

ASTRONOMISCHE NACHRICHTEN.

N^o 2929-30.

Double Star Observations

made with the 36 inch refractor of the Lick Observatory by *S. W. Burnham*.

The double star observations which follow comprise that work with the 36 inch Clark refractor since the publication of my last list (A. N. 2875), and were principally made during the first four months of the present year. A few measures with the 12 inch telescope, which were omitted in the first series, are included in this list; but substantially all the measures have been made with the large refractor, as indicated in the last column of the Catalogue following.

The micrometer for the large telescope was made by Fauth, but after the Clark plan in all essential particulars; and, after some minor changes, was made to work most satisfactorily. The bright-wire illumination is very perfect; and no star or nebula which can be seen at all is too faint for measurement. The light is under perfect control, and can be instantly changed from the maximum brilliancy of the wires to invisibility. Either a part or all of the light, depending upon the object under observation, is passed through red glass before reaching the wires. The illustration and description of the Clark micrometer for the

12 inch refractor, with the device for a self-adjusting illuminating lamp, given in Monthly Notices for March, 1882, will apply equally well to the large micrometer.

The micrometer eye-pieces give powers (approximately) of 450, 670, 1000, 1350, 2000, 2700 and 3300. For very close pairs the last three were generally used when the air was sufficiently steady. In measuring very unequal pairs, with distances of 1".5 and upwards, the two lower powers have been usually employed. It did not seem worth while to indicate the particular power used in each of the measures.

The current double star number continued from my previous catalogues was inadvertently omitted from the list of new pairs in A. N. 2875. For convenience of reference hereafter, I have attached these numbers to the stars of that list, and carried them forward through the present Catalogue.

The several new pairs of the first list, and the mean results of the measures, are as follows:

β	Star	RA. 1880	Decl. 1880	Pos.	Dist.	Mags.	1880+	<i>n</i>	Remarks
1026	Lal. 58	0 ^h 5 ^m 48 ^s	+52° 57'	329.6	0".48	8.1 8.9	8.76	4	
1027	W ₂ 0 ^h 200	0 8 44	+20 50	186.8	1.54	7.2 10.3	8.82	3	
1028	γ Cassiopeiae	0 48 50	+60 1	255.9	2.18	— 11	8.69	6	
1029	ζ Piscium	1 7 27	+6 56	248.7	0.93	— 11	8.71	5	B and C
				63.5	23.72	—	8.71	5	A and B
1030	W ₂ 3 ^h 5	3 3 11	+21 17	164.6	0.58	8.4 8.4	8.83	3	
1031	Aldebaran	4 29 2	+16 16	281.1	2.34	9 12	8.81	3	C and D
				109.5	30.90	—	8.82	2	A and B
				34.9	116.91	—	8.81	3	A and C
1032	σ Orionis	5 32 43	— 2 40	357.0	0.26	4 6	8.81	4	A and B
				237.1	11.23	—	8.84	3	AB and C
				83.3	12.84	—	8.84	3	AB and D
				60.5	41.18	—	8.85	1	AB and E
1033	ν^2 Sagittarii	18 47 51	—22 49	104.0	1.37	5.5 11	8.68	1	
1034	γ Aquarii	20 50 25	—10 9	165.0	2.09	6 11.7	8.68	5	
1035	B. A. C. 7422	21 17 16	—26 4	198.7	1.05	8 10.7	8.74	3	
1036	Yarnall 9529	21 40 59	—17 51	205.9	4.53	8 11	8.74	3	
1037	W ₁ 22 ^h 854	22 41 56	+12 22	224.4	0.66	8.7 10.8	8.81	3	
1038	DM. +41° 4881	23 45 31	+41 25	157.6	0.60	8.3 8.3	8.73	3	

In looking for new pairs, I have for the most part examined only naked eye-stars; hence, the large proportion of bright stars. Comparatively little time has been given to the discovery of new objects; in fact, I have purposely

avoided finding them any faster than they could be thoroughly measured, and have rejected many new pairs among the smaller stars which incidentally came into the field. As far as possible, at least three measures have been

made of each pair, new and otherwise. The present work comprises about 400 measures of both classes of stars. This, under the circumstances, is perhaps as much as could be expected, taking into account the season, which here is the most unfavorable part of the year; that many

clear nights are unsuitable for this kind of work; that one evening each week the telescope is at the service of visitors, and during a portion of the time is in use for other astronomical work; and the further fact that much time is required to handle and set so large a telescope.

New Double Stars

discovered with the 36 inch refractor of the Lick Observatory.

β 1039. Lal. 6084.

RA. $3^h 10^m 59^s$ Decl. $+7^\circ 13'$.

1888.911	211.8	1.48	7, 13	36
8.914	208.2	1.97	7, 13	36
9.093	208.3	2.17	7, 13	36
1889.00	209.4	1.87	7, 13	

β 1040. Lal. 6591.

RA. $3^h 28^m 48^s$ Decl. $+29^\circ 37'$.

1888.906	338.1	3.38	8, 12	36
.911	337.0	3.76	8, 11.5	36
.928	335.8	3.47	8, 11.5	36
1888.91	337.0	3.54	8, 11.7	

The magnitude in DM. is 7.4.

β 1041. W_2 3^h 793, 798.

RA. $3^h 37^m 0^s$ Decl. $+27^\circ 26'$.

A and B.

1888.906	39.9	123.49	7, 7	36
.911	39.8	123.68	—, —	36
.928	39.9	123.54	7, 7	36
1888.91	39.9	123.57	7, 7	

B and C.

1888.906	349.4	7.76	—, 13	36
.911	346.0	7.86	—, 12.5	36
.928	348.0	7.99	—, 13	36
1888.91	347.8	7.87	—, 12.8	

The wide pair is $O\Sigma$ (App.) 38. I know of only the following measures:

1874.22 38.2 122.50 Δ 3 n 6.2, 6.3.

β 1042. Lal. 2372.

RA. $3^h 52^m 36^s$ Decl. $-3^\circ 0'$.

A and B.

1888.911	94.0	55.04	7.5, —	36
.914	93.6	—	—, —	36
.922	93.9	54.75	—, —	36
.928	93.7	55.01	7.5, —	36
1888.92	93.8	54.93	7.5, —	

B and C.

1888.911	39.3	1.17	9, 10	36
.914	32.5	1.12	—, —	36
.922	34.6	1.04	8.7, 9.5	36
.928	34.0	1.03	8.5, 9.0	36
1888.92	35.1	1.09	8.7, 9.5	

β 1043. 3 Camelopardali.

RA. $4^h 30^m 28^s$ Decl. $+52^\circ 50'$.

1888.922	297.0	4.06	5, 11	36
.925	296.4	3.79	—, 12	36
.928	298.5	3.92	—, 12	36
1888.92	297.3	3.92	—, 12	

β 1044. DM. $+16^\circ 637$.

RA. $4^h 33^m 0^s$ Decl. $+16^\circ 16'$.

This faint and rather difficult pair was found with 12 inch. It is $3^m 58^s$ following Aldebaran.

1888.900	217.3	1.13	9, 11	36
.906	220.1	1.01	9, 11	36
.911	218.1	0.94	9, 11	36
1888.91	218.5	1.03	9, 11	

β 1045. 99 Tauri.

RA. $4^h 50^m 32^s$ Decl. $+23^\circ 46'$.

1889.091	6.1	6.28	6, 12.5	36
.093	6.5	6.26	6, 12	36
.099	5.9	6.37	6, 12.5	36
1889.09	6.2	6.30	6, 12.3	

β 1046. 9 Aurigae.

RA. $4^h 56^m 59^s$ Decl. $+51^\circ 26'$.

A and B.

1888.922	94.7	6.21	5.5, 13	36
.925	93.5	6.39	—, 13	36
.928	93.2	6.27	—, 12	36
1888.92	93.8	6.29	5.5, 12.7	

A and C ($= H_1 VI 35$).

1888.922	60.8	89.91	—, 9	
.928	60.9	89.94	—, 9	
1888.92	60.8	89.92	—, 9	

The wide pair has not been measured before since it was entered by Herschel more than a century ago. His measures are:

1783.30 62.2 79.50.

β 1047. Aurigae 47.

RA. $5^h 2^m 13^s$ Decl. $+27^\circ 53'$.

The smaller component of this pair is a close and difficult double, and might be easily overlooked by instruments of moderate aperture.

B and C.

1889.091	76°3	0°37	9 , 9.3	36
.093	74.5	0.40	8.7 , 9.5	36
.104	75.2	0.54	8.5 , 8.8	36
1889.09	75.3	0.44	8.7 , 9.2	

A and BC ($= \Sigma 645$).

1889.091	26.8	11.60	7.5 , —	36
.093	26.2	11.79	7.0 , —	36
.104	26.7	11.68	7.0 , —	36
1889.09	26.6	11.69	7.2 , —	

The wide pair was first observed by Herschel. There does not seem to be any change in angle or distance.

1783.74 26°0 13'60 H₁
1829.90 26.8 11.71 Σ .

Herschel's distance is probably too large.

 β 1048. Lal. 10437.

RA. 5^h 26^m 37^s Decl. —1° 41'.

1889.128	359.0	2.29	6 , 10.5	36
.131	357.3	2.14	6.5 , 11	36
.134	358.4	2.18	— , —	36
1889.13	358.2	2.20	6.2 , 10.7	

In Heis 6^m, and U.A. 6¹/₂.

 β 1049. Σ 734.

RA. 5^h 27^m 3^s Decl. —1° 48'.

C and D (new).

1888.906	295.2	0.83	9 , 10	36
.911	298.5	0.78	— , —	36
.914	296.6	0.69	8.5 , 9	36
.928	294.3	0.74	8.5 , 9	36
1888.91	296.1	0.76	8.7 , 9.7	

A and B (Σ 734).

1888.906	355.0	1.68	— , —	36
.911	352.6	1.59	— , —	36
.914	357.3	1.66	— , —	36
.928	355.9	1.53	7 , 8	36
1888.91	355.2	1.61	7 , 8	

A and C (H₁ V. 119).

1888.906	242.8	29.53	— , —	36
.911	242.5	29.45	— , —	36
.928	243.1	29.28	— , —	36
1888.91	242.8	29.42	— , —	

The old stars seem to be relatively fixed. Some of the prior measures are:

1832.93	356°4	1°78	A and B	Σ
1878.99	354.9	1.75		β
1783.76	248.4	30.20	A and C	H ₁
1832.48	243.1	29.29		Σ
1879.02	242.9	29.47		β .

 β 1050. Bond 974.

RA. 5^h 30^m 55^s Decl. —5° 33'.

1888.928	283°0	0°64	— , —	36
9.077	284.4	0.62	10.5 , 12	36
9.091	283.5	0.75	10.5 , 11.5	36
1889.03	283.6	0.67	10.5 , 11.7	

A difficult pair of small stars in the nebula of Orion.

 β 1051. Bond 1096.

RA. 5^h 32^m 1^s Decl. —4° 57'.

1889.077	22.6	0.82	10 , 10.7	36
.091	25.3	0.73	9.8 , 10.5	36
.093	26.2	0.71	10.5 , 10.8	36
1889.09	24.7	0.75	10.1 , 10.7	

Another difficult pair in the nebula of Orion. It is Nr. 1096 of Bond's Catalogue. A star 7¹/₂^m p 22⁵/₄, and 2' 34" n.

 β 1052. Lal. 10776.

RA. 5^h 35^m 39^s Decl. —2° 57'.

1889.134	192.0	0.62	7 , 8	36
.137	189.4	0.59	7 , 8	36
.142	185.8	0.77	6 ¹ / ₂ , 7 ¹ / ₂	36
1889.14	189.1	0.66	7.2 , 8.2	

In U.A. 6.7^m.

 β 1053. Aurigae 146.

RA. 5^h 45^m 18^s Decl. +37° 19'

1889.922	283.2	0.43	7.5 , 9.5	36
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 β 1054. 136 Tauri.

RA. 5^h 45^m 47^s Decl. +27° 35'.

1889.060	234.1	14.78	5-6 , 11	36
.091	231.3	15.21	6 , 12	36
.099	231.2	15.02	6 , 12	36
1889.08	232.2	15.00	6 , 12	

 β 1055. Aurigae 161 = B.A.C. 1899.

RA. 5^h 51^m 32^s Decl. +44° 35'.

A and B.

1888.922	332.9	1.49	6.5 , —	36
.925	328.4	1.46	7 , 11	36
.928	337.3	1.88	— , 12	36
1888.92	332.9	1.61	6.7 , 11.5	

A and C ($=$ H₁ V. 91).

1888.922	327.0	33.36	— , —	36
.925	330.3	33.45	— , 9	36
.928	331.7	33.25	— , 9.5	36
1888.92	329.7	33.35	— , 9.2	

Like many others of this class, this pair has been wholly neglected since it was observed by Herschel more than one hundred years ago. The change, if any, is probably due to proper motion. Herschel gives:

1783.49 315°1 30°05 H₁ 1 n.

1*

β 1056. μ Orionis.RA. $5^h 55^m 47^s$ Decl. $+9^\circ 39'$.

1889.104	271.6	16.78	4, 14	36
.110	273.9	16.73	—, 14	36
.115	272.0	16.89	—, 13	36
1889.11	272.0	16.80	—, 14	

 β 1057. Aurigae 183.RA. $5^h 58^m 42^s$ Decl. $+29^\circ 32'$.

1889.091	209.5	10.06	6.3, 11.5	36
.099	209.8	9.89	6.3, 11.0	36
.104	209.0	10.00	6.3, 11.0	36
1889.10	209.5	9.98	6.3, 11.2	

 β 1058. 4 Geminorum.RA. $6^h 3^m 13^s$ Decl. $+23^\circ 1'$.

1889.102	107.4	0.49	7.8, 7.8	36
.154	101.3	0.33	6.7, 7.2	36
1889.13	104.3	0.41	7.2, 7.5	

An occultation of this star by Jupiter, Nov. 7, 1882, was observed by Wilson at the Cincinnati Observatory, and singularly no gradual diminution of light was noticed. In a pair of this kind, with the present angle and distance, the change should have been apparent.

 β 1059. μ Geminorum.RA. $6^h 15^m 42^s$ Decl. $+22^\circ 34'$.

A distant double companion. There are many faint stars less distant from the bright star.

B and C.

1889.091	265.6	0.80	10, 10.7	36
.099	266.7	0.78	9, 10	36
.104	267.9	0.81	10.5, 11.5	36
1889.10	266.7	0.80	9.8, 10.7	

A and BC.

1889.091	141.1	122.68	3, —	36
.099	141.0	122.34	—, —	36
.104	141.0	122.46	3, —	36
1889.10	141.0	122.49	3, —	

 β 1060. Lal. 13491.RA. $6^h 52^m 38^s$ Decl. $+3^\circ 46'$.

1889.154	56.5	3.17	7, 12	36
.157	60.2	2.86	7, 12	36
1889.15	58.3	3.01	7, 12	

Large star reddish.

 β 1061. α Argus.RA. $7^h 33^m 55^s$ Decl. $-26^\circ 32'$.A and B ($= H_1$ III.27).

1889.110	318.8	10.02	4, 4	36
.115	317.6	10.10	4, 4	36
.131	319.0	9.83	4.5, 4.5	36
1889.12	318.5	9.98	4.1, 4.1	

B and C.

1889.110	229.8	6.53	—, 13	36
.115	227.3	6.24	—, 14	36
.131	230.7	6.62	—, 14.5	36
1889.12	229.3	6.46	—, 13.8	

The new star is rather difficult under ordinary conditions in this latitude. Change in the bright pair is uncertain.

 β 1062. 82 Geminorum.RA. $7^h 41^m 23^s$ Decl. $+23^\circ 26'$.

1889.102	32.8	4.19	6, 13	36
.104	34.4	3.92	—, —	36
.107	29.6	4.08	6, 14	36
1889.10	32.3	4.06	6, 13.5	

 β 1063. ξ Argus.RA. $7^h 44^m 15^s$ Decl. $-24^\circ 34'$.

1889.110	189.7	4.65	4, 13	36
.114	186.8	4.56	3 $\frac{1}{2}$, 14	36
.131	189.5	4.69	—, 14.5	36
1889.12	188.7	4.63	—, 13.8	

Very faint star at this altitude.

 β 1064. 19 Argus.RA. $8^h 5^m 39^s$ Decl. $-12^\circ 34'$.

A and B.

1889.049	245.7	1.72	6, 12	36
.077	242.7	1.70	6, 12	36
.091	245.7	2.14	6, 13	36
.093	245.6	1.80	6, 13	36
1889.08	244.9	1.84	6, 12.5	

A and C ($= H_1$ IV.26).

1889.060	255.7	70.96	6, 9	36
.077	255.7	70.29	—, 9	36
.091	255.9	70.78	—, 9	36
1889.08	255.8	70.68	—, 9	

Herschel did not measure the wide pair, but it was observed later, and appears as No. 91 of South and Herschel's Catalogue of double stars. That is the only measure previous to the above.

1826.60 256.0 70.17 Sh.

 β 1065. β Cancri.RA. $8^h 10^m 0^s$ Decl. $+9^\circ 33'$.

1889.104	295.2	29.40	3, 14	36
.107	294.8	29.43	4, 14	36
.131	294.1	28.59	—, —	36
1889.11	294.7	29.14	3 $\frac{1}{2}$, 14	

β 1066. Lal. 16489.

RA. $8^h 18^m 31^s$ Decl. $+9^\circ 49'$.

1889.107	189.5	2.50	6.5, 13	36
.131	188.9	2.19	7, 13.5	36
.134	184.6	2.06	7, 13	36
1889.12	187.7	2.25	6.8, 13.2	

The magnitude in DM. is 7.6

β 1067. α Ursae Majoris.

RA. $8^h 20^m 17^s$ Decl. $+61^\circ 7'$.

1889.142	192.9	6.67	$3\frac{1}{2}$, 15.5	36
.251	191.6	7.01	—, 15	36
.285	189.8	7.34	—, 15	36
1889.22	191.4	7.01	$3\frac{1}{2}$, 15.2	

An exceedingly faint companion, and difficult to measure except with a steady air.

β 1068. Lal. 17381.

RA. $8^h 43^m 1^s$ Decl. $+9^\circ 19'$.

A and B.

1889.131	190.3	0.50	7.5, 8.0	36
.151	193.0	0.42	8, 10	36
.288	186.3	0.44	7.5, 8.5	36
1889.19	189.9	0.45	7.7, 8.8	

AB and C.

1889.131	312.8	17.74	—, 12	36
.151	313.2	17.87	—, 13.5	36
1889.14	313.0	17.80	—, 12.8	

β 1069. Lal. 17416.

RA. $8^h 43^m 40^s$ Decl. $-10^\circ 34'$.

1889.097	61.6	2.02	6, 11	36
.091	59.5	2.40	7, 11	36
.093	61.3	1.98	6.8, 11	36
1889.09	60.8	2.13	6.6, 11	

β 1070. DM. $+26^\circ 19'40''$.

RA. $9^h 17^m 13^s$ Decl. $+26^\circ 46'$.

1889.107	70.4	0.57	8.8, 9.5	36
.134	78.0	0.53	9, 10	36
.151	67.1	0.41	9.5, 11	36
1889.13	71.8	0.50	9.1, 10.2	

This difficult pair of small stars was noted in measuring α Leonis (β 105). It is 27^s f, and $4'n$ of that star. The magnitude in DM. is 8.8.

β 1071. θ Ursae Majoris.

RA. $9^h 25^m 50^s$ Decl. $+52^\circ 11'$.

1889.151	74.9	5.42	3, 14	36
.247	72.6	4.76	—, 13.5	36
.285	77.2	5.10	—, 13.5	36
1889.23	74.9	5.09	3, 13.7	

A very faint attendant, requiring good seeing to measure. As the proper motion of the bright star is about $1''.12$ in the direction of 240° , the distance of the companion, if not a physical pair, will increase by nearly that amount annually.

β 1072. Sh. 110.

RA. $9^h 58^m 20^s$ Decl. $-17^\circ 31'$.

A and B.

1889.115	42.5	10.93	—, 12	36
.131	42.2	10.81	—, 12	36
.151	43.1	10.95	—, 13	36
1889.13	42.6	10.90	—, 12.3	

A and C (= Sh. 110).

1889.115	272.8	21.28	7, 7.2	36
.131	273.1	21.30	7, 7	36
.151	273.7	21.11	6.8, 7	36
1889.13	273.2	21.23	6.9, 7.1	

From a comparison with the only other measure made of the bright stars, it would seem that there has been no relative movement.

1823.34 $272^\circ 7'$ $21'' 49'$ Sh.

β 1073. Sextantis 101.

RA. $10^h 26^m 26^s$ Decl. $-5^\circ 27'$.

1889.291	49.7	2.90	7, 11.5	36
.293	46.5	3.12	7, 11.5	36
.296	44.7	3.04	6.8, 11.5	36
1889.29	46.9	3.02	7, 11.5	

This star is $6\frac{1}{2}^m$ in Lalande (Lal. 20428), and $7^m 2$ in SD.

β 1074. Lal. 20453.

RA. $10^h 28^m 20^s$ Decl. $+46^\circ 26'$.

1889.249	209.7	2.28	6, 11.5	36
.285	204.7	2.19	7, 11	36
.291	210.8	1.84	6.3, 11	36
1889.27	208.4	2.10	6.4, 11.2	

β 1075. φ^3 Hydrae.

RA. $10^h 30^m 25^s$ Decl. $-15^\circ 43'$.

1889.131	277.4	3.00	6, 13	36
.134	275.8	3.07	6, 13	36
.151	278.1	3.02	6, 13	36
1889.14	277.1	3.03	6, 13	

β 1076. 55 Leonis.

RA. $10^h 49^m 32^s$ Decl. $+1^\circ 23'$.

1889.258	53.4	1.14	6, 10	36
.285	48.5	0.84	5.5, 10	36
.288	47.2	0.98	6, 11	36
1889.28	49.7	0.99	5.8, 10.3	

β 1077. α Ursae Majoris.RA. $10^h 56^m 19^s$ Decl. $+62^\circ 24'$.

1889.142	327.0	0.96	2, 11	36
.151	325.9	0.83	—, 11	36
.227	326.3	0.77	—, 11.5	36
.247	325.1	1.08	—, 11	36
1889.19	326.1	0.91	2, 11.1	

A good example of a very unequal, and moderately close pair. It is a difficult object to measure with the large telescope except under very favorable conditions. It can hardly fail to prove to be a physical pair.

 β 1078. Crateris 79 = Lal. 22102.RA. $11^h 33^m 46^s$ Decl. $-13^\circ 48'$.

1889.293	50.8	8.19	6, 13	36
.296	49.4	8.17	6.5, 11.5	36
.302	49.1	8.30	6.5, 12	36
1889.30	49.8	8.22	6.3, 12.2	

 β 1079. Lal. 22586.RA. $11^h 54^m 34^s$ Decl. $-21^\circ 7'$.

1889.293	148.0	11.59	6, 13.5	36
.296	148.0	11.87	6, 13.5	36
.302	147.7	11.62	6.5, 13	36
1889.30	147.9	11.69	6.2, 13.3	

 β 1080. 17 Comae.RA. $12^h 22^m 55^s$ Decl. $+26^\circ 35'$.A and B (= Σ 21 App. I).

1889.093	250.2	145.23	—, —	36
.107	250.4	144.87	—, —	36
1889.10	250.3	145.05	—, —	

B and C.

1889.093	156.8	2.01	—, 13.5	36
.107	157.8	1.59	—, 14	36
.131	155.9	1.78	—, 13.5	36
1889.11	156.8	1.79	—, 13.7	

The new star is very minute, and, like many other stars of the same class, given in this catalogue, will require a large aperture to satisfactorily measure it. The bright stars have remained substantially unchanged since the first measures.

1836.43	250.7	145.35	Σ
1877.77	250.4	145.38	Je.

 β 1081. 37 Comae.RA. $12^h 54^m 32^s$ Decl. $+31^\circ 26'$.

1889.107	351.8	5.07	4.5, 14	36
.134	351.6	5.21	—, 13.5	36
.151	350.6	5.17	—, 14	36
1889.13	351.3	5.15	—, 13.8	

Very much like the last pair except in distance.

 β 1082. 78 Ursae Majoris.RA. $12^h 55^m 35^s$ Decl. $+57^\circ 1'$.

1889.142	76.7	1.19	6, 9.5	36
.151	74.7	1.45	5.7, 10.5	36
.154	74.3	1.58	5.5, 10	36
.173	70.4	1.44	6, 9	12
.175	75.0	1.63	6, 9.5	12
.247	76.3	1.71	6, 9	36
1889.17	74.6	1.50	6, 9.6	

It is singular that so easy a pair should have been overlooked heretofore. A 6 inch aperture would probably show it.

 β 1083. Pi. 12^h 268.RA. $13^h 0^m 27^s$ Decl. $+29^\circ 40'$.

B and C.

1889.093	236.3	0.47	11, 11.5	36
.107	237.4	0.47	11.5, 11.5	36
.131	238.1	0.53	12, 12	36
1889.11	237.3	0.49	11.5, 11.7	

A and BC (= H₂ 2638).

1889.093	220.4	5.97	6.5, —	36
.107	221.3	6.46	6, —	36
.131	217.9	6.26	7, —	36
1889.11	219.9	6.23	6.5, —	

The new pair is a very difficult object, and was therefore missed by me in measuring Herschel's companion with the Chicago $18\frac{1}{2}$ inch. With good seeing it is a beautiful triple star with the large telescope. As one star the companion was seen with difficulty in 1874 with the 6 inch. Herschel also noted a more distant star not measured above. The following are all the prior measures:

1831	209.6	6" $\pm$	H ₂ 1 n AB
1878.42	218.9	6.54	β 1 n
1831	6.0	20 $\pm$	H ₂ 1 n AD
1878.42	7.2	40.28	β 1 n.

 β 1084. W₁ 13^h 235.RA. $13^h 15^m 58^s$ Decl. $-4^\circ 2'$.

1889.302	87.9	2.70	7, 12	36
.312	90.0	2.64	7.3, 13	36
.323	91.5	2.72	7, 13	36
1889.31	89.8	2.69	7.1, 12.7	

 β 1085. Taylor 6986.RA. $14^h 52^m 34^s$ Decl. $-4^\circ 30'$.

1889.296	18.0	9.19	6, 13.5	36
.302	20.6	9.52	6, 13	36
.312	20.0	9.31	6, 13	36
1889.30	19.5	9.34	6, 13.2	

β 1086. 47 Bootis.RA. $15^h 1^m 27^s$ Decl. $+43^\circ 37'$.

1889.154	256.4	6.16	$5\frac{1}{2}$, 13	36
.227	257.1	6.01	—, 13.5	36
.244	256.2	5.93	—, 13	36
1889.21	256.6	6.03	$5\frac{1}{2}$, 13.2	

 β 1087. τ Coronae.RA. $16^h 4^m 35^s$ Decl. $+36^\circ 46'$.

1889.154	166.8	3.03	$5\frac{1}{2}$, 14	36
.227	171.2	3.22	—, 14	36
.244	169.4	3.07	—, 13.5	36
1889.21	169.1	3.11	$5\frac{1}{2}$, 13.8	

Similar to the last, but more difficult. The distance of the companion, if not connected with the primary, should increase about one-third of a second annually, from the proper motion of the bright star, which is $0''.34$ in the direction of 348° .

 β 1088. μ Draconis.RA. $17^h 2^m 51^s$ Decl. $+54^\circ 38'$.

B and C.

1889.244	191.4	12.26	—, 13.5	36
.285	190.0	12.31	—, 12.5	36
.288	191.3	12.19	—, 13	36
1889.27	190.9	12.25	—, 13	

A and B ($= \Sigma 2130$).

1889.244	159.7	2.42	$5\frac{1}{2}$, $5\frac{1}{2}$	36
.258	159.6	2.30	—, —	36
.285	158.9	2.53	—, —	36
.288	159.5	2.37	—, —	36
1889.27	159.4	2.40	—, —	

Future observations will show whether the new star belongs to the binary system. It is much easier than many of the faint companions given in this list.

 β 1089. Y. 7220.RA. $17^h 23^m 22^s$ Decl. $-5^\circ 49'$.

1888.600	4.8	1.20	7, 11	12
.636	7.2	0.91	$6\frac{1}{2}$, 11	12
.681	3.5	0.75	7, 11	12
1888.64	5.2	0.95	6.8, 11	

Found with the 12 inch, and inadvertently omitted from the list in A.N. 2875.

 β 1090. β Draconis.RA. $17^h 27^m 43^s$ Decl. $+52^\circ 23'$.

1889.227	11.8	4.01	3, 15	36
.244	15.7	4.00	—, 15	36
.288	12.0	3.75	—, 15	36
.293	13.9	4.12	—, 14.5	36
1889.26	13.4	3.97	—, 14	

The companion is a very minute point, but well seen under proper conditions. If not a physical pair, the position-angle should increase from the proper motion of the bright star.

 β 1091. Lal. 33592.RA. $18^h 8^m 35^s$ Decl. $+38^\circ 34'$.

1888.782	40.8	0.53	8.5, 8.5	12
.785	35.5	0.53	8.7, 8.7	12
1888.78	38.1	0.53	8.6, 8.6	

 β 1092. Rad. 5777.RA. $22^h 33^m 3^s$ Decl. $+72^\circ 15'$.

A and B (new).

1889.293	240.9	0.29	7.5, 7.5	36
.312	233.3	0.36	7.5, 7.5	36
1889.30	237.1	0.32	7.5, 7.5	

AB and D.

1889.293	137.1	42.05	—, 7.5	36
.312	137.7	42.09	7, 7	36
.323	137.5	42.37	7.5, 7	36
1889.31	137.4	42.17	7.2, 7.2	

AB and C.

1889.293	263.9	29.24	—, 12.5	36
.312	264.3	29.15	—, 12	36
.323	263.7	29.18	—, 12	36
1889.31	264.0	29.19	—, 12.2	

This has long been known as a very wide double ($= H_1 V. 94 = H_2 3133 = O\Sigma$ App. 236). The large telescope shows the preceding bright star to be a close double. The fainter star, C, is not mentioned by H_1 and $O\Sigma$, but given in $H_2 3133$, and with an error of 90° in the position angle of D. The place in $H_1 V. 94$ has an error of 7^m RA. and $29'$ Decl. The bright stars are evidently fixed relatively. The following are all the prior measures:

1783.20	135.2	41.67	H_1	1 n
1875.13	137.6	42.18	A	3 n
1883.18	137.7	42.19	Franz	5 n.

The following star is Rad. 5779.

Measures of Double Stars.

 β 734. Ceti 132.RA. $0^h 46^m 47^s$ Decl. $-24^\circ 39'$.

1888.838	347.4	10.66	7, 10	12
.851	346.4	11.01	—, —	12
1888.84	346.9	10.83	7, 10	

Apparently unchanged:

1879.68 348.9 10.74 β 3 n.

Polaris.

RA. $1^h 13^m 45^s$ Decl. $+88^\circ 40'$.

1889.293. Carefully examined with the 36 inch with various powers. Both stars single, and no companion nearer than the Σ star.

A. C. 2. 95 Ceti.

RA. $3^h 12^m 12^s$ Decl. $-1^\circ 22'$.

1888.720	104.4	0.53	6, 8	12
.818	121.2	0.37	6, 9	36
1888.77	112.8	0.45	6, 8.5	

Extremely difficult. Heretofore I have always found it single. No measures since the following:

1854.81 73.1 $0.7 \pm$ Da. 3 n. Σ 566. 2 Camelopardali.RA. $4^h 30^m 27^s$ Decl. $+53^\circ 14'$.

A and B.

1888.922	292.4	1.62	—, —	36
.925	291.8	1.57	—, —	36
.928	291.4	1.54	—, —	36
1888.92	291.9	1.58	—, —	

A and C.

1888.922	210.6	23.47	—, 13	36
.925	209.6	24.17	—, 13	36
.928	209.3	23.43	—, 13.5	36
1888.92	209.8	23.66	—, 13.2	

A star near this, 3 Camelopardali, was found to be a new pair, and this pair was measured after observing the other. The faint star, C, has not been seen heretofore. The slow retrograde motion of the close pair continues.

 β 314. Leporis 3.RA. $4^h 53^m 39^s$ Decl. $-16^\circ 34'$.

A and B.

1889.115	327.5	1.09	6, 8	36
.134	324.8	1.06	6.8, 8.5	36
.137	328.3	0.99	6.8, 8.5	36
1889.13	326.9	1.05	6.5, 8.3	

A and C.

1889.115	28.8	54.63	—, 9	36
.134	29.2	54.27	—, 7.5	36
1889.13	29.0	54.45	—, 8.2	

Change doubtful but perhaps distance increasing. In three of the measures by Δ the angle is reversed.

1876.69 149.9 0.43 Δ 4 n.

No other measures of the distant star.

 β 555. β Orionis.RA. $5^h 8^m 47^s$ Decl. $-8^\circ 20'$.

1889.093. The small star appeared to have no certain elongation with the highest powers on the 36 inch. The fact that this star has appeared to be round for several years with apertures up to $18\frac{1}{2}$ inches would suggest a possible mistake in the suspected duplicity, although at the time there seemed to be no doubt of the well known companion being a very close pair. However, it should be carefully watched since it may be in rapid motion.

 Σ 719.RA. $5^h 22^m 27^s$ Decl. $+29^\circ 27'$.

A and B.

1889.096	334.6	1.03	6.5, 9	36
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A and C.

1889.096	351.4	15.16	—, 8.5	36
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 Σ 728. 32 Orionis.RA. $5^h 24^m 22^s$ Decl. $+5^\circ 51'$.

1888.856	175.8	0.35	4, 6	36
9.110	183.6	0.36	5, 6	36
9.134	178.2	0.44	5, 6	36
1889.03	179.2	0.38	4.7, 6	

This well known binary has now become a very difficult pair.

 θ Orionis.RA. $5^h 29^m 23^s$ Decl. $-5^\circ 28'$.

A and B.

1888.862	31.8	8.66	—, —	36
.879	32.3	8.86	—, —	36
.895	32.7	8.70	—, —	36
1888.88	32.3	8.74	—, —	

A and C.

1888.862	131.5	13.00	—, —	36
.879	131.2	13.06	—, —	36
.895	131.1	12.79	—, —	36
1888.88	131.3	12.95	—, —	

D and C.

1888.856	240.7	13.23	—, —	36
.862	240.1	13.48	—, —	36
.879	241.1	13.35	—, —	36
1888.87	240.6	13.35	—, —	

D and B.

1888.862	299.4	19.35	—, —	36
.879	299.4	19.33	—, —	36
.895	299.7	19.50	—, —	36
1888.88	299.5	19.39	—, —	

B and C.

1888.862	162.9	16.87	—, —	36
.879	163.3	16.70	—, —	36
.895	162.7	16.71	—, —	36
1888.88	163.0	16.76	—, —	

A and D.

1888.862	95.3	21.57	—, —	36
.879	95.5	21.55	—, —	36
.895	95.4	21.54	—, —	36
1888.88	95.4	21.55	—, —	

A and E (Fifth star).

1888.862	352.0	4.28	—, —	36
.879	352.4	4.30	—, —	36
.895	350.1	4.36	—, —	36
1888.88	351.5	4.31	—, —	

C and F (Sixth star).

1888.854	121.3	4.05	—, —	36
.856	121.8	4.06	—, —	36
.862	119.5	3.86	—, —	36
1888.86	120.9	3.99	—, —	

Soon after the large telescope was mounted, Mr. Alvan G. Clark discovered a very faint star within the trapezium. It is a difficult object with the 36 inch, and certainly has never been seen before, notwithstanding the numerous alleged discoveries with telescopes down to three or four inches aperture. Not less than a dozen of these imaginary stars have been distributed about the interior of the trapezium, and some of them noted with instruments which failed to show the fifth and sixth stars. Mr. Sadler has given a diagram of these stars so far as they can be located from the rather vague descriptions, none of them having been measured. It would be difficult to find now a real star which would not fall upon or near one of these places. I do not think the Clark star can be fairly seen with an aperture very much less than that of the large telescope. Good admospheric conditions are necessary, and in making the measures given below, it could not be seen on many nights, although the seeing appeared to be good enough to make the attempt. As to the light-power of the 36 inch telescope, it is sufficient to refer to the new unequal pairs of the preceding list. These very minute companions, for

Bd. 123.

example, θ Ursae, σ Ursae, β Draconis, μ Draconis, 37 Comae, τ Coronae, ξ Argus, 47 Bootis, etc., are at least four or five times as bright as Clark's star, and correspondingly easier to see and measure. I have already stated in my measures with the Chicago 18 $\frac{1}{2}$ inch that the trapezium was repeatedly examined by me during a period covering several years, and that I was never able to see the least trace of any of the interior stars claimed to have been seen. Certainly the new star would be far beyond the grasp of that telescope, perfect as it is for every kind of difficult work. It is a significant fact that some of the largest and best instruments in Europe failed to show any of the supposed new stars soon after their announcement.

In this connection it may be of interest to cite the principal communications to astronomical periodicals relating to the alleged discovery of stars within the trapezium of Orion:

Sadler (Engl. Mech. XXXIV.448; Sid. Mess. VII.217).
 Lassell (Mon. Not. XVII.68; XXII.164, 276).
 Common (Ast. Reg. XVIII.116).
 D'Abbadie (Mon. Not. XVII.245, 266).
 Huggins (Mon. Not. XXVI.71; Ast. Reg. V.54).
 Gill (Mon. Not. XXVII.315).
 Buckingham (Mon. Not. XXXIII.228).
 Tempel (A.N.1898).
 Denning (A.N.1915; Obsy. III.356).
 Porro (A.N.1091).
 Salter (Ast. Reg. VIII.60, 96).
 Denning (Ast. Reg. IX.37).
 Key (Ast. Reg. IV.134).
 Byles (Obsy. V.86).

The measures of the new star are as follows:

C and G (Clark's star).

1888.856	31.7	7.66	—, —	36
8.928	32.7	7.31	—, 16	36
9.049	37.9	7.81	—, 16	36
9.077	32.6	6.83	—, 16	36
1888.98	33.9	7.40	—, 16	

D and G.

1888.856	273.1	7.45	—, —	36
8.928	267.9	7.12	—, —	36
9.049	272.1	6.56	—, —	36
9.077	269.1	6.99	—, —	36
1888.98	270.5	7.03	—, —	

While the foregoing measures were being made, Mr. E. E. Barnard of this Observatory, detected another new star just outside of and preceding the trapezium, and upon a careful examination, discovered that this excessively faint star was itself double. I was only able to see it on one night, and then made a fairly satisfactory measure, considering the extraordinarily difficult character of the object. It is infinitely more difficult than any double star I have ever attempted to see or measure; and certainly could not be seen by me with any smaller telescope. I could

not see it double on any other night on which measures were made. Only the most perfect atmospheric conditions are equal to so minute a pair, and even then it would be overlooked by the most experienced observers not possessing Mr. Barnard's rare acuteness of vision.

A and H (Barnard's star).

1888.928	178.6	7.74	—, 16	36
9.077	178.2	8.14	—, 16	36
1889.00	178.4	7.94	—, 16	

C and H.

1888.928	275.1	9.17	—, —	36
9.049	276.1	8.41	—, —	36
9.077	275.7	8.29	—, —	36
1889.02	275.6	8.62	—, —	

H and H'.

1889.073	274.0	1.32	16, 16.5	36
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Mr. Barnard has also discovered another excessively faint star within the trapezium on the line joining the bright stars B and C, and nearer the latter. I have not been able to see it, at least not with certainty, but I have no doubt of its existence, and hope to be able to measure it hereafter.

The accompanying diagram shows the relative positions of the stars of this interesting group as determined by the foregoing measures. A comparison of these measures with those made by Σ , Hall and others shows beyond question that the six principal stars are absolutely fixed with reference to each other so far as any change is concerned which could be detected by observations covering more than half a century.

For the purpose of making an accurate map, I had intended to connect each of the small stars near the trapezium with the bright stars by measuring the position angles from two points, but after a few observations it was given up as using time which could be better employed elsewhere. Of the stars observed in this way, four are north of the trapezium, and three south. These are all comparatively bright stars, and are probably found in the catalogues of stars in this region.

1888.895	52.7	B and a
.895	17.7	D and a
.895	48.6	B and b
.895	22.1	D and b
.895	335.5	A and c
.895	305.8	B and c
.895	350.8	A and d
.895	326.4	B and d
.928	195.1	C and e
.928	176.1	A and e
.928	140.7	C and f
.928	190.2	D and f
.928	115.8	C and g
.928	143.5	D and g.

S. 503.

RA. $5^h 49^m 10^s$ Decl. $+13^\circ 56'$.

A and B.

1889.096	9.1	3.40	7, 8	36
.104	8.8	3.32	7, 8	36
.128	7.9	3.36	7, 8	36
1889.11	8.6	3.36	7, 8	

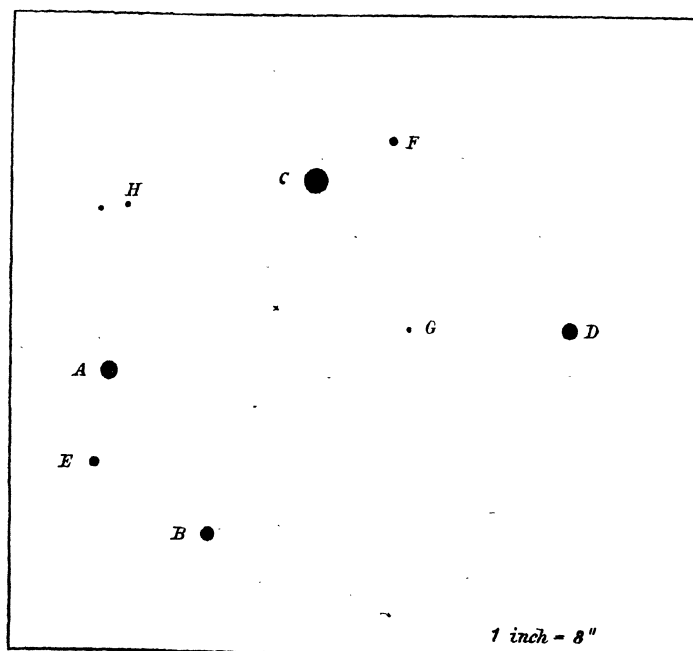
A and C.

1889.096	163.1	20.83	—, 10.5	36
.104	163.7	21.04	—, 11	36
.128	162.9	20.89	—, 11	36
1889.11	163.2	20.92	—, 10.8	

An interesting object from the proper motion of the larger star. The minimum distance must have been reached not far from 1883, and the nearer stars are now drifting apart. There are no measures between those of South in 1825 and Dembowski's in 1873. The former measured a distant star ($201''.76$), which in 1883 I found was $234''.09$ from A. The small star, C, was first measured by me in 1878.

A and B.

1825.07	134.1	39.94	S 2 n
1873.93	120.1	8.08	A 3 n
1881.18	99.3	3.58	β 3 n
1883.11	82.6	2.90	β 3 n
1889.11	8.6	3.36	β 3 n



A and C.

1878.00	157.3	28.09	β 1 n
1883.10	158.8	24.61	β 4 n
1889.11	163.2	20.92	β 3 n.

 β 1008. η Geminorum.RA. $6^h 7^m 38^s$ Decl. $+22^\circ 32'$.

1889.104	294.6	1.34	3, 10	36
.134	291.8	1.00	—, 11	36
.173	298.1	0.79	—, —	12
1889.14	294.8	1.04	—, 10.5	

There may be some change in the angle.

1882.05 301.4 0.96 β 5 n.

A. G. C. 1. Sirius.

RA. $6^h 39^m 53^s$ Decl. $-16^\circ 33'$.

1888.818	15.1	5.25	—, —	36
8.856	16.5	5.33	—, —	36
9.049	11.0	5.28	—, —	36
9.052	14.5	5.27	—, —	36
9.077	12.6	5.24	—, —	36
1888.97	13.9	5.27	—, —	

The companion to Sirius is a very easy object, under proper conditions, and is not likely to ever get beyond the reach of the large refractor.

I have carefully looked for other stars near Sirius, but without finding anything worth noting.

 β 580.RA. $7^h 38^m 1^s$ Decl. $+28^\circ 19'$.

1889.142	130.9	1.14	9.5, 12.5	36
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This pair is the nearest of Herschel's companions to β Geminorum. The only other measures are:

1878.10 128.0 1.40 β 2 n. β 101. 9 Argus.RA. $7^h 46^m 13^s$ Decl. $-13^\circ 35'$.

1889.049	81.2	0.28	6, 6.4	36
.077	75.6	0.34	6, 6.5	36
.091	72.2	0.35	5.5, 6	36
.093	76.6	0.39	5.5, 6.3	36
1889.08	76.4	0.34	5.7, 6.3	

This pair, which was discovered with the 6 inch in 1873, is certainly a binary in rapid motion. Some of the measures are:

1875.71	289.4	0.46	Δ 3 n
1878.52	301.8	0.46	β 3 n
1880.12	315.1	0.34	Hl 1 n
1883.11	336.2	$0.3 \pm$	β 1 n
1888.26	356.1	0.29	Sp 5 n.

 Σ 1196. ζ Cancri.RA. $8^h 5^m 20^s$ Decl. $+18^\circ 1'$.

1889.285	Examined under fairly good conditions with powers up to 1500 or more, and no other component, or near star, seen.			
.296				

 β 208.RA. $8^h 33^m 54^s$ Decl. $-22^\circ 16'$.

1889.131	44.9	1.08	—, —	36
.173	50.1	1.05	7, 8	12
1889.15	47.5	1.06	7, 8	

There would seem to be no doubt of change in this pair from the following:

1874.20	30.4	$1.4 \pm$	β 1 n
1878.43	33.9	1.37	Cin ₅ 5 n
1882.21	40.9	1.21	Sp 3 n
1889.15	47.5	1.06	β 2 n

 Σ 1273. ϵ Hydrae.RA. $8^h 40^m 25^s$ Decl. $+6^\circ 52'$.

A and B.

1888.818	151.0	0.27	4, 6	36
9.151	157.9	0.25	4, 6	36
1888.98	154.4	0.26	4, 6	

AB and C.

1888.818	226.5	3.11	—, —	36
9.151	225.6	3.16	—, —	36
9.288	227.3	3.22	—, —	36
1889.08	226.5	3.16	—, —	

AB and D.

1889.151	193.5	19.71	—, 13	36
.288	194.1	19.66	—, —	36
1889.22	193.8	19.68	—, 13	

The duplicity of the principal star was detected by Schiaparelli in 1888, but an apparent elongation had been noted by $O\Sigma$ in 1860. It is a difficult pair, and will certainly prove to be a ternary system. The motion of C has been about 31° since 1830.

The distant companion was detected with the Washington 26 inch.

1888.28	142.0	0.21	Sp 6 n	A and B
1878.60	192.0	20.05	β 2 n	AB and D.

Perrotin. DM. $+8^\circ 21' 32''$.RA. $8^h 44^m 49^s$ Decl. $+8^\circ 47'$.

1889.107	351.0	0.97	8, 8.7	36
.115	348.9	1.01	7.8, 8.5	36
.131	350.4	0.88	8, 8.7	36
1889.12	350.1	0.95	7.9, 8.6	

Discovered by Perrotin, and stated to be in the vicinity of $O\Sigma$ 195, but no place given. I wished to identify the star, and find its position, and in doing that, made the measures given. The magnitude in DM. is 8.2. The only other measures are:

1884.20	349.3	0.78	7.5, 8.7	Per 2 n.
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2*

α Cancr.RA. $9^h 1^m$ Decl. $+11^\circ 10'$.

1889.131. This star was examined for the reason that Dawes and others noticed a gradual disappearance when occulted by the moon. I could see no sign of duplicity.

 β 105. α Leonis.RA. $9^h 17^m 40^s$ Decl. $+26^\circ 42'$.

1889.107	204.3	2.83	$4\frac{1}{2}$, 11	36
.134	201.6	2.71	—, 10.8	36
.151	205.8	2.83	—, 11	36
1889.13	203.9	2.79	—, 10.9	

Engelmann speaks of a $10''$ star in the direction of 65° . There is certainly no companion in this place, and no third star near in any direction. A difficult pair of small stars about $5'$ nf is given in the preceding list of new doubles.

There seems to be no change in α Leonis.

1876.20	203.8	3.05	Δ 5 n
1883.47	205.1	3.36	En 8 n.

Jacob 5. Lac. 3873.

RA. $9^h 25^m 26^s$ Decl. $-28^\circ 14'$.

1889.115	248.0	1.16	6, 7	36
.296	241.4	1.25	7, 7.3	36
.312	245.1	0.74	6, 7	36
1889.24	244.8	1.05	6.3, 7.1	

Discovered by Jacob during an occultation by the moon. Change is doubtful from the two preceding measures.

1858.1	244.6	0.55	J -1 n
1878.53	235.5	0.58	Cin ₅ 2 n.

 $O\Sigma$ 521. v Ursae Majoris.RA. $9^h 42^m 30^s$ Decl. $+59^\circ 36'$.

1889.151	294.9	11.34	5, 13	36
.159	293.3	11.11	—, 13	36
.247	295.3	11.24	—, 11.5	36
1889.18	294.5	11.23	—, 12.5	

There is no relative motion, but the two stars must belong to the same system since they have the same considerable proper motion of $0''.34$ in the direction of $233^\circ 7'$. The following are the only other measures I have found:

1855.58	295.3	11.32	$O\Sigma$ 7 n.
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A. C. 5. 8 Sextantis.

RA. $9^h 46^m 34^s$ Decl. $-7^\circ 32'$.

1889.091	121.5	0.44	5.5, 6.0	36
.131	128.0	0.45	$5\frac{1}{2}$, 6	36
.296	127.2	0.72	—, —	36
1889.17	125.6	0.54	$5\frac{1}{2}$, 6	

The last distance is too large, the images at the time being very unsteady. This pair is a binary, and in rapid motion. It was discovered by Mr. Clark in 1852 with a telescope of only $4\frac{3}{4}$ inch aperture. I found it apparently single with $18\frac{1}{2}$ inch in 1879-81.

1854.22	50.5	0.5 $\pm$	Da 1 n
1875.30	169.0	—	Δ 4 n
1878.22	117.4	0.2 $\pm$	Cin 2 n
1878.26	161 $\pm$	0.25 $\pm$	β 2 n.

 Σ 1424. γ Leonis.RA. $10^h 13^m 20^s$ Decl. $+20^\circ 27'$.

1889.291	113.8	3.64	—, —	36
.293	113.3	3.42	—, —	36
.302	116.7	3.48	—, —	36
1889.29	114.6	3.51	—, —	

These measures were made while looking for a suspected close star.

 β 599. 65 Leonis.RA. $11^h 1^m 50^s$ Decl. $+2^\circ 30'$.

1889.258	88.0	1.87	$5\frac{1}{2}$, 10.5	36
.274	87.6	1.74	5.8, 10.5	36
.285	89.9	1.72	5.5, 10.5	36
1889.27	88.5	1.78	5.6, 10.5	

A neighboring star, 55 Leonis, was found to be a new pair, and after observing that, this pair was measured. Change is doubtful.

1878.20	82.4	1.78	β 4 n.
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 β 916. Crateris 31.RA. $11^h 8^m 13^s$ Decl. $-14^\circ 47'$.

1889.134	359.0	1.03	7.5, 8	36
.312	1.8	0.90	7.5, 8.5	36
.323	359.8	0.70	7.5, 8.5	36
1889.25	0.2	0.88	7.5, 8.3	

No earlier measures except an angle of 357.9 (1879.27) at Cin.

 β 607.RA. $12^h 35^m 2^s$ Decl. $-0^\circ 48'$.

1889.296	314.3	1.18	9, 10.2	36
.312	317.5	1.23	9, 10	36
.323	317.2	1.18	9, 10	36
1889.31	316.3	1.20	9, 10	

Near γ Virginis, 35^s p. There seems to be no material change.

1878.23	315.9	1.15	β 6 n.
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Σ 1670. γ Virginis.RA. $12^h 35^m 37^s$ Decl. $-0^\circ 47'$.

A and B.

1889.296	153.0	5.58	—, —	36
.312	154.3	5.67	—, —	36
.323	153.0	5.90	—, —	36
1889.31	153.4	5.72	—, —	

A and C.

1889.293	159.0	53.43	—, 15	36
.296	158.2	52.81	—, 14.5	36
.312	161.0	53.12	—, 14	36
1889.30	159.4	53.12	—, 14.5	

The faint star measured as a light-test. It should not be confounded with a bright star about twice as far in the direction of 88° . This was called 15^m by Herschel, but would be about 11^m of the scale used here, which would make it twenty five times as bright as the other star.

 β 609.RA. $13^h 4^m 28^s$ Decl. $-4^\circ 18'$.

1889.302	351.6	0.87	6.8, 10	36
.312	342.9	0.94	7, 9.5	36
.323	352.7	0.92	6.5, 10	36
1889.31	349.1	0.91	6.8, 9.8	

Poor seeing when the second measure was made. Very little if any change.

1878.32	356.1	0.89	β 1 n
1880.34	356.1	0.82	Cin ₆ 2 n.

 β 935. 86 Virginis.RA. $13^h 39^m 33^s$ Decl. $-11^\circ 49'$.

A and B.

1889.293	298.0	1.54	6, 10	36
.296	299.8	1.87	6, 10	36
.302	300.9	1.58	5.5, 10	36
1889.30	299.6	1.66	5.8, 10	

C and D.

1889.293	276.1	2.08	10, 11	36
.296	276.4	2.37	10.5, 11	36
.302	275.3	2.28	11, 11.5	36
1889.30	275.9	2.24	10.5, 11.2	

A and C ($= \Sigma$ 1780 rej.)

1889.293	164.2	27.24	—, —	36
.296	165.5	27.09	—, —	36
.302	165.2	27.19	—, —	36
1889.30	164.6	27.17	—, —	

A beautiful quadruple star. It was observed by H_2 and Σ as a double, but they failed to notice that each of the stars was double. Thus far there seems to be little evidence of change.

1879.37	298.4	1.61	β 5 n	AB
1879.40	274.2	1.72	β 3 n	CD
1879.33	164.7	26.94	β 2 n	AC.

The 36 inch shows two new nebula in the field with this quadruple. They are small and diffused, and not very faint. One is $4\frac{1}{2}^s$ p, and 136.8^s ; and the other $19\frac{1}{2}^s$ p, and 101.6^s .

 β 348. 2 Serpentis.RA. $14^h 55^m 40^s$ Decl. $+0^\circ 20'$.

1889.302	121.3	0.80	6, 6.7	36
.312	116.8	0.72	Poor seeing	36
1889.31	119.0	0.76	6, 6.7	

 β 943.RA. $15^h 12^m 16^s$ Decl. $+1^\circ 23'$.

1889.296	92.1	2.51	6, 11.8	36
.302	92.8	2.70	6, 12	36
.312	93.1	2.67	6.5, 13	36
1889.30	92.7	2.63	6.2, 12.3	

Apparently without change.

1879.70	92.5	2.30	β 4 n.
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 β 32. 6 Serpentis.RA. $15^h 14^m 54^s$ Decl. $+1^\circ 9'$.

1889.296	19.6	2.51	5.5, 10	36
.302	15.0	2.45	6, 10	36
.312	19.1	2.36	6, 10	36
1889.30	17.9	2.44	5.8, 10	

There may be a little increase in the angle.

1875.43	13.2	2.28	Δ 4 n
1885.49	14.1	2.27	Tarrant 3 n.

 β 818. 32 Herculis.RA. $16^h 28^m 50^s$ Decl. $+30^\circ 45'$.

1889.244	34.4	3.55	6, 13.5	36
.293	31.0	3.37	6, 13	36
.312	33.2	4.01	6, 14	36
1889.28	32.9	3.64	6, 13.5	

The companion, with the $15\frac{1}{2}$ inch refractor of the Washburn Observatory, with which it was discovered, was of the last degree of difficulty; and it is not prominent even with this telescope. The only other measures are:

1881.48	33.5	3.29	β 3 n.
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Küstner 1.

RA. $16^h 48^m 27^s$ Decl. $+77^\circ 43'$.

1889.173	187.9	2.70	7.3, 10.5	12
.227	188.9	2.70	7, 10	36
.247	191.1	2.76	6.8, 10.5	36
1889.21	189.3	2.72	7, 10.3	

Discovered by Küstner with the Berlin Meridian Circle (A.N. 2756). There are no published measures of this pair.

α Herculis.RA. $17^h 9^m 10^s$ Decl. $+14^\circ 32'$.

A and C.

1888.671	333.9	23.97	—, 15	36
9.312	337.7	23.12	—, 15	36
1888.99	335.8	23.54	—, 15	

A faint star noted by Mr. Alvan G. Clark. It has not been measured before.

 β 633. γ Draconis.RA. $17^h 53^m 49^s$ Decl. $+51^\circ 30'$.

1889.227	151.5	21.11	—, 12	36
.244	151.0	21.17	—, 13	36
.288	151.3	21.02	—, —	36
1889.25	151.3	21.10	—, 12.5	

The only prior measures are:

1879.09 151.9 20.91 β 4 n. Σ 2272. γ Ophiuchi.RA. $17^h 59^m 23^s$ Decl. $+2^\circ 33'$.

A and B.

1889.296	349.0	2.16	—, —	36
.312	348.5	2.16	—, —	36
1889.30	348.7	2.16	—, —	

A and C.

1889.296	203.6	59.40	—, 13	36
.312	203.0	59.51	—, 12.5	36
1889.30	203.3	59.45	—, 12.7	

A and D.

1889.296	43.3	95.29	—, 12.5	36
.312	43.2	95.06	—, 12	36
1889.30	43.2	95.17	—, 12.2	

Secchi measured these two faint stars in 1856. When observed by Hall in 1878, it appeared that the nearest of the two had a large proper motion nearly at right angles to that of γ Ophiuchi. Comparing the above measures with Hall's, it is seen at once that the change in the two faint stars is the same, and corresponds exactly to the recognized proper motion of γ Ophiuchi, and that neither of them has any sensible motion of its own. Laying off the measures to scale, and taking the change in place of the faint stars as determined by the two sets of measures, we find the proper motion of the binary system to be, roughly, $1''.2$ in the direction of 173° . The measures of Secchi of the sp star are evidently erroneous, or belong to some other star. The distance of this star in 1856 should have been $97''$ in the direction of 191° . His angle of the nf star was exactly right. The distance at that time, by the diagram, should have been about $75''$. The distance of this star is of course increasing. Roughly speaking, the minimum distance of the sp star from γ Ophiuchi of $30''$ will be reached about the year 1932. The measures to this time are as follows:

1856.63	215.1	87.57	Se 1 n
1878.84	197.8	71.38	Hl 3 n
1889.30	203.3	59.45	β 2 n.

For the other star we have:

1856.62	67.2	—	Se 1 n
1878.84	49.6	87.21	Hl 3 n
1889.30	43.2	95.17	β 2 n.

The motion of the close pair has been 82.6 since the measures of Hl in 1879. I could not see any third component, and both stars appeared to be round with all powers.

Küstner 2.

RA. $19^h 35^m 38^s$ Decl. $+71^\circ 20'$.

1889.173	271.9	1.35	8, 9.5	12
.312	272.9	1.45	6.5, 8.5	36
.315	268.5	1.52	7, 9.5	12
1889.27	271.1	1.44	7.2, 9.2	

Discovered by Küstner with the Berlin Meridian Circle (A.N. 2756). So far as I am aware, it has not been measured before.

Ho. 137.

RA. $20^h 35^m 37^s$ Decl. $+29^\circ 23'$.

1888.644	272.5	1.01	7, 10	12
.859	274.5	0.76	7, 10	12
1888.75	273.5	0.88	7, 10	

Discovered by Hough (A.N. 2779). He found:

1885.83 278.9 1.23 Ho 2 n.

Ho. 152.

RA. $21^h 7^m 20^s$ Decl. $+27^\circ 51'$.

1888.644	333.7	0.69	8.5, 9.0	12
.859	324.2	0.71	8.7, 9.5	12
1888.75	328.9	0.70	8.6, 9.2	

Discovered by Hough who gives:

1882.66 320.2 0.49 Ho 3 n.

A. G. Clark. τ Cygni.RA. $21^h 10^m 0^s$ Decl. $+37^\circ 32'$.

A and B.

1888.733. Single with all powers up to 3300. Good definition.

AB and C.

1889.312	247.3	19.44	—, 13.5	36
.323	246.2	19.23	—, 13	36
1889.32	246.7	19.33	—, 13.2	

The only other measure of C is by Hall, 260.3 15.68 (1876.90) 1 n. The proper motion of A according to Auwers is 0.48 in 17.4 , which appears to substantially account for the change in C. The seeing was not good enough when the measures were made to look for the close star. Gore finds a period of 53.87 years.

O Σ 482. B.A.C. 7990.RA. 22^h 47^m 55^s Decl. +82° 31'.

1889.293	32°8	3"64	5, 11	36
.312	38.3	3.23	—, 10.5	36
.323	36.5	3.34	5.5, 10.5	36
1889.31	35.9	3.40	5.2, 10.7	

Very little change. The following are all the previous measures :

1850.59	30°2	3"46	O Σ 6 n
1866.61	33.0	3.71	A 3 n.

Ho. 200.

RA. 23^h 24^m 19^s Decl. +85° 45'.

1889.293	140°5	2"35	7, 10	36
.312	143.1	2.44	6.5, 11	36
.323	144.1	2.36	6.3, 10.8	36
1889.31	142.6	2.38	6.6, 10.6	

The only other measures are :

1885.83	137°7	1"73	Ho 2 n.
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Mt Hamilton 1889 May 1.

Beobachtungen am 10inch. Refractor der Lütticher Sternwarte.

Von Dr. L. de Ball.

1888	M.Z. Lüttich	$\Delta\alpha$	$\Delta\delta$	Vgl.	α app.	$\log p.A$	δ app.	$\log p.A$	Red. ad l. app.	*
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Comet 1889 I.

Nov. 5	13 ^h 28 ^m 52 ^s	— 0 ^m 47 ^s 86	+ 2' 13".9	9.6	5 ^h 3 ^m 54 ^s 89	8.722 _n	+ 1° 31' 5".4	0.823	+ 2 ^s 71 + 4".3	1
6	12 32 52	+ 1 45.19	+ 0 13.2	7.7	4 58 51.87	9.105 _n	+ 1 13 0.5	0.826	+ 2.75 + 4.7	2
7	11 17 42	+ 0 0.35	+ 2 51.9	3.3	—	9.348 _n	—	0.828	+ 2.77 + 4.8	3
7	12 2 41	— 1 3.89	+ 3 48.3	10.5	4 53 32.72	9.202 _n	+ 0 54 6.2	0.828	+ 2.77 + 4.8	4
30	9 58 29	— 0 35.66	—	7	—	8.434	—	—	+ 2.82 —	5
30	10 15 40	—	+ 2 50.3	8	—	—	—	0.867	— + 8.7	5
Dec. 8	7 56 8	+ 0 20.10	+ 4 3.3	6.6	1 37 10.11	8.681 _n	— 7 14 57.3	0.873	+ 2.60 + 9.1	6
28	6 31 23	—	+ 3 37.7	6	—	—	—	0.875	— + 9.3	7

(33) Polyhymnia.

Nov. 6	11 52 53	+ 0 31.07	— 1 48.1	9.5	2 40 39.46	8.506	+ 17 43 42.5	0.679	+ 3.13 + 11.6	8
7	10 23 47	— 0 23.76	— 0 7.6	11.7	—	9.048 _n	—	0.686	+ 3.13 + 11.7	9

Mittlere Oerter der Vergleichsterne für 1888.0.

*	α 1888.0	δ 1888.0	Autorität	*	α 1888.0	δ 1888.0	Autorität
1	5 ^h 4 ^m 40 ^s 04	+ 1° 28' 47".2	A.N. 2887	6	1 ^h 36 ^m 47 ^s 41	— 7° 19' 9".7	A.N. 2887
2	4 57 3.93	+ 1 12 42.6	A.N. 2893	7	0 27 6	— 7 32	9 ^m 5
3	4 53 37	+ 0 52	9 ^m 5. DM. + 0° 9 11	8	2 40 5.26	+ 17 45 19.0	Küstner, 670 Sterne.
4	4 54 33.84	+ 0 50 13.1	W ₁ 4 ^h 11 61	9	2 40 8	+ 17 41	9 ^m 5. DM. + 17° 434
5	2 23 13	— 6 9	9 ^m 5				

Correction der Ephemeride von (33) Polyhymnia im Berl. Jahrb.:

$$1888 \text{ Nov. } 6 \quad \Delta\alpha = -19^s.10 \quad \Delta\delta = -1' 27".7.$$

Bemerkungen.

Die vorstehenden Beobachtungen wurden mit Hülfe eines Fadennikrometers unter Anwendung heller Fäden erhalten; wegen der recht mangelhaften Fädenbeleuchtung sind solche Beobachtungen hier stets schwierig. — Die erste Position des Cometen für Nov. 7, sowie die für Dec. 8 beruhen auf Messungen von Positionswinkel und Distanz; dabei halte ich den erstgenannten Ort trotz der

grossen Uebereinstimmung der Einzelbestimmungen nicht für sonderlich genau. — Die Correction für Refraction ist berücksichtigt. — Nov. 6 unruhige Luft. — Nov. 30 windig. — Dec. 28 dunstig; Comet ziemlich schwach. Der Sternort wurde mittelst der Relation: Stern — Comet = +44° — 3' 5 aus der Ephemeride erhalten.

L. de Ball.