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Micrometrical Measures of Double Stars

made in the years 1889, 1890, 1891 and 1892.

By *Kenneth F. Tarrant*, F. R. A. S.

The present series of measures is a continuation of those published in No. 2991 of the *Astr. Nachr.*, and brings the observations up to the present time. All the measures have been made with the same instrument, micrometer and powers previously employed, and no star is included which has not been measured on at least two nights. During the year 1890 the telescope was dismantled and removed to its present position (some 510 feet above sea level) and the advantage of the greater elevation has been strikingly manifested in dealing with objects having considerable south declination; owing however to the nature of the ground, considerable difficulty was at first experienced from the settlement of the mounting of the telescope, which has been overcome by a solid concrete foundation. The illu-

mination of the micrometer is now entirely electric, the current being obtained from the accumulators which supply the house. A rheostat is placed in circuit by which the quantity of light is completely under control, and by a simple arrangement, either bright wires or bright field can be obtained; the latter form of illumination has been employed for all those objects in which the components were sufficiently bright, when this was not the case the wires have been illuminated.

The objects as in the previous lists are arranged in the following order viz: Dorpat Catalogue, Pulkova Catalogue, Burnham, and Miscellaneous objects, the latter including several stars not often observed.

Dorpat Catalogue.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$\Sigma 228 = \text{Andromedae } 259. (6.5-7.5).$				
1889.654	35°45	0".40	V	Very close
.659	38.57	0.35	V	Slight elongation
1889.656	37.01	0.37		Definition very good
1890.087	40.27	0".4 est.	V	Dist. meas. impossible; good seeing
.095	44.87	0.3 est.	VI	Scarcely any elongation
.109	43.18	0.3?	VI	Too close for distance
1890.097	42.77	0.35 est.		This star is still closing
1891.747	64.0?	—	V	Perhaps elongated
.850	60.0?	—	V	Doubtful. Fine seeing
1891.798	62.0?	—		Rapid direct ang. change

This pair is now practically beyond my aperture, and must be left to larger instruments.

$\Sigma 337. (7.0-9.0).$

1890.095	165.60	17".36	III	Good
.106	165.00	16.75	IV	Rather unsteady
.109	164.27	17.50	IV	
1890.103	164.99	17.20		Unchanged

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$\Sigma 367. (7.5-7.5).$				
1890.095	231°79	0".60	IV	Good definition
.101	229.67	0.72	V	Well separated
1890.098	230.73	0.66		
Certain decrease of angle. Components equal.				
$\Sigma 388. (7.5-9.0).$				
1890.106	208.60	3.17	IV	Companion very small
.197	209.08	3.05	III	Well seen
.199	206.23	2.95	IV	Unsteady at times
1890.167	207.97	3.05		
Apparently unchanged since 1865.				

$\Sigma 465. (8.0-10.0).$

1890.106	233.47	5.60	IV	B well seen
.109	235.40	6.17	IV	Definition unsteady
.112	232.27	5.47	V	Good measure
1890.109	233.71	5.74		No evidence of change

There are very few measures of this pair for reference since Σ . The small star B bears illumination fairly well, and it is strange that Dembowski should have failed to see it.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
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 $\Sigma 567.$ (8.0-9.0).

1890.101	318.21	1.70	IV	Good
.109	319.19	2.20	IV	Definition poor at times
1890.105	318.70	1.95		Slow direct ang. motion

I have always noted a full magnitude difference between the components. A decided increase in distance since Σ .

 $\Sigma 631.$ (7.2-8.5).

1889.005	106.50	5.50	IV	Good measure
.101	105.18	5.42	IV	
1889.053	105.84	5.46		Unchanged

 $\Sigma 679.$ (9.0-9.5).

1890.112	314.15	19.50	V	First rate definition
.145	317.08	19.27	IV	Diffused
.191	315.00	19.40	IV	Good
1890.149	315.74	19.39		Apparently fixed

 $\Sigma 683.$ (8.0-10.0).

1890.112	79.47	11.87	V	Good measure
.145	78.88	12.13	IV	Definition moderate
.191	79.20	11.63	IV	
1890.149	79.18	11.87		Relatively fixed

A pair of which there are but few measures.

 $\Sigma 694.$ (8.0-8.0).

1890.109	183.60	1.51	IV	Dist. measures difficult
.112	185.08	1.33	V	Good
1890.110	184.34	1.42		No sign of change

The components have always been noted as «equal»; there is little doubt that the first distance measure is too large.

 $\Sigma 734.$

A and B. (7.0-8.5).

1890.199	359.67	1.67	V	Definition good
.205	357.51	1.58	VI	Very good measure
1890.202	358.59	1.62		Probably fixed

B and C. (see β 1049). $\Sigma 738 = \lambda$ Orionis. (4.0-6.0).

1890.095	41.84	4.65	IV	
.101	44.24	4.26	IV	Definition very good
1890.098	43.04	4.45		Unchanged

The small star C was not measured.

 $\Sigma 742 = \text{Tauri } 380.$ (7.2-7.5).

1890.112	258.66	3.45	V	Good
.115	257.08	3.27	IV	
1890.113	257.87	3.36		

Certain increase in angle, but very slow. This pair is probably binary.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
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 $\Sigma 776.$ (8.1-9.0).

1890.095	105.16	2.35	IV	Rather unsteady
.101	106.21	2.09	IV	Good
1890.098	105.68	2.22		Change very doubtful

 $\Sigma 785.$

A and B. (7.0-8.2).

1890.101	347.02	13.58	IV	Good definition
.197	348.27	13.68	IV	
1890.149	347.64	13.63		Relatively fixed

A and C. (see $O\Sigma 116$). $\Sigma 787.$ (8.0-8.5).

1890.112	76.52	1.30	V	Angle measures difficult
.145	73.85	1.42	V	
.191	73.47	1.28	VI	Good
.199	74.26	1.38	V	
1890.161	74.52	1.34		

Perhaps a slight decrease in angle. The second measure above is certainly too large in distance.

 $\Sigma 950^2.$ 15 Monocerotis. (9.0-10.5).

1890.060	47.21	3.27	IV	Both stars faint
.095	44.88	3.43	IV	Well seen
1890.077	46.04	3.35		

Apparently unchanged since 1869.

For the relation of the principal star of this small pair to 15 Monocerotis see Astr. Nachr. No. 2991. It is the E of the measures there given.

 $\Sigma 1024.$ (8.2-8.8).

1890.251	312.06	1.28	V	Seeing moderate
.258	314.50	1.36	V	Measures difficult
.262	310.18	1.20	IV	Good
1890.257	312.24	1.28		Relatively fixed

 $\Sigma 1095.$ (8.2-9.0).

1890.060	76.20	10.02	III	
.076	74.03	9.97	IV	Unsteady at times
.084	77.15	10.25	IV	
1890.073	75.79	10.08		No sign of change

 $\Sigma 1099.$ (8.0-8.7).

1890.060	338.47	4.25	IV	
.076	341.87	3.79	IV	Moderate definition
.084	339.10	4.36	IV	Windy and unsteady
1890.073	339.81	4.13		

There may be a very slight diminution of the angle, distance unchanged.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
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$\Sigma 1103. (7.3-8.3).$

1890.060	242°21	4"31	IV	Definition moderate Good
.076	244.10	4.17	IV	
.087	245.00	4.25	IV	
1890.077	243.77	4.24		Unchanged since Σ

$\Sigma 1110 = \alpha \text{ Geminorum. } (3.0-4.0).$

1889.293	230.56	5.98	IV	Fine definition
.301	231.01	5.77	V	Good
.303	230.27	5.87	IV	
1889.299	230.61	5.87		

The best results in the foregoing measures have been obtained in twilight; the angle is certainly diminishing, but the motion is exceedingly slow; measured in 1885:

232°93 5"78 2n.

$\Sigma 1116. (7.3-7.8).$

1890.060	107.25	1.78	IV	Well separated
.076	106.72	1.75	IV	
.095	108.12	1.87	V	
1890.077	107.36	1.80		

There is apparently a very slow decrease in the angle, but few companion measures.

$\Sigma 1134 = H_1 \text{ II.39. } (7.5-11.0).$

1890.076	146.27	10.28	IV	Good measure
.087	145.48	10.18	IV	
.095	145.77	9.79	III	
.106	146.10	10.42	IV	
1890.091	145.90	10.16		Unchanged since Σ

$\Sigma 1137. (8.0-9.2).$

1890.095	134.50	2.78	IV	Images diffused
.106	135.08	2.67	IV	
1890.100	134.79	2.72		

No certain evidence of change; the small star does not bear much illumination for its magnitude.

$\Sigma 1149. (7.3-9.0).$

1890.076	42.48	21.55	IV	Small star faint
.095	40.65	22.00	IV	Well seen
1890.085	41.56	21.77		Unchanged

$\Sigma 1175. (7.8-9.0).$

1890.095	221.74	2.20	IV	Very good
.106	222.55	1.98	IV	
1890.100	222.14	2.09		

The above measures confirm the slow direct motion in angle, shewn by the results in 1888. The pair is not a very easy object to measure.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
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$\Sigma 1216. (7.0-7.5).$

1891.186	181°17	0"47	VI	Well seen
.216	185.27	0.40	V	In contact?
.232	178.75	0.35	VI	Very close and difficult
1891.211	181.73	0.40		Angular change

Measures at all times most difficult. On the occasion of the first measure the stars appeared almost separated while on the last the elongation was (although certain) but slight. Hence the distance measures may be to some extent in error, though I do not think they are far out. The pair requires first rate air to see it at all.

$\Sigma 1245 = \text{Pi. } 8^h 10.8. (6.0-7.0).$

1889.221	26.51	10.21	III	
.243	26.39	10.46	IV	
.301	27.08	10.63	III	
1889.255	26.66	10.43		

An uninteresting pair, but has been almost entirely neglected by every one except Dembowski; evidently fixed.

$\Sigma 1273 = \epsilon \text{ Hydrae.}$

A and B (Schiaparelli). (3.8-5.5).

1889.221	146.20	—	VI	Elong. if any very slight
.243	151.80	—	V	Not single but very close
.301	157.05	—	V	Elongated?
1889.255	151.68	—		

The close star discovered by Schiaparelli is too difficult with my aperture to render any measures of much value; on the above three occasions a fairly consistent elongation was measured, and the results are given for what they are worth, no distance measures were possible. The inequality of the components renders the pair additionally troublesome. Observations with large apertures indicate angular motion in the close pair and the three components probably form one system.

$\frac{1}{2} (A + B) \text{ and } C. C = 7.8.$

1889.243	227.49	3.15	V	Splendid definition
.301	229.00	2.96	V	
1889.273	228.24	3.05		

Certainly binary, angle increasing and distance diminishing.

$\Sigma 1302. (8.7-9.5).$

1890.199	227.16	2.47	IV	Stars faint
.205	230.00	2.18	IV	
1890.202	228.58	2.32		

No decided evidence of change, but few measures.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$\Sigma 1311 = \text{Cancr } 194. (6.5-7.0).$				
1889.301	198°98	7".20	IV	Good seeing
.303	199.81	7.16	V	
1889.302	199.39	7.18		Relatively fixed

Another of the Struve stars seldom observed, hardly any measures since those of Dembowski in 1868.

$\Sigma 1316.$				
A and B. (8.2-10.2).				
1890.197	168.11	7.86	IV	Components faint
.205	167.84	7.62	IV	Not easy
1890.201	167.97	7.74		

B and C. C = 10.0.				
1890.197	47.18	3.63	IV	Not well seen
.205	46.21	3.80	IV	Difficult
1890.201	46.69	3.71		

From the faintness of the components this has always proved a difficult star to measure. There is undoubted change, although from a comparison of the few measures that have been made, it is very difficult to say whether it is due to proper motion or not. The system deserves more attention than it has hitherto had. B and C appear to be closing.

$\Sigma 1445. (9.2-11.8).$				
1890.199	164.71	3.07	IV*	Very faint and difficult
.205	158.36	2.68	III*	B very small
.251	161.01	2.87	III*	Well seen
1890.218	161.36	2.87		

The small star is very faint. No evidence of change hitherto. * = bright wire illumination.

$\Sigma 1523 = \xi \text{ Ursae majoris. } (4.0-4.5).$				
1889.369	217.50	1.60	V	Good
.383	213.84	1.72	III	Poor definition
.386	215.20	1.65	IV	
.418	219.50	1.56	IV	Images diffused
.470	220.97	1.87	IV	Unsteady
1889.405	217.40	1.68		

Retrograde motion, now an easy pair to measure.

$\Sigma 1627 = \text{Pi. } 12^h 32.33. (6.0-6.5).$				
1889.303	195.96	19.93	III	Measures certain
.418	196.47	19.80	III	
1889.360	196.21	19.86		

Evidently relatively fixed. A very fine pair.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$\Sigma 1677 = \text{H}_1 \text{ III. } 53. (6.8-7.6).$				
1889.303	347°78	15".75	III	Good
.418	346.52	15.50	III	
1889.360	347.15	15.62		

Very similar to the last. Unchanged.

$\Sigma 1681. (8.3-8.3).$				
1889.301	196.21	8.47	IV	
.303	195.60	8.50	III	Good measure
1889.302	195.90	8.48		

The above were made under better conditions than in 1888. Relatively fixed.

$\Sigma 1690 = \text{H}_1 \text{ II. } 42. (7.0-9.0).$				
1889.301	146.60	5.87	IV	Well seen
.303	147.58	5.61	III	B very small
1889.302	147.09	5.74		Relatively fixed

The companion star has always appeared smaller than the magnitude assigned to it.

$\Sigma 1701. (7.0-9.5).$				
1889.301	307.60	21.32	IV	
.303	305.10	21.19	III	
1889.302	306.35	21.25		

A wide pair of which there are few measures, evidently fixed.

$\Sigma 1716 = \text{Virginis } 427. (8.2-10.7).$				
1889.301	144.88	2.67	IV	Difficult
.303	143.80	2.56	III	Stars faint
1889.302	144.34	2.61		

Rather a difficult pair to measure from the small magnitude of B; there is a well marked diminution of the angle.

$\Sigma 1763 = 81 \text{ Virginis. } (7.3-7.3).$				
1889.293	40.60	2.58	IV	Good
.301	38.52	2.67	IV	
.303	40.07	2.71	III	Hazy
1889.299	39.73	2.65		

Components equal. Relatively fixed.

$\Sigma 1788 = \text{Pi. } 3^h 238. (6.7-7.5).$				
1889.293	73.66	2.57	IV	Very good
.301	73.92	2.61	IV	
.303	74.75	2.48	III	Images diffused
.320	72.87	2.54	IV	Good
1889.304	73.80	2.55		

A binary in slow direct motion of which there are many measures.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
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Σ 1799. (8.0-9.0).

1889.303	293.78	4.15	III	Seeing moderate
.418	294.40	3.87	IV	Good

1889.360	294.09	4.01		
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Evidently unchanged.

Σ 1833 = Pi. 14^b62. (7.0-7.2).

1889.293	168.00	5.17	IV	
.301	168.22	5.48	IV	
.303	168.21	5.20	III	Unsteady

1889.299	168.14	5.28		
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Possibly a very slight increase in angle.

Σ 1846 = η Virginis. (5.0-9.4).

1889.293	110.08	4.48	IV	
.301	109.57	4.23	IV	
.303	110.62	4.66	III	Not very good

1889.299	110.09	4.45		
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Unchanged. My measured distance is probably a little too large.

Σ 1865 = ζ Bootis. (4.0-4.2).

1889.243	290.87	0.48	V	Very close
.293	289.23	0.40	V	Not separated

1889.268	290.05	0.44		
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This star is closing and is now much more difficult than in 1885. It is quite impossible to measure under any but the best atmospheric conditions.

Σ 1928. (8.7-9.5).

1889.659	274.87	6.49	IV	
.665	276.05	6.60	IV	Distance meas. difficult

1889.662	275.46	6.54		
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Unchanged.

Σ 1944. (7.5-8.1).

1889.454	330.87	1.29	III	Measures difficult
.457	328.25	1.33	IV	
.465	331.76	1.28	V	

1889.458	330.29	1.30		
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Probably binary, but the angular change is very slow.

Σ 1957. (7.9-9.7).

1889.481	153.27	1.38	IV	Good
.646	154.00	1.52	IV	

1889.563	153.63	1.45		
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Retrograde motion.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
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Σ 2041. (7.2-10.0).

1889.325	3.38	2.80	IV	Good measure
.386	2.80	2.67	V	

1889.355	3.09	2.73		
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Apparently fixed; this star is synonymous with $O\Sigma$ 308.

Σ 2055 = λ Ophiuchi. (4.5-5.5).

1889.325	45.80	1.56	IV	
.383	44.56	1.49	V	Very good

.386	44.59	1.60	V	
.454	44.89	1.67	IV	
.470	46.62	1.58	III	Unsteady

1889.403	45.29	1.58		
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A binary in direct motion, of which there are many measures.

Σ 2084 = ζ Herculis. (3.0-7.0).

1891.569	64.76	1.46	IV	Well seen
.637	62.10	1.27	IV	

.673	62.81	1.37	IV	Difficult
.703	65.28	1.45	V	

1891.645	63.73	1.38		
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The stars are closing up rather rapidly. The distance measures have always proved difficult; it is best seen in twilight. Measured in 1885: $89^{\circ}36' 17''$ 4n.

Σ 2173 = Ophiuchi 221. (6.0-6.2).

1889.418	342.08	0.60	V	
.457	345.18	0.67	V	
.473	349.67	0.75	IV	Measures difficult
.479	343.08	0.60	...	
.481	345.06	0.70	...	Well seen

1889.461	345.01	0.66		
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Binary in retrograde motion. The stars have opened considerably since 1887 and it is now a comparatively easy object to measure. The angle measures apparently need a correction of 180° .

Σ 2200. (8.0-8.8).

1892.676	166.24	1.74	V	
.709	168.60	1.65	IV	Good seeing

1892.692	147.42	1.69		
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No evidence of change hitherto.

Σ 2201. (8.0-10.3).

1892.676	305.18	7.21	IV	
.728	304.62	7.11	III	Fine definition

1892.702	304.90	7.16		
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Probably unchanged.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$\Sigma 2212. (8.7-8.7).$				
1892.676	159°31	3".06	IV	Images good
.728	159.03	3.28	III	
1892.702	159.17	3.17		

Unchanged. I have always noted the components as »equal«.

$\Sigma 2227. (9.0-9.0).$				
1892.676	115.21	17.66	IV	Stars faint
.711	117.88	18.03	III	Difficult
.728	114.72	18.20	III	
1892.705	115.93	17.96		

There has apparently been a decided decrease in distance since Σ , but little, if any angular change.

$\Sigma 2233. (7.5-10.2).$				
1892.676	68.13	2.15	IV	Good measure
.728	65.66	2.36	IV	Well seen
1892.702	66.89	2.25		

Unchanged. The small star appears to be below 10. mag.

$\Sigma 2240. (9.7-10.5).$				
1892.676	199.16	3.08	IV	Measures difficult
.728	198.76	3.16	IV	Good
1892.702	198.96	3.12		

From the faintness of the components this has always proved a difficult star to measure. There is no sign of change since Σ .

$\Sigma 2272 = 70 \text{ Ophiuchi. } (4.2-6.0).$				
1889.383	344.17	2.08	IV	Definition moderate
.446	346.86	1.98	V	Unsteady
.454	344.00	2.20	V	Good measure
.481	346.00	2.00	V	Well seen
.646	343.48	2.08	IV	
.654	345.40	2.25	IV	
1889.510	344.98	2.09		
1890.602	335.67	2.18	IV	Good
.618	333.77	2.25	V	Well seen
.621	334.28	2.20	V	Diffused
.780	332.87	2.27	V	
1890.655	334.14	2.22		
1891.520	328.33	2.30	V	Good
.528	327.14	2.21	IV	Very good measure
.544	328.01	2.28	IV	
1891.530	327.82	2.26		

Epoch	Pos. Angle	Dist.	Pow.	Remarks
1892.618	320°05	2".27	V	Distance meas. difficult
.621	321.87	2.40	IV	Fine seeing
.632	320.97	2.43	IV	
.646	321.82	2.35	IV	
1892.629	321.17	2.36		

The foregoing measures will shew the rapid angular movement that has taken place in this pair during the last few years. It was first observed in 1886, a measure on one night in that year giving: P. A. 14°78, D. 1".83, and has been systematically measured since, the mean results being given below. Although the stars have passed their least distance and are now steadily separating I have never found it a very easy object, and some of the best measures were made with daylight enough to see the wires. The latest elements indicate a period of about 95 years.

1886.498	14°78	1".83	1 n
87.812	3.49	1.91	4 n
88.552	353.09	1.92	6 n
89.510	344.98	2.09	6 n
90.655	334.14	2.22	4 n
91.530	327.82	2.26	3 n
92.629	321.17	2.36	4 n

$\Sigma 2296. (7.0-10.4).$				
1892.621	9.50	3.01	IV	Good
.646	10.22	3.21	IV	Well seen
.654	11.02	3.17	III	Angle measures difficult
1892.640	10.24	3.13		

On the occasion of the first two measures an apparent elongation of the principal star was noticed, the third night was not so good, and this was not confirmed; although probably atmospheric it will be worth while to reexamine the star this year. There appears to be no change in the Σ companion.

$\Sigma 2316 = 59 \text{ Serpentis. } (5.7-7.7).$				
1889.479	315.21	3.87	IV	Very good
.481	315.51	4.04	IV	
1889.480	315.36	3.95		

Unchanged since Σ .

$\Sigma 2369. (7.5-8.0).$				
1890.780	96.10	1.38	V	Rather unsteady
.785	97.43	1.45	IV	
.799	96.40	1.29	IV	
1890.788	96.64	1.37		

Probably unchanged.

$\Sigma 2426. (7.0-9.0).$				
1892.676	258.50	16.50	IV	
.703	259.10	16.42	III	
1892.689	258.80	16.46		

Epoch	Pos. Angle	Dist.	Pow.	Remarks
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It is singular that Σ should have measured the smaller star in the opposite quadrant, the difference in magnitude being very marked; applying a correction of 180° to the measure it is evident that the stars are relatively fixed.

$$\Sigma 2428 = \text{Pi. } 18^h 263. \quad (8.0-10.0).$$

1892.676	288°16	6'50	IV	Good
.703	286.77	6.54	IV	
1892.689	287.46	6.52		

This pair is relatively fixed.

$$\Sigma 2434 = \text{Pi. } 18^h 274.$$

A and B. (7.5-8.5).

1890.780	128.25	23.05	V	
.785	127.43	23.42	IV	
1890.782	127.84	23.23		

B and C. (8.5-10.0).

1890.780	58.67	1.63	V	Stars faint
.785	57.08	1.48	IV	Well seen
1890.782	57.87	1.55		

The above measures fully confirm the movement shewn by the previous measures in 1888. The close pair is not an easy object at any time.

$$\Sigma 2443. \quad (8.2-8.8).$$

1892.676	314.51	6.43	IV	Good
.681	309.18	5.63	III	Measured distance too small, unsteady
.703	310.54	6.25	IV	Well seen
1892.686	311.41	6.10		

Evidently fixed. My distance may be a little too small.

$$\Sigma 2513. \quad (8.2-9.0).$$

1892.632	319.10	2.27	IV	Fine seeing
.646	318.21	2.16	IV	
1892.639	318.65	2.21		

There may be a slight increase in the angle, but doubtful.

$$\Sigma 2565. \quad (8.8-8.8).$$

1892.635	216.70	5.27	IV	Variable definition
.646	218.66	5.08	III	Good measure
1892.640	217.68	5.17		

The foregoing measures require a correction of 180° to the angle, but there is very little difference in the magnitude of the components; apparently fixed.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
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$$\Sigma 2570 = \text{Pi. } 19^h 257. \quad (7.1-9.3).$$

1892.676	274°89	4'07	IV	
.703	276.69	4.18	IV	
1892.689	275.79	4.12		

I have never seen any trace of the elongation in the principal star, suspected by Dembowski in 1877, but the seeing was not first rate when the measures were made. There is apparently no change in the Σ star.

$$\Sigma 2589 = \text{H}_1 \text{ II.95.} \quad (8.0-8.2).$$

1892.632	298.21	5.00	III	
.635	296.86	4.89	IV	Unsteady
1892.633	297.53	4.94		

Unchanged. Very few measures.

$$\Sigma 2591. \quad (7.7-8.0).$$

1892.635	105.60	28.91	III	
.654	107.38	29.18	III	
1892.644	106.49	29.04		

Relatively fixed. I have not noted the difference of half a magnitude between the components.

$$\Sigma 2597 = \text{Aquilae } 191. \quad (7.0-8.0).$$

1892.635	89.88	1.57	IV	
.646	91.63	1.78	V	
.654	90.14	1.70	IV	
1892.645	90.55	1.68		

Unchanged in angle, the distance a little less than Σ . Nothing seen of the elongation of A suspected by Dembowski in 1864.

$$\Sigma 2602. \quad (8.5-9.0).$$

1892.635	148.28	11.87	IV	Not very steady
.654	146.19	12.24	III	
1892.644	147.23	12.05		

Fixed.

$$\Sigma 2625 = \text{Pi. } 19^h 396. \quad (7.0-10.8).$$

1892.709	12.13	12.60	III	Small star faint
.807	12.77	12.91	III	Not easy
1892.758	12.45	12.75		

The companion is very small, not an easy pair to measure; no evidence of change.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$\Sigma 2644 = \text{Pi. } 20^h 26. (7.0-7.2).$				
1892.635	208°17	3"15	IV	Good
.646	209.46	2.97	IV	A beautiful object
1892.640	208.81	3.06		
Measured in 1888: 209°10 3"31 2 n. No change since Σ .				
$\Sigma 2654. (6.5-7.7).$				
1889.481	232.38	13.82	IV	Good
.654	234.43	14.18	III	Fine seeing
1889.567	233.40	14.00		
A very fine object, unchanged since Σ .				
$\Sigma 2661. (7.5-8.7).$				
1889.481	342.50	24.18	IV	
.646	342.03	24.02	III	
1889.563	342.26	24.10		
Measured in 1888: 342°41 24"42. Evidently fixed.				
$\Sigma 2683. (8.0-8.5).$				
1892.709	66.10	21.79	III	Moderate definition
.807	67.32	22.98	III	Distance meas. difficult
1892.758	66.71	22.38		
Practically unchanged. An insignificant object.				
$\Sigma 2699. (8.0-9.0).$				
1892.709	191.58	9.44	IV	Variable definition
.807	195.73	9.66	III	
.840	195.30	9.59	IV	Good
1892.785	194.20	9.56		
No motion. A pretty little pair.				
$\Sigma 2713. (9.3-9.3).$				
1889.654	243.08	4.97	IV	
.659	244.18	4.73	IV	
1889.656	243.63	4.85		
Unchanged. The components noted on both occasions as »equal«.				
$\Sigma 2729 = 4 \text{ Aquarii. } (6.5-6.5).$				
1890.780	177.47	0.45	V	Very close
.785	179.00	0.53	VI	In contact
1890.782	178.23	0.49		
1892.654	181.06	0.55	V	Measures difficult
.711	187.23	0.43	VI	Not separated
.728	185.13	0.68	VI	Well seen, but distance too large
1892.697	184.47	0.55		

Epoch	Pos. Angle	Dist.	Pow.	Remarks
Binary in slow direct motion, not an easy object to measure even under the best conditions. The measures in 1887 give: 170°49 0"53. 2 n; the latter distance certainly too large.				
$\Sigma 2817. (8.0-8.2).$				
1890.777	156°52	25"50	IV	
.780	155.63	25.88	III	
.785	155.93	25.94	IV	
1890.780	156.02	25.77		
Unchanged, components nearly equal.				
$\Sigma 2825. (8.0-8.5).$				
1890.777	111.02	0.98	IV	
.780	113.25	1.03	V	
.785	113.09	0.87	IV	
1890.780	112.45	0.96		
I measured this star in 1888: 109°55 1"11 3 n. Combining the two sets of measures we have				
1889.760 111°0 1"03,				
although the pair does not look like a merely optical double, there is no satisfactory evidence of change hitherto, and the measures are most discordant.				
$\Sigma 2847. (7.8-8.3).$				
1890.777	306.17	1.18	IV	Diffused, angle uncertain
.780	299.35	1.28	V	Good
.785	302.41	1.22	IV	Good
1890.780	302.64	1.22		
A beautiful little pair, but very stationary. Measured in 1888: 301°47 1"29 4 n.				
$\Sigma 2862. (7.8-8.3).$				
1890.777	102.30	2.27	IV	
.780	100.50	2.21	V	Good measure
1890.778	101.40	2.24		
There may be a very slight diminution in angle, but doubtful.				
$\Sigma 2904. (9.0-9.5).$				
1892.632	309.51	7.75	IV	Not easy
.635	310.17	7.42	IV	Stars very faint
1892.633	309.84	7.58		
Apparently a slight diminution in angle and distance since Σ .				
$\Sigma 2935 = \text{Pi. } 22^h 200. (7.0-8.0).$				
1892.807	312.01	2.56	IV	Well seen
.840	310.77	2.40	IV	Good
.848	314.03	2.63	III	Variable definition
1892.831	312.27	2.53		
Measured in 1887: 312°45 2"63 2 n; unchanged. A fine object				

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$\Sigma 2939 = \text{Pi. } 22^h 20^m. (7.7-11.0).$				
1892.807	59°76	10"76	IV	Good
.840	61.33	10.15	IV	B very small
.848	63.00	10.61	III	Rather diffused at times
1892.831	61.36	10.50		

A very fine pair, measured in 1887: $61^{\circ}27' 11''.04$ 3n. As these were not made under the best conditions it was decided to remeasure it. The two sets do not indicate any change since Σ .

$$\Sigma 2944 = \text{Pi. } 22^h 21^m.$$

A and B. (7.0-7.5).

1890.777	259.61	3.87	IV	Good
.780	259.26	3.75	V	Well seen
1890.778	259.43	3.81		

Angle certainly slowly increasing; probably binary; measured in 1887: $258^{\circ}88' 3''.92$ 2n.

A and C. C = 8.0.

1890.777	135.27	47.57	IV	Good
.780	134.61	48.00	V	Dist. meas. troublesome
1890.778	134.94	47.78		

Decrease in angle probably due to proper motion, my measures in 1887 give: $136^{\circ}10' 47''.12$ 2n.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$\Sigma 2964 = \text{H}_1 \text{ N. } 90. (8.2-9.3).$				
1890.780	279°32	8"77	V	
.785	281.01	9.18	IV	
.799	281.93	9.04	IV	Good measure
1890.788	280.75	8.99		

Unchanged since Σ .

$$\Sigma 2980 = \text{W}_1 23^h 5. (7.5-10.2).$$

1892.807	112.66	4.55	IV	B faint
.840	110.83	4.23	III	Very good
.848	112.00	4.53	IV	Variable definition
1892.831	111.83	4.43		

A pretty pair. Evidently unchanged.

$$\Sigma 2981 = \text{Ll. } 45303. (9.0-9.0).$$

1892.807	114.26	4.01	IV	Both stars very small
.840	115.47	3.52	III	Not easy
1892.823	114.86	3.76		

Components exactly equal. No sign of motion.

$$\Sigma 3044 = \text{Pi. } 23^h 21^m 16. (6.5-7.2).$$

1889.659	281.01	18.47	III	Good
.665	283.22	18.73	III	Rather diffused
1889.662	282.11	18.60		

A fine wide pair. Unchanged.

Pulkova Catalogue.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$O\Sigma 43 = \text{Ll. } 4924. (7.0-8.7).$				
1890.030	53°86	0"97	V	
.060	52.47	1.26	IV	Well separated
.095	48.63	1.03	V	
1890.061	51.65	1.08		

Probably a binary in slow retrograde motion, distance increasing.

$$O\Sigma 64 = \text{Pi. } 3^h 16^m.$$

A and B. (7.0-10.5).

1890.109	238.21	3.38	IV	
.112	241.88	3.05	IV	B very faint
.145	240.20	3.42	IV	Good
1890.122	240.09	3.28		

A and C. C = 10.

1890.109	235.67	10.25	IV	
.112	236.52	10.00	IV	Hazy
.145	236.20	10.52	IV	Measures good
1890.122	236.13	10.25		

There is very little sign of any change in either the close pair or the distant companion, and they are appa-

Epoch	Pos. Angle	Dist.	Pow.	Remarks
rently relatively fixed. The small stars will not bear much illumination.				

$$O\Sigma 79 = 55 \text{ Tauri. } (6.5-8.0).$$

1890.095	89°27	0"45	V	Not separated
.109	86.03	0.57	IV	Well seen
.112	84.42	0.48	VI	Excessively close
1890.105	86.57	0.50		

Binary in direct motion, the distance appears to have diminished and it is a difficult pair.

$$O\Sigma 82 = \text{W}_1 4^h 28^m. (7.3-8.5).$$

1890.095	151.20	0.75	V	Well seen
.101	156.21	0.67	V	Images diffused
.109	152.66	0.70	IV	Good
.112	153.67	0.82	VI	
.115	155.16	0.70	V	Stars ill defined
.145	154.24	0.85	IV	Dist. meas. most difficult
.197	153.27	0.71	VI	Good measure
1890.124	153.77	0.74		

Certain retrograde motion with a decrease of distance. This pair has often appeared nebulous and difficult to focus.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$O\Sigma 95 = \text{Pi. } 4^h 288. (6.5-7.0).$				
1890.115	331°06	0"93	IV	Well separated
.145	333.80	0.87	V	
.191	329.63	0.90	V	Measures certain
1890.150	331.49	0.90		

Slow retrograde motion with an increase in distance. A very fine pair.

$O\Sigma 108. (7.0-11.0).$				
1890.115	131.51	3.37	IV	Well seen
.191	134.17	3.52	V	B rather faint
1890.153	132.84	3.44		

This pair is apparently fixed; the small star is not a very difficult object.

$O\Sigma 114. (8.2-10.0).$				
1890.112	282.58	2.88	IV	Measures difficult
.197	279.26	2.69	IV	B very faint
.205	281.48	2.95	IV	
1890.171	281.10	2.84		

The angular change (if any) in this small pair is very slow, but the measures are not quite satisfactory although probably not far out.

$O\Sigma 115. (7.3-8.3).$				
1890.112	123.21	0.89	IV	Good
.197	125.52	0.78	IV	Images rather diffused
.199	121.68	0.81	V	
1890.169	123.47	0.82		

No sign of change in the last 20 years.

$O\Sigma 116. (7.0-11.7).$				
1890.101	65.23	18.34	III	Hazy, measures difficult
.197	69.70	17.98	IV	B excessively faint
.205	66.19	18.73	IV	Good seeing. B very small
1890.167	67.04	18.35		

This little star constitutes the third component of $\Sigma 785$. It is very minute, and difficult to measure; there is no sign of change in angle or distance.

$O\Sigma 118 = \text{Pi. } 5^h 222. (6.0-8.0).$				
1890.112	318.00	0.85	IV	
.145	316.14	0.96	V	Good
.197	313.16	0.90	IV	Seeing moderate
1890.151	315.17	0.90		

The third star C not measured, no sign of change in the close pair. The measured distance may be a little too large.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$O\Sigma 185. (7.0-7.0).$				
1890.205	—	—	VI	No certain elongation; fine night
.251	—	—	VI	Perhaps elongated; but very doubtful

This pair if double is beyond my aperture, the highest power giving no certain elongation under good conditions.

$O\Sigma 197. (7.7-8.7).$				
1890.199	57°20	1"48	IV	Measures certain
.205	59.43	1.33	VI	Well seen
1890.202	58.31	1.40		

Evidently unchanged.

$O\Sigma 340. (7.5-8.0).$				
1889.659	231.22	31.24	IV	
.665	230.60	31.33	III	
1889.662	230.91	31.28		

There is apparently a very slow diminution in angle in this pair, the distance remaining nearly constant; probably the result of proper motion.

$O\Sigma 349. (7.5-7.5).$				
1889.659	90.00	—	V	If double, very close
.665	96.27	—	V	Oval
.671	93.31	—	VI	Slight elongation
1889.665	93.19	—		

On the above three nights an apparently certain elongation was measured, the stars are however too close for any distance measures. From a comparison of the few previous observations there does not appear to be much change, the distance is certainly not more than 0"4 probably less.

$O\Sigma 387. (7.0-7.5).$				
1889.386	349.05	0.57	IV	Distance meas. difficult
.418	351.28	0.50	V	
.454	354.30	0.65	VI	Good measure
.457	349.81	0.55	V	
.473	353.27	0.58	IV	Seeing moderate
.481	353.86	0.63	V	
1889.444	351.92	0.58		
1891.569	348.76	0.52	V	Fine definition
.673	351.07	0.60	V	
.695	349.81	0.50	IV	
1891.645	349.88	0.54		

Binary in retrograde motion, the angular change is not very rapid, not much alteration in distance since 1886 when it was measured: 0"89 0"45 1886.516 4n. In good air it is not a very difficult pair.

Burnham's Lists.

The following pairs from the Catalogues of Mr. S. W. Burnham are arranged in order of Right Ascension.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$\beta 513 = 48 \text{ Cassiopeiae. (5.0-7.5).}$				
1889.293	292.88	0.60	IV	Very difficult
.303	296.18	0.79	V	Separated?
1889.298	294.53	0.69		
1890.205	303.87	0.60	V	
.251	298.23	0.54	V	Very close
1890.228	301.05	0.57		

This pair has closed up very much since the last measures with this telescope in 1886 and there has been very considerable angular change; it is now a most difficult object under the best conditions and will soon be non-measurable.

$\beta 525 = \text{BAC. } 920. (7.0-7.0).$				
1890.030	110.21	0.4 est.	V	Dist. meas. impossible
.060	118.17	-0.4	VI	Not separated
.095	115.50	oval	VI	Elongation certain
1890.061	114.62	—		

Certainly binary, and now exceedingly close with a decided increase in angle. As the above measures were made under very good conditions, they are probably better than those made in 1888. The pair is evidently closing and will soon be beyond my aperture.

$\beta 535 = \alpha 38 \text{ Persei. (4.0-8.5).}$				
1890.095	57.08	0.97	VI	Difficult
.106	56.43	1.07	V	Well seen
.109	54.88	1.00	V	Measures good
1890.103	56.13	1.01		

A fine but very difficult pair from the inequality of the components, and requiring first class weather. There has been little or no change since its discovery in 1877.

$\beta 881 = 46 \text{ Eridani. (6.0-10.5).}$				
1891.898	54.21	1.48	IV	B very small
.922	50.26	1.60	V	Well seen
.941	53.49	1.45	IV	Good
.963	52.60	1.57	IV	Measures difficult
1891.931	52.64	1.52		

This pair like the preceding belongs to a class especially difficult to measure with a reflector. All the above measures except the last were made under very good conditions. Compared with the 1888 measures $53^{\circ}03' 17''60$ there is evident slow retrograde motion.

$\beta 1049. (8.5-9.5).$				
1890.199	300.53	0.80	V	Certainly double
.205	294.86	0.67	V	Close and difficult
1890.202	297.69	0.73		

Epoch	Pos. Angle	Dist.	Pow.	Remarks
This is the double companion of $\Sigma 734$ (see p. 275). But for the close proximity of the principal star I do not think it is a very difficult object. It closely resembles Bird's little pair near Procyon.				
$\beta 92 = W_2 5^h 1309. (9.3-11.5).$				
1890.112	175.53	8.67	IV	Stars faint
.145	171.48	8.38	IV	Dist. meas. most difficult
.197	168.21	8.73	IV	Well seen
1890.151	171.74	8.59		
1892.131	172.16	9.28	V	Not easy
.191	168.45	8.97	V	Good
1892.161	170.30	9.12		

The measured distance in the first set of measures is certainly too small; there has been little, if any, change since its discovery. The small star is very faint and proportionately difficult to measure.

$\beta 407 = W_1 8^h 1159. (7.8-10.3).$				
1890.199	163.68	6.18	IV	
.205	159.21	5.85	III	Definition moderate
1890.202	161.44	6.01		

Rather an insignificant pair. The measures do not indicate any decided change since its discovery.

$\beta 24 = \text{Ll. } 17586. (8.0-9.0).$				
1890.199	169.08	1.21	IV	Well seen
.205	172.34	1.30	V	
.251	170.21	1.19	V	Very good measure
1890.218	170.54	1.23		

Unchanged. A pretty little object.

$\beta 211 = \text{Hydrae } 68. (7.5-10.0).$				
1890.199	264.27	1.18	IV	Measures moderate
.205	260.82	1.07	V	Fairly good
1890.202	262.54	1.12		

The various measures appear to indicate a slow increase in the angle, the distance remaining very constant. It is a difficult pair requiring good weather.

$\beta 212 = \text{Hydrae } 95. (7.5-8.3).$				
1890.191	230.10	1.37	IV	Good
.197	225.47	1.20	V	
.205	226.65	1.46	V	Definition fair
1890.197	227.40	1.34		

Very little sign of change; an easy pair to measure.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$\beta 25 = W_1 10^b 242. (8.3-9.3).$				
1890.199	178°31	1780	V	Rather diffused
.205	176.23	1.71	V	
.251	174.88	1.87	IV	Seeing moderate

1890.218	176.47	1.79		
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Very similar to the last, the larger distance being balanced by the smaller magnitude of the components. Easy enough in clear weather and apparently unchanged.

$\beta 220 = \text{Crateris } 22. (6.5-7.0).$				
1890.205	138.27	0.63	V	Seeing fair
.251	135.73	0.75	IV	
.258	137.05	0.58	IV	Very good
1890.238	137.01	0.65		

A very fine close pair, not very difficult but for its s. declination; the measures shew a certain decrease in the angle. Probably binary.

$\beta 26 = \text{Ll. } 21697. (7.0-10.5).$				
1890.205	72.13	3.06	IV	B very faint
.251	69.89	2.79	V	Measures good
1890.228	71.01	2.92		

The small star is faint and does not bear illumination well. Evidently unchanged.

$\beta 28 = \text{BAC. } 4213. (6.3-10.7).$				
1889.320	355.67	2.15	IV	Most difficult
.323	357.01	2.45	III	B very small
.325	358.33	2.09	IV	Dist. meas. uncertain
1889.322	357.00	2.23		
1892.331	11.14	2.24	IV	Well seen
.336	8.63	2.03	V	
.342	6.43	2.51	IV	Unsteady
.353	10.03	2.13	V	Good
1892.340	9.05	2.22		

A most difficult pair from its s. declination and the inequality of the components, the second series of measures being made from a greater altitude and under good conditions are certainly the better, they indicate a marked increase in the position angle. When well seen it is a beautiful object.

$\beta 929. (6.2-6.2).$				
1889.293	215.10	0.66	V	
.301	216.38	0.70	IV	Well separated
.303	217.78	0.54	IV	
.383	220.08	0.72	VI	
.388	216.47	0.68	V	Measures certain
1889.333	217.16	0.66		

Angle certainly decreasing slowly. A splendid pair. Measured in 1888: 219°08 0"54 1888.253 5 n.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
$\beta 223 = \text{Ll. } 25350. (7.8-11.3).$				
1889.323	345°50	18775	III	Difficult
.418	343.88	18.37	V	B exceedingly faint
1889.370	344.69	18.56		

An insignificant pair; apparently unchanged.

$\beta 106 = \mu \text{ Librae. } (5.5-6.5).$				
1889.454	339.46	1.71	V	Good
.479	339.86	1.98	V	Measures certain
1889.466	339.66	1.84		

The above, compared with the measures made with this instrument in 1886 (337°25 1"52 1886.393 4 n) indicate a slow increase in the angle.

$\beta 36 = 2 \text{ Scorpii. } (5.5-10.2).$				
1889.473	277.37	2.91	IV	Difficult
.479	275.20	2.78	IV	Not very well seen
1889.476	276.28	2.84		

A fine pair but very low in this latitude; not much evidence of change.

$\beta 39 = 11 \text{ Scorpii. } (6.0-10.5).$				
1889.418	257.21	3.20	IV	Small star steadily seen
.473	258.21	3.30	V	B faint
1889.445	257.71	3.25		

Very similar to the last, and, like it, more an atmospheric test than anything else; the measures do not indicate any change. B is much fainter than the smaller component of the preceding pair.

$\beta 132 = \text{BAC. } 6158. (6.7-7.0).$				
1892.635	228.00	1.03	V	Good
.654	229.37	0.97	IV	Good
1892.644	228.68	1.00		

A very considerable decrease in angle, accompanied by an increase in distance; it is now an easy pair enough, almost certainly binary.

$\beta 133 = \text{BAC. } 6261. (7.5-7.5).$				
1892.635	265.21	1.76	V	Fine seeing
.654	263.61	1.82	IV	Good
1892.644	264.41	1.79		

A pretty pair, very stationary, easy of measurement; the stars being equal in magnitude.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
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β 648 = BAC. 6480. (6.0-9.5).

1891.569	252.98	1.08	V	Well seen
.637	246.18	1.26	IV	
.695	249.81	0.97	V	Measures good

1891.633	249.65	1.10		
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A splendid double star, and a binary in rapid retrograde motion. When discovered in 1878 the measures gave $312^{\circ}55$ $0^{\circ}60$ 2 n. In good air it is now not more difficult than β 130 (90 Herculis) which it closely resembles.

β 267. (9.8-10.0).

1892.654	243.27	1.99	IV	Components very faint
.728	239.95	2.10	IV	Measures difficult

1892.691	241.61	2.04		
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A difficult little object the components being faint. No sign of change hitherto.

β 368 = Aquarii 45. (7.5-7.5).

1892.635	91.75	0.65	V	Distance meas. difficult
.676	93.48	0.60	VI	
.728	91.08	0.55	V	Good

1892.679	92.10	0.60		
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A fine close pair; the previous measures are not very accordant, but on the whole indicate slow retrograde motion, without much change in distance.

β 164. (8.0-8.5).

1891.695	238.27	0.52	V	
.747	242.18	0.68	IV	Air variable
.851	239.91	0.50	IV	Good
.865	239.74	0.60	VI	

1891.789	240.02	0.57		
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More difficult than the preceding, the components being fainter; evidently unchanged.

β 72 = W₁ 21^h51. (9.0-11.5).

1890.774	44.27	2.00	IV	Difficult
.777	44.03	1.88	V	B faint

1890.775	44.15	1.94		
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The little star is very small, and requires very good conditions for its measurement. There does not appear to be much change.

β 165 = Ll. 41954. (8.7-11.0).

1890.774	174.83	4.58	IV	Not easy
.777	173.78	4.27	V	Stars faint

1890.775	174.30	4.42		
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Another faint pair, probably unchanged.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
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β 172 = 51 Aquarii. (6.5-6.5).

1890.774	16.03	0.60	V	Definition moderate
.777	14.88	0.73	IV	Images rather diffused
.780	17.68	0.68	IV	

1890.777	16.19	0.67		
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1892.654	14.06	0.75	V	Good
.728	11.27	0.60	VI	
.761	13.50	0.70	V	First class night

1892.714	12.94	0.68		
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The second set of measures were made under very good conditions, and are decidedly better than those of 1888 and 1890; they indicate a slow diminution in the angle; almost certainly binary.

β 76 = Ll. 43906. (8.0-10.0).

1890.774	332.27	1.38	IV	Unsteady
.777	336.50	1.45	IV	Stars faint

1890.775	334.38	1.41		
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1892.635	332.79	1.38	IV	Very good
.676	334.43	1.50	IV	

1892.655	333.61	1.44		
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This pair was re-measured in consequence of the conditions being unfavourable in 1890. The measures do not indicate change.

β 77. (9.5-10.3).

1890.774	209.45	2.89	IV	Unsteady
.777	210.87	3.05	IV	Difficult measures
.780	214.21	2.70	IV	

1890.777	211.51	2.88		
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1892.632	209.07	2.62	IV	Stars rather faint
.635	210.18	2.88	V	Well seen

1892.633	209.62	2.75		
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Perhaps a little diminution in angle, but very doubtful.

β 178 = Aquarii 252. (6.0-8.0).

1890.774	320.18	0.75	V	Definition moderate
.780	322.73	0.85	IV	Separated?

1890.777	321.30	0.80		
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A very fine pair; the motion if any is retrograde.

β 181 = Aquarii 286. (7.0-10.5).

1892.632	309.48	1.62	IV	Well seen
.703	307.61	1.57	V	
.728	309.18	1.70	IV	Measures good

1892.687	308.79	1.63		
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Apparently unchanged, a difficult pair, being so far south.

$$\beta 182 = W_1 23^h 175. (8.5-8.5).$$

Epoch	Pos. Angle	Dist.	Pow.	Remarks
1892.632	47°68	0".82	V	Good
.635	43.25	0.76	IV	
.654	49.28	0.65	VI	
.728	48.35	0.70	V	Well seen
1892.662	47.14	0.73		

Difficult like the preceding, from south declination; there is apparently a slow direct motion in angle, distance unchanged. The components have always appeared exactly equal.

Miscellaneous.

The following pairs, not included in any of the foregoing catalogues are also arranged in order of Right Ascension; many of them are very interesting objects.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
Bradley 757 (Peters). (6.5-6.5).				
1889.005	351°09	1".75	V	Good
.101	349.50	1.58	IV	Distance too small?
.167	346.20	1.71	V	
1889.091	348.93	1.68		

An easy pair, the components almost exactly equal. There are not many measures, but there is little sign of change in the last 20 years. This star is BAC. 1678.

Dawes 6 = $W_1 5^h 520. (7.0-7.0).$				
1890.191	91.06	0.80	V	Well seen
.197	88.29	0.91	V	Not difficult
1890.194	89.67	0.85		

A close equal pair, not difficult, and apparently unchanged.

Anonyma. (10.0-11.7).				
1890.101	251.52	6.27	III	Measures most difficult
.197	249.27	7.51	IV	Stars very faint
1890.149	250.39	6.89		

A pair of small stars found while measuring the faint $O\Sigma$ companion to $\Sigma 785$. It is north of, and in a moderately high power field with that triple. The measures are only single settings and may be to some extent in error; but the object does not appear to have been noted before.

South 503 = $W_1 5^h 1202-6-7.$				
A and B. (7.0-8.2).				
1890.115	359.08	3.80	IV	Good
.131	3.27	3.68	IV	
.145	1.03	3.75	III	Very good
.205	359.87	3.51	V	Definition variable
1890.149	0.81	3.68		
A and C. C = 11.5.				
1890.115	165.43	20.01	IV	Good measure
.131	164.30	19.75	IV	
.145	163.17	19.96	III	Well seen
1890.130	164.30	19.90		

Epoch	Pos. Angle	Dist.	Pow.	Remarks
The distance of AB is steadily increasing, my measures in 1888 giving: $19^\circ 74 \ 3' 29 \ 1888.174 \ 3n$. C is difficult to measure except under very good conditions.				
Canis minoris (Bird). (9.0-9.0).				
1890.205	191°08	0".79	IV	Well seen
.251	194.47	0.88	IV	Stars rather faint
.258	193.33	0.75	IV	Very good
1890.238	192.96	0.80		

A comparison of the few measures that have been made of this close pair, since its discovery in 1864, shews a slow increase in the angle, accompanied perhaps by a very slight decrease in distance. If binary the period must be very long. From the faintness of the components it is never an easy object with this aperture.

8 Sextantis = Alvan Clark 5. (5.0-6.0).				
1889.243	124.23	0.45	VI	Not separated
.293	122.35	0.50	VI	Measures good
1889.268	123.29	0.47		

An interesting binary, in retrograde motion, measured in 1888: $136^\circ 75 \ 0' 45 \ 1888.262 \ 4n$. It is certainly wider than then but still very difficult.

46 Virginis = Alvan G. Clark 5. (5.0-8.5).				
1889.320	148.59	1.27	V	Well seen
.325	149.91	1.18	IV	Measures certain
.418	155.17	1.35	V	
1889.354	151.22	1.26		

A very fine double star, but one of a class especially difficult to measure with a reflector, resembling in this respect $\beta 547$. The measures indicate little or no change.

54 Virginis = H. 412. (6.3-7.0).				
1889.301	34.09	5.21	IV	Good
.303	35.00	5.25	IV	
1889.302	34.54	5.23		

Unchanged, a fine pair of its class.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
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σ Scorpii = H. 505. (4.0-9.4).

1889.418	272.01	21.06	III	Air variable
.457	271.54	20.65	IV	Moderate seeing

1889.437	271.77	20.85		
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A wide unequal pair of which there do not appear to be many measures, evidently fixed; the measured distance above may be a little too large.

ρ Ophiuchi = H. 512. (4.0-7.5).

1889.418	355.06	3.00	IV	Fair seeing at times
.454	357.60	3.32	IV	Good

1889.436	356.33	3.16		
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The angle certainly is diminishing but the motion is very slow.

α Scorpii (Antares) = Mitchell. (1.0-7.5).

1891.501	270.40	2.90	III	Small star very green
.520	273.10	2.81	IV	Measures difficult
.528	274.18	3.26	IV	Very fine
.544	269.77	3.03	III	Rather unsteady

1891.523	271.86	3.00		
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This is evidently an atmospheric test, under good conditions the small star is easy enough; not much sign of change; when well seen the contrasted colours are very fine.

μ^2 Herculis = Alvan Clark 7. (9.0-10.0).

1888.361	328.84	0.5 est.	V	
.380	331.47	elong.	VI	Dist. meas. impossible
.657	331.95	0.4 est.	VI	

1888.466	330.75	—		
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Very rapid direct motion; on the above occasions there was no doubt of the star's duplicity, but the faintness of the components and their great closeness rendered distance measures of any value quite impossible, and they were therefore not attempted.

21 Sagittarii = Alvan Clark 10. (5.0-8.0).

1890.618	293.17	1.89	V	Well seen
.621	294.27	1.68	IV	Measures good

1890.619	293.72	1.78		
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Several pairs of which only one night's measures were secured in the different years, have been carried over for re-measurement, and will be included in the observations of the present year.

Bushey Heath, Herts., 1893 April.

Kenneth J. Tarrant.

Berichtigung. In Nr. 3185 p. 274 Z. 8 v. o. statt: simple arrangement lies: simple form of two way switch.

Ktz.

Epoch	Pos. Angle	Dist.	Pow.	Remarks
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A beautiful pair and, except for south declination, not difficult; little angular change but the distance may have diminished slightly. This pair is synonymous with Jacob 201.

Alvan Clark 11 = Ll. 33959. (7.0-7.0).

1889.479	176.23	0.45	VI	Not separated
.481	181.49	0.38	VI	Dist. meas. very difficult

1889.480	178.86	0.41		
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A very close pair of which there are not many measures. Although having every appearance of a physical pair, the evidence of change is very unsatisfactory. I have never fairly separated the components.

Dembowski 21. (7.2-9.0).

1889.481	69.75	1.38	V	Measures easy
.654	67.89	1.29	IV	Well seen

1889.567	68.82	1.33		
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This constitutes the close companion to Σ 2535 discovered in 1865; hitherto there has been no sign of change.

Alvan Clark 12 = W_1 19^h 1273. (7.0-8.0).

1889.479	320.19	0.95	IV	Well seen
.481	320.47	0.98	V	
.646	321.19	1.10	V	Good measure
.654	322.00	0.99	IV	

1889.565	320.96	1.01		
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There has probably been some decrease in angle, but the previous measures are curiously discordant, considering that the pair is not very close.

H. 720. Capricorni. (8.0-8.0).

1890.774	139.61	3.17	IV	Well seen
.777	141.17	3.22	IV	Not easy

1890.775	140.39	3.19		
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A fine easy pair, apparently fixed.