Da., 2
1842.80	207.3	204.7	0.87	0.86	+2.6	+0.01	1	Mädler
1843.69	209.3	209.5	0.93	0.91	−0.2	+0.02	4	Mä., 3; Da., 1
1844.49	213.7	213.6	0.85	0.96	+0.1	−0.11	5	Mädler
1846.42	220.3	222.2	0.97	1.07	−1.9	−0.10	2	O. Struve
1847.53	225.1	226.1	1.12	1.11	−1.0	+0.01	5	Mädler
1848.54	229.2	229.7	1.15	1.16	−0.5	−0.01	3	*OΣ*, 2; Da., 1
1849.19	232.5	231.9	1.09	1.18	+0.6	−0.09	3	O. Struve
1850.56	233.8	236.1	1.24	1.23	−2.3	+0.01	7.6	*OΣ*, 3; Mä., 3; Da., 1.0
1851.36	235.7	238.3	1.26	1.25	−2.6	+0.01	12	*OΣ*, 2; Mä., 8; Mä., 2
1852.49	238.4	241.6	1.23	1.29	−3.2	−0.06	3	O. Struve
1854.47	245.9	246.7	1.38	1.33	−0.8	+0.05	13.7	*OΣ*, 4; Da., 3; De., 6.0
1855.58	246.6	249.4	1.34	1.35	−2.8	−0.01	14	*OΣ*, 3; De., 8; Mo., 3
1856.69	249.1	251.5	1.31	1.37	−2.4	−0.06	7	De., 4; *OΣ*, 2; Mä., 1
1857.56	251.6	254.0	1.32	1.38	−2.4	−0.06	10	*OΣ*, 3; Se., 3; De., 4
1858.54	252.4	256.3	1.2	1.39	−3.9	−0.19	2	Dembowski
1859.16	255.3	257.3	1.46	1.40	−2.0	+0.06	3	O. Struve

t	θ_o	θ_c	ϱ_o	ϱ_c	$\theta_o - \theta_c$	$\varrho_o - \varrho_c$	n	Observers
1861.79	265°.2	263°.4	1″.21	1″.42	+1°.8	−0″.21	2	Mädler
1862.60	263.8	265.2	1.43	1.43	−1.4	0.00	15	$O\Sigma$, 2; De., 11; Mä., 2
1863.83	265.8	267.7	1.41	1.43	−1.9	−0.02	10	De., 9; Da., 1
1864.73	268.7	269.7	1.40	1.43	−1.0	−0.03	7	Dembowski
1865.70	270.5	271.8	1.39	1.44	−1.3	−0.05	9	De., 6; Kn., 3
1866.60	271.3	273.6	1.42	1.44	−2.3	−0.02	8	$O\Sigma$, 2; De., 5; Se., 1
1867.74	275.2	276.1	1.41	1.44	−0.9	−0.03	7	Dembowski
1868.82	277.0	278.2	1.48	1.44	−1.2	+0.04	6	De., 4; $O\Sigma$, 2
1869.75	279.9	280.6	1.48	1.44	−0.7	+0.04	6	Dembowski
1870.43	280.8	281.5	1.47	1.44	−0.7	+0.03	10	$O\Sigma$, 2; Gl., 1; De., 7
1871.58	283.9	283.8	1.49	1.45	+0.1	+0.04	8	De., 7; Gl., 1
1872.71	286.0	286.1	1.46	1.44	−0.1	+0.02	7	De., 6; W. & S., 1
1873.76	287.8	288.3	1.48	1.44	−0.5	+0.04	12	De., 9; W. & S., 1; Gl., 2
1874.80	290.7	290.4	1.37	1.44	+0.3	−0.07	9	De., 6; W. & S., 1; Gl., 2
1875.68	292.5	292.2	1.48	1.44	+0.3	+0.04	11	De., 6; Du., 5
1876.84	294.5	294.6	1.51	1.44	−0.1	+0.07	13.11	De., 5; Dk., 3.2; Pl., 5.4
1877.68	296.5	296.2	1.48	1.44	+0.3	+0.04	8	De., 4; Dk., 4
1878.75	300.7	298.4	1.45	1.44	+2.3	+0.01	9	De., 4; Dk., 5
1879.61	302.5	300.2	1.41	1.44	+2.3	−0.03	13	Hl., 8; Dk., 5
1880.74	304.4	302.5	1.52	1.43	+1.9	+0.09	10	β, 6; Dk., 4
1881.59	305.2	304.3	1.60	1.43	+0.9	+0.17	12.10	Jed., 3.2; β, 3; Big., 2.1; Hl., 4
1882.46	306.5	306.1	1.41	1.43	+0.4	−0.02	11.10	Jed., 7; Dk., 4.3
1883.77	311.3	307.7	1.56	1.43	+3.6	+0.13	12	En., 9; Hl., 3
1884.47	311.7	310.2	1.26	1.43	+1.5	−0.17	2	Seabroke
1885.80	316.1	312.9	1.45	1.43	+3.2	+0.02	5	Hall
1886.56	314.9	314.4	1.44	1.43	+0.5	+0.01	8.7	Sea., 3.2; Hl., 5
1887.08	313.1	315.4	1.43	1.43	−2.3	0.00	9.6	Sch., 6.3; Tar., 3
1888.66	318.9	317.5	1.41	1.43	+1.4	−0.02	11	Sch., 1; Hl., 4; Sch., 6
1889.79	321.5	320.9	1.43	1.44	+0.6	−0.01	8	β, 3; Hl., 4; Sea., 1
1890.86	324.3	323.1	1.43	1.44	+1.2	−0.01	6	Hl., 5; Sch., 1
1891.71	324.9	323.8	1.48	1.44	+1.1	+0.04	3	See, 1; Sch., 2
1892.89	326.7	327.2	1.52	1.44	−0.5	+0.08	8	Com., 3; Col., 2; Jo., 1; Sch., 2
1893.90	329.3	329.2	1.51	1.44	+0.1	+0.07	4	Com., 2; Sch., 2
1894.64	332.0	330.7	1.86	1.45	+1.3	+0.41	1	Glasenapp
1895.17	329.7	331.8	1.31	1.45	−2.1	−0.14	5.4	Ho., 3; Com., 2.1

Ephemeris for Σ 3062.

t	θ	ϱ	t	θ	ϱ
1896.50	334°.8	1″.45	1902.50	346°.8	1″.46
1897.50	336.8	1.45	1903.50	348.8	1.46
1898.50	338.8	1.45	1904.50	350.8	1.46
1899.50	340.8	1.45	1905.50	352.8	1.46
1900.50	342.8	1.46	1906.50	354.8	1.46
1901.50	344.8	1.46			

It will be seen that there are occasional systematic errors both in the angles and in the distances, and in some cases these deviations appear to be rather more extensive than we should expect in the work of the best observers; but the star has some peculiar difficulties, especially as regards the distance, and on the whole the measures are fairly accordant for so close an object.

In the last column we have given the abbreviated names of the observers and the number of nights on which the star was measured. Thus the record (for 1854.47): $O\Sigma$, 4; Da., 3; De., 6.0 means: Otto Struve on 4 nights, Daves on 3 nights, Dembowski on 6 nights for the angle, the distance not being measured. The abbreviations are: Σ = W. Struve; $O\Sigma$ = O. Struve: Da. = Dawes; Mä. = Mädler; De. = Dembowski; Mo. = Morton; Se. = Secchi; Kn. = Knott; Gl. = Gledhill; W. & S = Wilson and Seabroke; Du. = Dunér; Dk. = Doberck; Hl. = Hall; Jed. = Jedrzejewicz; β = Burnham; Big. = Bigourdan; En. = Engelmann; Sea. = Seabroke; Sch. = Schiaparelli; Com. = Comstock; Col. = Collins; Jo. = Jones; Ho. = Hough. Several very short names are written in full.

This star deserves the careful attention of observers, as the next 20 years will give the material which will make the orbit exact to a very high degree. It may be pointed out that the system has a considerable proper motion in space, in α +0″.346, in δ +0″.020; and therefore the chances are that it has a sensible parallax. If the parallax could be determined it would give us the absolute dimensions of the system and the combined mass of the components — two elements of the highest interest in the study of the stellar systems.

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T. J. J. See.