

821
B66
1904
THESIS

Double-Star Measures
made at the
Lowell Observatory
by

1898 and 1899.

The following measures were made with the 61 cm refractor of the Lowell Observatory. The measures are mostly of Burnham stars and of those from the "First Catalogue of Double and Multiple in the Southern Hemisphere" by T. J. J. See. A few other stars are included and also 24 new stars which were discovered by the writer in searching for the others. In a few cases new components have been discovered to known stars. Where these have been discovered by Mr Cogshall the fact has been noted. The approximate places, for the epoch 1900.0, of most of the new stars is given and the Catalogue number in one

of the following catalogues:- Argentine General Catalogue, Gould; Southern Durchmusterung Schörfeld; Cape Photographie Durchmusterung, Cordoba Durchmusterung, Thome. Those new stars whose places are not given are referred by number to one of the above catalogues. The new stars are designated by the symbol λ_B to distinguish them from other stars discovered at the Lowell Observatory.

The following abbreviations are used:-

On star catalogues,

A.G.C. = Argentine General Catalogue, Gould.

S.D. = Southern Durchmusterung, Schörfeld.

C.P.D. = Cape Photographie Durchmusterung.

Cord DM. = Cordoba Durchmusterung, Thome.

On Double-Star Observers,

β = Burnham

λ_1 = First Catalogue of Double and Multiple Stars, See.

h = Sir John Herschel

Hh = Sir William Herschel's work as edited by Sir John.

Jacob = Capt. W. S. Jacob.
Innes = R. T. Innes.
Howe = H. A. Howe
Ho = Hough
Harvard = Harvard Observers
Cord. dpl. = noted by Gould
A O e₂ = Argelander-Oeltgen
O S = Otto Struve.

Description of Instruments used &c will be found in the "First Measures of New Double and Multiple Stars in the Southern Hemisphere", Astronomical Journal Nos 431-432.

Each observation is composed of four settings of the micrometer for position angle and three double distances. The magnitudes are the means of estimates made at each observation.

$\lambda_B 1$

Now

$$\alpha = 6^h 56^m 4^s ; \delta = -21^\circ 56' 40''$$

10 - 11

t	θ	ρ
1899.046	345.8	2".34

N of $\lambda_1 74$ by $128''$

$\lambda_B 2 (?)$

$$\alpha = 7^h 16^m ; \delta = 29^\circ 30'$$

9 - 10

1899.181	165.7	2".65
----------	-------	-------

near $\beta 1024$

$\lambda_B 3$

A.G.C. 10615-

$$\alpha = 7^h 55^m 30^s ; \delta = -26^\circ 51'$$

8 - 10

1899.200	161.1	7.58
----------	-------	------

Another faint companion in 75.5°
distant $2.0''$

Large star suspected double
in $193^\circ \pm 0.2^\circ$

Near a Horse Star.

$$\alpha = 10^h 37^m 49^s ; \delta = -33^\circ 8' 8 - 14.5''$$

t	θ	ρ
1899.008	276.1	24".23
1^s preceding $\lambda_1 120$		

$\lambda_B 5$

$$\alpha = 13^h 44^m ; \delta = -14^\circ 6' 8 - 8''$$

1899.159	204.2	0.33
----------	-------	------

Now on meridian.

$\lambda_B 6$

C.P.D. 6059 (-23°)

$$\alpha = 15^h 34^m 31.2^s ; \delta = -22^\circ 52' 1'' 8 - 8.5''$$

1899.425	165.5	0.73
----------	-------	------

15^{th} mag. star in $320^\circ \pm 25^\circ$

$\lambda_B 7$

Cord. D.M. 10650(-35°)

$$\alpha = 15^h 54^m; \delta = -35^\circ 42'$$

$$1899.197 \quad 103.1 \quad 6.43$$

 $\lambda_B 8$

$$\alpha = 17^h 40^m; \delta = -18^\circ 24'$$

$$1898.529 \quad 257.3 \quad 2.34$$

 $\lambda_B 9$

$$\alpha = 18^h 44^m; \delta = +8^\circ 30'$$

$$8 - 8$$

$$1898.625 \quad 253.2 \quad 0.4 \pm$$

Thought to be dpl. as estimated
but seeing very bad.

 $\lambda_B 10$

S.D. 5391(-6°)

$$\alpha = 20^h 5^m; \delta = -6^\circ 24'$$

A.B. 8 - 11.5

$$1898.701 \quad 162.8 \quad 18.37$$

A.C. 8 - 11.5

$$701 \quad 123.6 \quad 31.72$$

A.D. 8 - 11.5

$$701 \quad 89.8 \quad 53.97$$

 $\lambda_B 11$

S.D. 5856(-20°)

$$\alpha = 20^h 6^m; \delta = -20^\circ 12'$$

A.B. 8.5 - 11.5

$$1898.714 \quad 237.5 \quad 16.79$$

A.C. 8.5 - 14

$$714 \quad 80.3 \quad 22.68$$

 $\lambda_B 12$

S.D. 5954(-20°)

$$\alpha = 20^h 47^m; \delta = -19^\circ 18'$$

1898.714 Look up on a better
night Suspect a companion
in $0^\circ \pm 15'' \pm$

 $\lambda_B 13$

S.D. 6048(-18°)

$$\alpha = 21^h 54^m; \delta = 18^\circ 30'$$

$$1898.671 \quad 113.2 \quad 33.14$$

$\lambda_B 14$

$$\alpha = 21^h 54^m 5^s; \delta = -18^\circ 10'$$

	8.5 - 13	
t	θ	ρ
1898.684	114.1	32.11
.714	113.9	32.50
.722	114.1	32.57

 $\lambda_B 15$

S.D. 6053 (-18°)

$$\alpha = 21^h 56^m; \delta = -17^\circ 54'$$

7.5 - 11

1898.671	346.2	3.85	B.
.744	346.6	4.07	C.

Found while searching for λ_{463} $\lambda_B 16.$

$$\alpha = 23^h 4^m; \delta = +32^\circ 3'$$

1898.512	76.0	57.38
----------	------	-------

Near Sh 352

 $\lambda_B 17$ Near $\beta 267$

	8.5 - 9	
1898.625	221.4	9.56

Not $\beta 267$ but a wider pair
further S in same finder field $\lambda_B 18.$

A.G.C. 17358

	8 - 14.5	
t	θ	ρ
1899.189	43.3	2.16

 $\lambda_B 19$

Cord. D.M. 10578 (-34°)

1899.200	130.5	14.86
----------	-------	-------

 $\lambda_B 20$

C.P.D. 6186 (-24°)

	8.5 - 9	
1899.427	350.0	3.37
.430	351.6	3.74

Star in cluster.

 $\lambda_B 21$

C.P.D. 6641 (-35°)

8.5 - 8.5

1899.430	101.3	6.64
----------	-------	------

 $\lambda_B 22$

S.D. 4637 (-18°)

	8 - 8.5	
1899.430	258.4	2.58

$\lambda_B 23$ S.D. 4650 (-18°)

t	9-12.5	ρ
1899.430	217.0	3.74

 $\lambda_B 24$ C.P.D. 6389 (-35°)

8.5-8.6

1899.433 $220^\circ \pm$ $0.3 \pm$

Cor d. Dpl.

A.G.C. 29658-9

8-8.2

1898.673 63.7 4.88 Sh 268 = α Serpentina1898.529 197.3 32.05 Sh 283 = θ Serpentina

1898.529	283.6	22.02
.529	283.8	22.41 mm.B.

 $\beta 286$

6-13

t	θ	ρ
1898.636	214.6	6.32

.668	213.4	5.65
------	---------	--------

<u>673</u>	<u>212.4</u>	<u>6.82</u>
1898.659	213.5	6.93

Seeing not good.

 $\beta 285$

AB 8.5-11

1898.671	319.6	1.57
----------	---------	--------

<u>.689</u>	<u>317.1</u>	Seeing too poor for dis
1898.680	318.3	1.570

AC 8.5-9

1898.671	140.8	59.50
----------	---------	---------

<u>.689</u>	<u>140.2</u>	<u>60.62</u>
-------------	--------------	--------------

1898.680	140.5	59.76
----------	---------	---------

A.E. E discovered by C.

1898.671	148.1	13.34 C.
----------	---------	------------

689	145.0	Seeing too poor for dist.
-----	---------	---------------------------

CD 9-12

1898.671	20.6	2.52
----------	--------	--------

<u>.689</u>	<u>17.1</u>	Seeing too poor for dist
1898.680	18.8	2.52

t	$\beta 48$ $8 \quad 10.5$	P
1898.675	3.7	1.90
.742	2.2	2.49
<u>.755</u>	<u>1.6</u>	<u>2.38</u>
1898.724	2.5	2.26

	$\beta 967$ $8 \quad 12.5$	
1898.725	196.7	2.45
.728	200.6	2.26
<u>.731</u>	<u>197.7</u>	<u>2.59</u>
1898.728	198.3	2.43

	$\beta 265$ $8 - 10$	
1898.711	234.2	1.53
.714	233.3	1.07
<u>.725</u>	<u>237.5</u>	<u>1.15</u>
1898.717	235.0	1.25

	$\beta 973$	
	AB 8.5 - 12.5	
1898.731	346.5	1.74
.733	353.4	1.64
<u>.739</u>	<u>350.5</u>	<u>1.78</u>
1898.734	350.1	1.72

t	AC, 8.5 - 12 $0 \quad 11.3$	P
1898.731	[11.3]*	10.92
.733	20.1	11.21
<u>.739</u>	<u>21.4</u>	<u>11.16</u>
1898.734	20.7	11.10

* Probably circle read wrong by 10°

	AD = Σ 2435 $8.5 - 12$	
1898.731	3.0	9.72
.733	4.3	10.18
<u>.739</u>	<u>5.3</u>	<u>10.30</u>
1898.734	4.2	10.07

	CD	
1898.731	261.6	3.91
.733	261.8	3.57
<u>.739</u>	<u>260.2</u>	<u>3.82</u>
1898.734	261.2	3.77

	$\beta 974$ $8 \quad 10$	
1898.671	88.9	0.91
.701	85.7	0.91
<u>.703</u>	<u>88.0</u>	<u>0.91</u>
1898.692	87.5	0.91

	$\beta 56$	
t	$8-9.5$	ρ
1898.613	166.9	1.67
.625	166.0	1.57
<u>.666</u>	<u>165.4</u>	<u>1.42</u>
1898.635	166.1	1.55

	$\beta 833$	
t	$AB-8-8.5$	ρ
1898.701	62.9	123.00
.725	63.2	119.92
<u>.744</u>	<u>63.2</u>	<u>119.06</u>
1898.723	63.1	120.66

	AD	$8-12$	[Discovered by Borthing]
1898.701	357.1	43.79	
.725	357.6	43.70	
<u>.744</u>	<u>356.9</u>	<u>43.39</u>	
1898.723	357.2	43.63	

	$B.C.$	$8.5-12.5$	
1898.701	63.6	[1.51]	
.725	58.8	2.08	
.742	61.5	2.64	
<u>.744</u>	<u>60.0</u>	<u>2.28</u>	
1898.733	61.1	2.30	

Dist not good very bad seeing.

	$\beta 267$	
t	$8.5-9.5$	ρ
1898.636	242.2	2.04
.666	239.9	1.88
<u>.668</u>	<u>237.5</u>	<u>2.17</u>
1898.657	239.9	2.03

	$\beta 764$	
t	$AB. 8.5-8.5$	ρ
1898.744	361.0	0.85
.755	355.6	0.86
<u>.758</u>	<u>360.5</u>	<u>0.87</u>
1898.752	359.0	0.86

	$AC.$	$8.5-8$	
1898.744	112.3	100.41	
.755	111.7	100.23	
<u>.758</u>	<u>112.0</u>	<u>100.39</u>	
1898.752	112.0	100.34	

Another companion to C in $180^\circ \pm$
 $50'' \pm 14^{\text{th}}$ mag. discovered by Borthing

	AD	$8.5-8.2$	
1898.744	21.8	137.33	
.755	21.4	138.46	
<u>.758</u>	<u>21.6</u>	<u>137.62</u>	
1898.752	21.6	137.80	

3764 Continued.

t AE 8.5-11.5 [F discovered by Boethius]		
1898.744	89.9	58.75
.755	89.7	59.48
<u>.758</u>	<u>89.5</u>	<u>59.02</u>
1898.752	89.7	59.08

DF 8-13.5 [F discovered by Boethius]

1898.744	193.6	24.82
.755	193.1	24.51
<u>.758</u>	<u>193.6</u>	<u>24.56</u>
1898.752	193.4	24.56

(3765

7-12.5

1898.733	140.7	2.52
----------	-------	------

(3447

6.5-13

1898.613	329.6	8.86
.625	328.2	8.77
<u>.666</u>	<u>332.8</u>	<u>8.60</u>
1898.635	330.2	8.74

3683

8.2 12

t		
1898.618	194.3	2.72
.722	194.9	2.62
1898.695	194.6	2.67

(3478

AB 8.5-10

1898.668	30.1	Seeing too poor for
.742	31.4	1.66
<u>.758</u>	<u>30.2</u>	<u>1.58</u>
1898.723	30.6	1.62

AC 8.5-8.7

1898.668	238.9	28.47
.742	239.8	28.91
<u>.758</u>	<u>239.6</u>	<u>28.68</u>
1898.723	239.4	28.69

AD 8.5-13 [D discovered by Boethius]

1898.668	58.1	18.78 ^{Poor seeing}
[.742]		
<u>.758</u>	<u>57.3</u>	<u>19.06</u>
1898.713	54.7	18.92

$\beta 478$ cont.

t	θ	ρ
1898.668	20.8	[40" $\pm$ 7]
<u>.758</u>	<u>17.3</u>	<u>34.11</u>
1898.713	19.1	34.11

 $\beta 76$
8 - 9.5-

1898.641	337.4	1.52
.660	338.0	1.47
<u>.666</u>	<u>335.8</u>	<u>1.38</u>
1898.656	337.1	1.46

 $\beta 77$

ATB. 8 - 8.5-

1898.625	211.9	2.68
<u>.636</u>	<u>216.1</u>	<u>2.74</u>
1898.630	214.0	2.71

AC. 8 - 10

1898.625	225.2	28.61
<u>.636</u>	<u>225.1</u>	<u>28.06</u>
1898.630	225.1	28.33

 $\beta 1011$
7 - 11

1898.733	297.4	2.14
----------	-------	------

 $\beta 177$
8 - 8

t	θ	ρ
1898.660	275.5	2.79
.673	279.1	2.86
<u>.722</u>	<u>274.6</u>	<u>2.71</u>
1898.685	276.4	2.79

 $\beta 384$

7.5 - 9.5-

1898.630	66.9	1.43
<u>.733</u>	<u>66.5</u>	<u>1.22</u>
1898.681	66.7	1.32

 $\beta 715$

ATB.

7 - 13

1898.641	252.5	3.45
.684	259.4	3.44
<u>.758</u>	<u>259.7</u>	<u>3.65</u>
1898.694	257.2	3.51

A suspected dpl. in $180^\circ \pm$; 0.25-

1898.641 but needs confirmation.

 $\beta 387$

8 - 9

1898.625	70.1	5.98
.666	70.1	5.89
<u>.673</u>	<u>69.7</u>	<u>5.85</u>
1898.654	70.0	5.91

(B 721

AB 8 - 8.5

t	0	P
1898.681	117.1	0.73

 $\frac{AB}{2}, C \quad 7.5 - 12.5 \quad \left[\begin{array}{l} \text{C disconnected} \\ \text{by Buttrick} \end{array} \right]$

1898.681	301.7	21.38
----------	-------	-------

(B 726

8.5 - 10.5

1898.758	326.3	0.89
----------	-------	------

(B 1013

AC. 5.5 - 8

1898.722	296.8	74.06
----------	-------	-------

<u>.758</u>	<u>296.7</u>	<u>74.41</u>
-------------	--------------	--------------

1898.740	296.7	74.23
----------	-------	-------

AB 6 - 6

1898.722	254.0	1.07 ^{Poor} definition
----------	-------	---------------------------------

758	seeing too poor to measure.	
-----	-----------------------------	--

(B 391

7 - 7.2

1898.681	273.5	1.01
----------	-------	------

<u>.711</u>	<u>266.6</u>	<u>1.18</u>
-------------	--------------	-------------

1898.696	270.0	1.09
----------	-------	------

(B 486

5.5 - 11.5

t	0	P
1898.625	8.0	3.00

<u>.733</u>	<u>9.7</u>	<u>3.26</u>
-------------	------------	-------------

1898.679	8.8	3.13
----------	-----	------

(B 256

9 - 9.2

1898.722	251.7	2.51
----------	-------	------

(B 1093

7.5 - 8

1898.681	46.2	0.52
----------	------	------

.711	62.7	0.75
------	------	------

<u>.742</u>	<u>57.6</u>	<u>0.72</u>
-------------	-------------	-------------

1898.711	55.6	0.66
----------	------	------

(B 777

8 - 9

1898.673	167.8	3.95
----------	-------	------

.698	166.3	3.94
------	-------	------

<u>.714</u>	<u>166.9</u>	<u>3.77</u>
-------------	--------------	-------------

1898.695	167.0	3.89
----------	-------	------

	$\beta 494$	
	8 - 8.5	
t	θ	ρ
1898.625	172.3	1.26
.660	173.6	1.31
<u>.663</u>	<u>170.1</u>	<u>1.42</u>
1898.649	172.0	1.33

	$\beta 399$	
	6.5 - 9	
1898.625	304.1	1.69
.660	300.0	1.67
<u>.663</u>	<u>300.9</u>	<u>1.61</u>
1898.649	301.7	1.66

	$\beta 869$	
	8 - 12	
1898.698	195.5	5.15
.742	197.9	5.35
<u>.911</u>	<u>196.4</u>	<u>5.26</u>
1898.784	196.6	5.25

	$\beta 1168$	
	8 - 8.5	
1899.000	202.0	0.72

	$\beta 511$	
	8 - 8.5	
t	θ	ρ
1898.711	159.7	30.28
.714	160.4	30.43
<u>.742</u>	<u>160.2</u>	<u>30.49</u>
1898.722	160.1	30.40

B suspected to be close
dpl in $90^\circ \pm$, $0.2 \pm$

	$\beta 183$	
	8 - 8.7	
1898.709	227.9	2.50
.911	229.4	2.66
<u>.925</u>	<u>230.3</u>	<u>2.65</u>
1898.848	229.2	2.60

	$\beta 514$	
	8 - 10	
1898.681	133.4	6.39
.911	133.1	6.18
<u>.925</u>	<u>132.6</u>	<u>6.35</u>
1898.839	133.0	6.31

	$\beta 738$	
	7 - 8	
1899.000	184.1	0.79

<u>3517</u>			<u>3877 Cont.</u>		
AB 6.5 - 9.5			AC 6.5 - 10.5		
t	θ	ρ	t	θ	ρ
1898.911	248.4	11.37	1898.835	154.1	46.69
			.985	152.2	47.01
AC 6.5 - 9.5			1899.000	153.7	46.43
1898.911	289.2	56.11	1898.940	153.3	46.71
<u>3519</u>			<u>3527</u>		
8.5 - 9.5			8 - 8		
1898.742	60.9	1.05	1898.709	66.2	0.82
.985	54.5	0.85	.931	66.8	0.73
1899.000	57.1	0.89	1899.014	62.9	0.87
1898.909	57.5	0.93	1898.885	65.3	0.81
<u>3520</u>			<u>312</u>		
8.5 - 10.5			7.5 - 10		
1898.709	209.0	0.92	1898.709	271.3	2.14
.925	205.0	0.84	.911	274.9	2.06
1898.817	207.0	0.88	.925	270.9	2.22
			.848	272.4	2.14
<u>3877</u>			<u>3534</u>		
AB 6.5 - 12			8 - 12.5		
1898.835	144.6	11.54	1898.835	194.9	2.55
.985	142.1	11.78	.911	193.4	2.77
1899.000	144.4	11.74	1898.873	194.1	2.66
1898.940	143.7	11.69			

$\beta 1003$

8-13

 θ ρ

t		
1898.931	34.1	2.73

1899.014	34.7	2.79
----------	------	------

1898.972	34.4	2.76
----------	------	------

 $\beta 744$

AB 7.5-8

1898.931	307.3	0.80
----------	-------	------

AC = h 3644; 7.5-11

1898.931	7.2	35.80
----------	-----	-------

AD 7.5-9

1898.931	40.8	44.88
----------	------	-------

 $\beta 882$

8-9.5

1898.835	224.5	2.70
----------	-------	------

.985	255.5	2.75
------	-------	------

1898.910	240.0	2.72
----------	-------	------

 $\beta 186$

8-9.5

1898.835	183.0	1.70
----------	-------	------

.931	177.8	1.52
------	-------	------

.985	184.1	1.72
------	-------	------

1898.917	181.6	1.65
----------	-------	------

 $\beta 312$

7.5-8.5

 θ ρ

t		
1898.835	343.6	3.56

.931	345.4	3.30
------	-------	------

1898.883	344.5	3.43
----------	-------	------

 $\beta 189$

7-11

1898.835	288.8	4.48
----------	-------	------

.931	284.0	4.31
------	-------	------

.985	287.5	4.41
------	-------	------

1898.917	286.8	4.40
----------	-------	------

 $\beta 322$

8-9

1898.835	103.0	2.87
----------	-------	------

 $\beta 16$

6-10

1898.835	351.5	1.82
----------	-------	------

h 2998 = A Oc₂ 20874-5

AB 8-8

1898.722	141.4	5.72
----------	-------	------

Suspect a companion to A in $10^\circ \pm$; $2.0^\circ \pm 12''$

A.C. 8-13.5

1898.722	276.0	8.04
----------	-------	------

C discovered on this date by Boothroyd, not noted by either Herschel or Sec.

O Stone 110

t	$8 - 8.2$	ρ
1898.731	177.2	3.22
Another companion $80^\circ \pm; 50'' \pm$ mag. 10		

Cord. dpl. = Cord. G.C. 29658-9

$8 - 9$		
1898.739	65.1	5.00
$\lambda, 7$		
$8.5 - 10.5$		
1898.862	198.5	9.05
$\lambda, 9$		
$8.5 - 13$		
1898.925	245.9	3.59
$\lambda, 10$		
$8 - 11$		
1898.758	321.0	4.68
.845	325.4	Seeing too poor
.862	322.5	4.05
<u>.911</u>	<u>327.1</u>	<u>4.25</u>
1898.859	324.0	4.33

$\lambda, 15$		
$8 - 10$		
1898.722	313.1	3.05
.862	310.9	2.97
<u>.925</u>	<u>313.7</u>	<u>3.11</u>
1898.836	312.6	3.04
$\lambda, 20$		
$4 - 15$		
1899.022	126.6	46.87
$\lambda, 22$		
$8 - 9$		
1899.046	344.9	0.77
$\lambda, 27$		
$8.5 - 9.5$		
1898.985	349.2	0.56
$\lambda, 36$		
$7.5 - 13$		
1899.014	347.6	8.00
$\lambda, 41$		
$8 - 13.5$		
1899.014	118.9	9.24
$\lambda, 54$		
$8.5 - 13.5$		
1899.008	266.7	13.54

	$\lambda, 60$	
	$8-12.5$	
t	θ	ρ
1899.008	97.3	26.16

	$\lambda, 64$	
	$8.5-10$	
1898.835	71.0	8.08

	$\lambda, 68$	
	AB	$5-14.5$
1899.000	142.9	25.69

	AC	$5-14.5$
1899.000	302.6	28.15

Another companion $160^\circ \pm$; $10'' \pm$ mag. 14.5
not noted by See Discovered by Boothroyd.

	$\lambda, 74$	
	$6-14$	
1899.046	228.9	13.15

	$\lambda, 79$	
	$8-8$	
1899.200	282.3	0.47

<u>.214</u>	<u>296.1</u>	<u>0.60</u>
1899.207	289.2	0.53

	$\lambda, 81$	
	$7.5-8.5$	
t	θ	ρ
1898.997	38.6	8.92
1899.022	38.6	8.86
1899.046	<u>34.3</u>	<u>8.96</u>
1899.022	37.2	8.91

	$\lambda, 82$	
	$8.5-9.5$	
1899.197	349.9	7.20
.211	<u>349.3</u>	<u>7.15</u>
1899.204	349.6	7.17

	$\lambda, 101$	
	AB	$8.5-12$
1898.931	84.7	7.71
1899.214	<u>89.5</u>	<u>7.08</u>
1899.072	87.1	7.40

	A.C.	$8.5-13.5$
1899.214	39.2	10.2
Companion C discovered by Boothroyd.		

	$\lambda, 106$	
	AB	$6.5-12$
1899.197	223.3	16.83
	BC.	$12-12.5$
1899.197	332.2	4.17

	$\lambda, 120$	
t	$8-14$	ρ
1898.997	293.0	6.05
1899.008	293.2	6.26
1899.175	293.8	5.83
<u>.244</u>	<u>294.5</u>	<u>5.90</u>
1899.106	293.6	6.01

	$\lambda, 131$	
	$5-14.5$	
1898.997	127.5	31.32
1899.244	125.9	31.68
<u>.345</u>	<u>126.2</u>	<u>30.39</u>
1899.195	126.5	31.13

	$\lambda, 136$	
	$9-13$	
1899.337	258.6	7.62
<u>.345</u>	<u>262.2</u>	<u>7.21</u>
1899.341	260.4	7.41

	$\lambda, 144$	
	$6-14.5$	
1899.189	175.4	25.82

	$\lambda, 171$	
	$8-8$	
1899.433	295.5	0.50

	$\lambda, 178$	
t	$8-14$	ρ
1899.200	227.5	14.34
.345	233.1	14.06
<u>.430</u>	<u>232.9</u>	<u>14.39</u>
1899.325	231.2	14.26

	$\lambda, 187$	
	$9-13$	
1899.427	38.9	4.26
<u>.436</u>	<u>37.8</u>	<u>5.32</u>
1899.431	38.3	4.79

	$\lambda, 189$	
	$8-13$	
1899.441	254.8	13.46

	$\lambda, 190$	
AB	$8-10$	
1899.189	223.6	7.43
.345	223.6	6.92
<u>.430</u>	<u>223.2</u>	<u>7.17</u>
1899.321	223.5	7.17

	AC	8-13.5	
1899.189	142.8	31.94	
1899.345	143.4	29.66	
<u>.430</u>	<u>142.9</u>	<u>31.35</u>	
1899.321	143.0	30.98	

	$\lambda, 194$	
t	$8 - 8.5$	ρ
1899.200	321.1	0.62
	$\lambda, 199$	
	$8 - 12.5$	
1899.438	227.0	8.11
	$\lambda, 200$	
	$8 - 12$	
1899.441	96.6	10.09
	$\lambda, 202$	
	$AB \ 8.5 - 8.5$	
1899.427	109.5	0.90
.433	107.7	0.84
<u>.436</u>	<u>110.6</u>	<u>0.84</u>
1899.432	109.3	0.86
	$AB, C \ 8 - 12.5$	
1899.427	134.8	29.66
.433	135.9	30.27
<u>.436</u>	<u>134.8</u>	<u>30.73</u>
1899.432	135.2	30.22

	$\lambda, 208$	
t	$6 - 11$	ρ
1899.189	19.9	23.15
.200	20.1	23.19
<u>.427</u>	<u>20.6</u>	<u>23.23</u>
1899.272	20.2	23.19
	$\lambda, 210$	
	$AB \ 8.5 - 8.5$	
1899.430	256.4	0.47
	$\frac{AB}{2} \ C \ 8 - 12$	
1899.430	346.3	25.38
	$\frac{AB}{2}, D \ 8 - 13$	
1899.430	20.3	25.99
	$\lambda, 217$	
	$5.5 - 13.5$	
1899.189	117.4	36.24
197	118.4	35.50
<u>.200</u>	<u>122.0</u>	<u>35.97</u>
1899.195	119.3	35.90
	$\lambda, 224$	
	$8 - 9.5$	
1899.427	343.0	3.39
.438	seeing too poor for anything.	

$\lambda, 227$
 $\begin{matrix} 6 & 14 \\ \theta & \end{matrix}$
 $\begin{matrix} t \\ 1899.200 \end{matrix}$ $\begin{matrix} 70.3 \\ \theta \end{matrix}$ $\begin{matrix} 21.25 \\ \rho \end{matrix}$

$\lambda, 244$
 $8.5 - 9$
 $\begin{matrix} 1899.197 \\ .482 \\ \hline 1899.339 \end{matrix}$ $\begin{matrix} 31.3 \\ 37.0 \\ \hline 34.1 \end{matrix}$ $\begin{matrix} 0.87 \\ 0.71 \\ \hline 0.79 \end{matrix}$

$\lambda, 251$
 AB 3-12.5
 $\begin{matrix} 1899.175 \\ 98.0 \end{matrix}$ $\begin{matrix} 38.89 \\ 10.0 \end{matrix}$
 AC 3-14
 $\begin{matrix} 1899.175 \\ 128.0 \end{matrix}$ $\begin{matrix} 45.0 \end{matrix}$
 AD 3-14
 $\begin{matrix} 1899.175 \\ 128.0 \end{matrix}$ $\begin{matrix} 45.0 \end{matrix}$

D and C discovered by Boothroyd
 not recorded by See.

$\lambda, 256 = C.P.D. 6642(-35)$
 $8 - 12$
 $\begin{matrix} 1899.197 \\ .430 \\ \hline 1899.313 \end{matrix}$ $\begin{matrix} 128.3 \\ 126.8 \\ \hline 127.5 \end{matrix}$ $\begin{matrix} 12.65 \\ 13.09 \\ \hline 12.87 \end{matrix}$

$\lambda, 268$
 $\begin{matrix} 7.5 - 7.5 \\ \theta \end{matrix}$
 $\begin{matrix} t \\ 1899.175 \end{matrix}$ $\begin{matrix} 168.1 \\ \theta \end{matrix}$ $\begin{matrix} 2.03 \\ \rho \end{matrix}$

$\lambda, 270 C$
 $\begin{matrix} 8 - 13 \\ 137.9 \end{matrix}$
 $\begin{matrix} 1899.425 \\ .427 \\ \hline 1899.426 \end{matrix}$ $\begin{matrix} 140.7 \\ 139.3 \end{matrix}$ $\begin{matrix} 9.12 \\ 8.88 \\ \hline 9.00 \end{matrix}$

$\lambda, 332$
 AB 8-12
 $\begin{matrix} 1899.427 \\ 189.1 \end{matrix}$ $\begin{matrix} 7.47 \\ 15.98 \end{matrix}$
 AC 8-12.5
 $\begin{matrix} 1899.427 \\ 0.2 \end{matrix}$ $\begin{matrix} 15.98 \end{matrix}$

$\lambda, 364$
 $\begin{matrix} 8.5 - 9 \\ 95.0 \end{matrix}$
 $\begin{matrix} 1899.485 \\ 95.0 \end{matrix}$ $\begin{matrix} 0.44 \end{matrix}$

$\lambda, 368$
 $8 - 10$
 $\begin{matrix} 1899.427 \\ 305.3 \end{matrix}$ $\begin{matrix} 16.63 \end{matrix}$

$\lambda, 378$

t	θ 8-9	ρ
1899.427	2.6	10.13
<u>.485</u>	<u>3.0</u>	<u>10.37</u>
1899.456	2.8	10.25

 $\lambda, 406$

8.5-11

1898.703	5.7	2.53
.760	4.0	2.68
<u>1899.485</u>	<u>4.3</u>	<u>2.54</u>
1898.983	4.7	2.58

 $\lambda, 419$

9-13.5

1898.760	68.6	7.07
----------	------	------

 $\lambda, 425$

8-11

1898.671	224.4	8.09
<u>1899.512</u>	<u>224.1</u>	<u>7.94</u>
1899.091	224.2	8.01

 $\lambda, 434$

t	θ 8.5-10.5	ρ
1898.671	153.2	4.30
.684	150.3	4.09
<u>.760</u>	<u>150.5</u>	<u>4.04</u>
1898.705	151.3	4.14

 $\lambda, 440$

8.5-12.5

1898.684	72.9	10.04
.711	72.2	10.31
<u>.760</u>	<u>69.0</u>	<u>10.40</u>
1898.718	71.4	10.25

 $\lambda, 446$

4-12

1898.758	12.8	21.38
.760	13.8	21.76
<u>1899.512</u>	<u>14.7</u>	<u>21.40</u>
1899.010	13.8	21.51

 $\lambda, 453$

75-11

1898.714	326.3	11.65
----------	-------	-------

$\lambda, 461$ AB $8.5 - 11$

t	θ	C
1898.701	59.6	3.91
1899.512	62.0	3.91
1899.106	60.8	3.91

AC $8.5 \quad 14$

1898.701	263.1	37.62
----------	-------	-------

C discovered on this date by Brothers,
not noted by Sec. Second companion
in $270^\circ \pm$ and slightly nearer to A
than C, discovered by Mr. Cogshall.

 $\lambda, 463$ $8.5 - 13$

1898.725	116.8	15.68
760	117.2	14.42
.782	118.5	15.30
1898.756	117.5	15.13

Suspect a second companion to A $350^\circ \pm; 2'' \pm$
 " " third " " $170^\circ \pm; 70'' \pm$
 " " fourth " " $240^\circ \pm; 7'' \pm$
 all of 13th mag. none noted by Sec.

 $\lambda, 472.$ $11 - 11.5$

t	θ	C
1898.760	58.0	5.74
1899.512	56.9	5.44
1899.136	57.5	5.59

 $\lambda, 476$ $8 - 14$

1898.856	38.4	3.5 $\pm$
1899.512	42.6	5.66

measure on second date not very
reliable as measures were not
complete being stopped by daylight.

 $\lambda, 482$ $7 - 13.5$

1898.755	95.9	14.71
.856	95.6	13.88
.862	93.0	14.45
1898.824	94.8	14.35

 $\lambda, 487$ $8 - 9$

1898.671	298.1	10.22
----------	-------	-------

Howe 7

t 8-9
 1899.203 202.6 1.93

Howe

 $\Delta = 7^h 57^m \quad \delta = -26^\circ 54'$

8-12.5
 1899.200 329.3 2.69

Jacob 5

8-8.5
 1899.200 201.8 0.65

Inness III $\Delta = 9^h 44^m$

7-12.5
 1899.197 30.4 2.48

Inness III $\Delta = 10^h 14^m$

8-8.5
 1899.200 327.4 0.87

Gilliss 145

7.5-9.5
 1899.197 328.8 22.34

h 4422

t 8-9
 1899.244 349.2 9.81

h 4563

7.5-8.5
 1899.427 238.7 6.61

B 536

8.5-9
 1899.055 212.2 0.51

Faint companion suspected
 in angle $350^\circ \pm$ dist. $4'' \pm$

1899.142 277.5 0.50
 1899.098 244.8 0.50

B 883

7.5-7.5
 1899.203 247.7 0.28
 .214 235.4 0.40 Seeing poor.

OZ 165

6-13
 1899.181 41.8 4.24

0Σ 171

8-10.5-

t
1899.181

135.3

C₁₁₆

(B 599

5.5-10

1899.337

82.7

1.78

Cond. Dpl. A.G.C. 29658-9

8-9

1898.742

66.0

5.01

Ho. 468

8-10

1898.742

347.3

3.79

Harvard 176

8.5-8.5-

1898.742

53.4

5.02

SD 6017 (-21°)

8.5-13.5-

1898.755

65.8

2.36

new discovered by Boothroyd.