

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.

$$\begin{array}{llll} 1783.74 & 26^{\circ}0 & 13^{\circ}60 & H_1 \\ 1829.90 & 26.8 & 11.71 & \Sigma \end{array}$$

Herschel's distance is probably too large.

 $\beta 1048$. Lal. 10437.RA. $5^h 26^m 37^s$ Decl. $-1^{\circ} 41'$.

| | | | | |
|----------|-------|------|------------|----|
| 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. $6\frac{1}{2}$.

 $\beta 1049$. $\Sigma 734$.RA. $5^h 27^m 3^s$ Decl. $-1^{\circ} 48'$.

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 ($\Sigma 734$).

| | | | | |
|----------|-------|------|-------|----|
| 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 (H_1 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 |

 $\beta 1050$. Bond 974.RA. $5^h 30^m 55^s$ Decl. $-5^{\circ} 33'$.

| | | | | |
|----------|-------|------|-------------|----|
| 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.

 $\beta 1051$. Bond 1096.RA. $5^h 32^m 1^s$ Decl. $-4^{\circ} 57'$.

| | | | | |
|----------|------|------|-------------|----|
| 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 $7\frac{1}{2}^m$ p $22\frac{5}{4}$, and $2' 34''$ n.

 $\beta 1052$. Lal. 10776.RA. $5^h 35^m 39^s$ Decl. $-2^{\circ} 57'$.

| | | | | |
|----------|-------|------|---------------------------------|----|
| 1889.134 | 192.0 | 0.62 | 7 , 8 | 36 |
| .137 | 189.4 | 0.59 | 7 , 8 | 36 |
| .142 | 185.8 | 0.77 | $6\frac{1}{2}$, $7\frac{1}{2}$ | 36 |
| 1889.14 | 189.1 | 0.66 | 7.2 , 8.2 | |

In U.A. 6.7^m .

 $\beta 1053$. Aurigae 146.RA. $5^h 45^m 18^s$ Decl. $+37^{\circ} 19'$

| | | | | |
|----------|-------|------|-----------|----|
| 1889.922 | 283.2 | 0.43 | 7.5 , 9.5 | 36 |
|----------|-------|------|-----------|----|

 $\beta 1054$. 136 Tauri.RA. $5^h 45^m 47^s$ Decl. $+27^{\circ} 35'$.

| | | | | |
|----------|-------|-------|----------|----|
| 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 | |

 $\beta 1055$. Aurigae 161 = B.A.C. 1899.RA. $5^h 51^m 32^s$ Decl. $+44^{\circ} 35'$.

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 ($= H_1$ 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:

$$1783.49 \quad 315^{\circ}1 \quad 30^{\circ}05 \quad H_1 \text{ in.}$$

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 |
|----------|-------|------|--------|----|

A and C.

| | | | | |
|----------|-------|-------|--------|----|
| 1889.096 | 351.4 | 15.16 | —, 8.5 | 36 |
|----------|-------|-------|--------|----|

 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 atmospheric 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, α 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 |
|----------|-------|------|----------|----|

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 | |

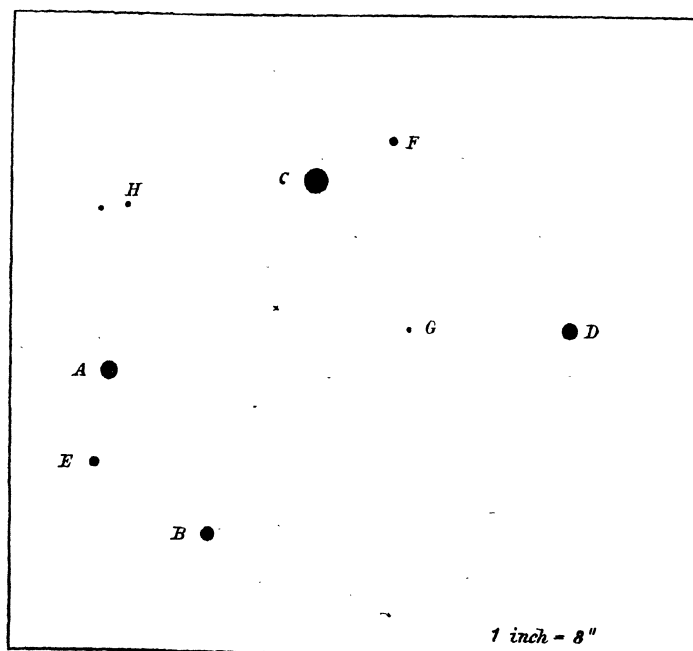
A and C.

| | | | | |
|----------|-------|-------|---------|----|
| 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 |
|----------|-------|------|-----------|----|

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 | H1 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. |
|---------|-------|------|----------|----------|

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. |
|---------|-------|-------|----------------|

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. |
|---------|------|------|--------------|

 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 $357^\circ 9'$ (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. |
|---------|-------|------|--------------|

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. |
|---------|------|------|--------------|

 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. |
|---------|------|------|--------------|

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. |
|---------|-------|------|---------|

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. | * |
|------|--------------|----------------|----------------|------|---------------|------------|---------------|------------|-----------------|---|
|------|--------------|----------------|----------------|------|---------------|------------|---------------|------------|-----------------|---|

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 Fadenmikrometers 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.