

used as a basis. In this way the magnitudes of the variable at maximum and minimum were found to be  $10^{\text{m} \cdot 06}$  and  $10^{\text{m} \cdot 29}$  and the range  $\text{m} \cdot 24$ .

The photographic magnitudes of the two comparison stars used above viz. C. P. D. —  $55^{\circ}3898$  and  $3903$  were found to be  $9^{\text{m} \cdot 81}$  and  $10^{\text{m} \cdot 55}$  respectively, the difference being  $\text{m} \cdot 74$ .

According to this the range observed by my visual estimates is  $\text{m} \cdot 74 \times 15 = \text{m} \cdot 11$ . The corresponding value of FINSEN is  $\text{m} \cdot 74 \times 20 = \text{m} \cdot 15$  and of HERTZSPRUNG  $\text{m} \cdot 74 \times 29 = \text{m} \cdot 21$ , the latter thus agreeing best with the results obtained with the photometer.

The mean error of a single estimate as derived from the difference between 2 observations following each other in phase is found to be for the 3 series:

Number of plates.	Observers.	M. e.
639	K.	$\pm 0.079 \times \text{m} \cdot 74 = \pm \text{m} \cdot 059$
255	F.	$\pm 0.090 \times \text{m} \cdot 74 = \pm \text{m} \cdot 067$
255	H.	$\pm 0.081 \times \text{m} \cdot 74 = \pm \text{m} \cdot 060$ ,

but these values should be considered in the light of the different range observed in each of the 3 series.

No conspicuous difference was found in the depth of even and odd minima, but the period has probably to be doubled, in which case strong doubling of the lines in the spectrum of the variable is to be expected.

I want to express my special thanks to Professor HERTZSPRUNG for the kind help and valuable advice, he gave me during the preparation of this paper and to Mr. VAN GENT and Mr. KUIPER, who introduced me to the practice of the microphotometer.

### Some characteristics of the light-variation of SS Cygni, by *W. E. Kruytbosch*.

As it is well known SS Cygni belongs to the class of semiregular variable stars, of which U Geminorum is the prototype.

The principal characteristics of the variation of SS Cygni are: **1.** that the magnitude varies between the fairly definite limits  $8^{\text{m} \cdot 2}$  and  $12^{\text{m} \cdot 0}$ ; **2.** that the star remains at the nearly constant minimum for somewhat more than half the time; **3.** that the maxima, which interrupt the constant minimum brightness at semiregular intervals of  $50^{\text{d} \cdot 1} \pm 15^{\text{d} \cdot 0}$  (m.e.) are mainly of two kinds, viz. short ones and long ones. In both cases the rise to maximum is generally quicker than the fall. In the case of a long maximum the star ordinarily remains at constant maximum brightness for a few days; **4.** that there is a pronounced tendency of short and long maxima to alternate.

The aim of the present note is to express statistically the characteristics just mentioned by the aid of all the available material up to date.

Among the numerous publications of observed maxima of SS Cyg. those compiled by CAMPBELL in *H.A.* **64** No. 11 for the years 1896 up to 1908\*) and those published annually by the Director of the Variable Star Section of the British Astronomical Association in its *Journal* from 1908 up to 1927 were most fit for my purpose. I could dispose in this way of 218 maxima, only 6 of which are uncertain.

\*) The following errata were found in *H.A.* **64**:

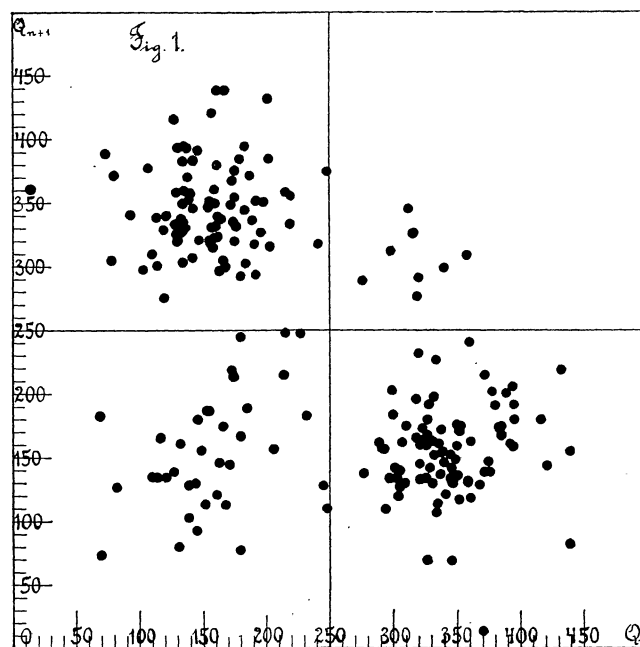
Max. 1897.3.22 Column 85, for 17'7 read 07'

Max. 1898.6.1 J. D. 4432'0 read 4442'0

Max. 1898.7.31 J. D. 4492'6 read 4450'6.

Max. 1898.9.18 J. D. 4541'9 read 4551'9

Max. 1907.5.22 J. D. 7717'1 read 7718'1



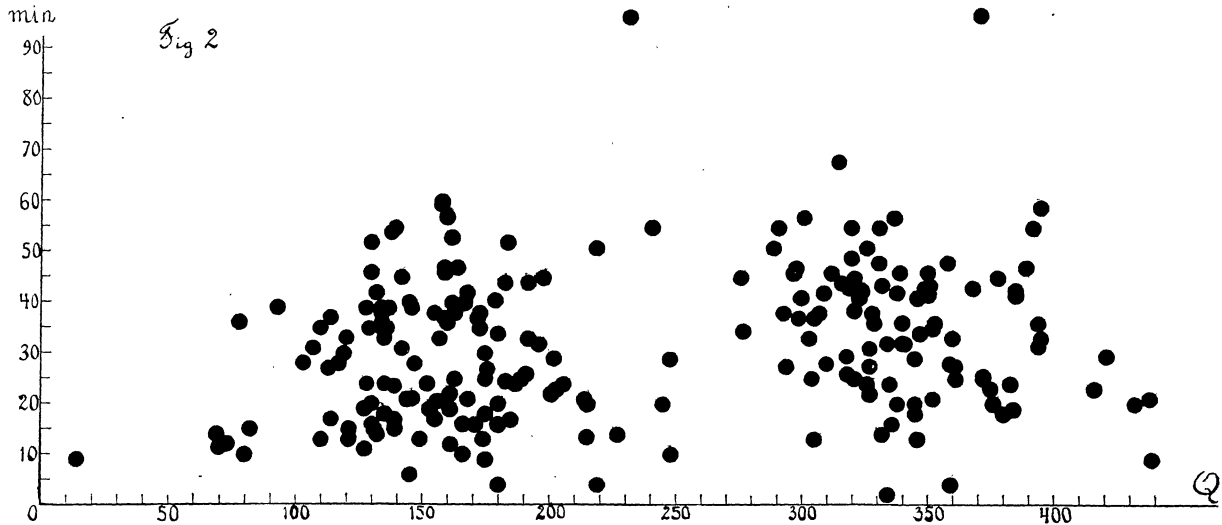
A continuous lightcurve was drawn from 1896 to 1927, on which the beginning and end of each maximum was read off. These points are, of course, more or less uncertain. The main thing is that they are fixed in the same way throughout the whole series. That this has here been done by the same person may be taken as a guarantee in this respect.

Besides the duration of each minimum from beginning to end, defined as just described, the integrated amount,  $Q$ , of light emitted by the star during each maximum was determined by mechanical integration, taking as

unit of intensity the minimum-light corresponding to  $12^m.0$  and as unit of time 1 day.

The results are compiled in Table I in which Column 1 gives the successive numbers of the maxima. No. 84 is the first maximum published by the *B. A. A.* From this maximum the maxima of *H. A. 64* were numbered retrogradely, Nos. 1 and 2 of the latter series were omitted, these first maxima after the discovery of

the variability of SS Cyg. in 1896 by Miss LOUISA WELLS being too incompletely observed. Column 2 gives the year and the calendar date of each maximum brightness, Column 3 the Julian date of idem, Column 4 the duration of the period in days from maximum brightness to next maximum brightness (P), Column 5 the duration of the maximum in days from the beginning of the rise to the end of the fall



(M), Column 6 idem of the following minimum in days (min.), Column 7 idem of the period in days from beginning of the rise to beginning of the next rise ( $P_1$ ), Column 8 the amount of light emitted during maximum (Q).

From the latter curves the points of maximum brightness were taken to determine the period (P) between the consecutive maxima. Because of the asymmetrical shape of most of the maximum curves the values of P and  $P_1$  differ generally, as may be seen in the Table.

A diagram showing the alternation between long and short maxima is given in Figure 1, the amount

of light emitted during one maximum being taken as abscissa and of the following maximum as ordinate. It is seen that the great majority (171) of the 217 pairs of consecutive maxima are clustered in two distinctly separated swarms. Some points represent two maxima. As there are practically no maxima near  $Q = 250$  the diagram may be properly divided into 4 sections separated by the two lines representing  $Q = 250$  for the first or the second maximum of the pair. The numbers of pairs in each of these 4 sections are

86	9
37	85.

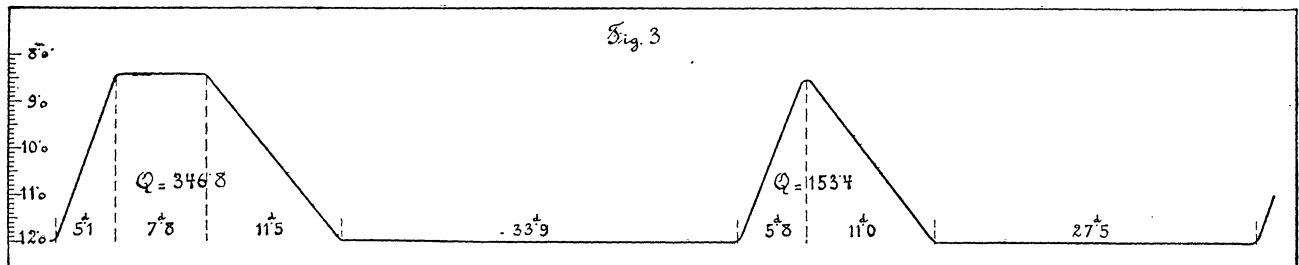


Figure 2 shows the relation between the amount of light emitted during maximum (Q) and the duration of the following (constant) minimum. This duration of the following minimum is only slightly different for long and short maxima, the median values being respectively  $35^d.3 \pm 1^d.4$  and  $27^d.2 \pm 1^d.4$  or the difference  $8^d.1 \pm 2^d.0$ .

Yet this difference indicates that the star in the mean remains longer in minimum after a long maximum than after a short one, though the individual maxima show no appreciable correlation with their following minimum.

The relation given in Figure 2 is not perceptibly altered when the non-alternating pairs of maxima (46) are excluded.

Figure 3 shows the mean light-curve of alternating long and short maxima, derived only from the observations given in the *B. A. A.-Journals* for the years 1908 up to 1927.

According to this normal curve the only systematic difference between long and short maxima is that in the case of the former the variable remains at constant maximum brightness for about a week, while in the case of the latter the decrease begins at once after maximum brightness has been reached. The rate of increase and decrease of brightness is essentially the same in both long and short maxima, the rise is in both cases about twice as quick as the fall, occupying

about 5 and 11 days respectively, the magnitude of maximum brightness is  $8^m.4$  for the long maxima and  $8^m.5$  for the short ones or not materially different.

The unit being the amount of light emitted by a  $12^m.0$  star in one day, the total amount of light emitted by SS Cyg. in all the observed maxima and minima during the years 1908 up to 1927 ( $6940^d$ ) is  $36308.3$  or  $5.2$  per day, corresponding to a constant brightness of  $10^m.2$ .

All attempts claiming to predict the occurrence of the maxima are useless as long as the star persists in its irregular character.

TABLE I.

Succ. Number.	Cal. Date of Maximum brightness.	Julian Date of Maximum brightness.	Duration of period P in days.	Duration of maximum M in days.	Duration of following minimum in days.	Duration of period P <sub>1</sub> in days.	Amount of light during maximum	Succ. Number.	Cal. Date of Maximum brightness.	Julian Date of Maximum brightness.	Duration of period P in days.	Duration of maximum M in days.	Duration of following minimum in days.	Duration of period P <sub>1</sub> in days.	Amount of light during maximum
3	1896 Nov. 21	3885.0	57.0	20.5	40.7	61.2	178.8	48	1903 June 26	6292.0	31.0	15.0	16.0	31.0	130.4
4	1897 Jan. 17	3942.0	64.0	25.5	42.5	68.0	385.0	49	» July 27	6323.0	46.0	20.4	27.6	48.0	326.6
5	» March 22	4006.0	64.0	12.5	42.5	68.0	167.9	50	» Sept. 11	6369.0	46.0	16.0	27.6	48.0	179.8
6	» Apr. 27	4042.0	36.0	13.8	21.0	33.5	113.5	51	» Oct. 16	6404.0	35.0	16.5	20.0	36.0	245.5
7	» June 9	4085.0	43.0	20.8	27.2	41.0	338.7	52	» Nov. 21	6440.0	36.0	15.0	20.0	36.5	127.9
8	» Aug. 11	4148.0	63.0	12.7	45.8	66.6	155.5	53	» Dec. 29	6478.0	38.0	18.0	24.0	39.0	334.4
9	» Oct. 2	4200.0	52.0	18.7	38.0	50.7	321.0	54	1904 Febr. 15	6526.0	48.0	11.0	32.0	50.0	107.1
10	» Dec. 2	4261.0	61.0	12.2	44.8	63.5	160.4	55	» March 30	6570.0	44.0	21.4	30.8	41.8	377.9
11	1898 Jan. 21	4311.0	50.0	18.8	35.6	47.8	331.7	56	» June 2	6634.0	64.0	15.0	44.8	66.2	377.9
12	» March 23	4372.0	61.0	13.0	43.6	62.4	197.8	57	» July 19	6681.0	47.0	23.0	29.0	44.0	202.0
13	» May 22	4432.0	60.0	20.2	44.8	57.8	350.5	58	» Sept. 17	6741.0	60.0	9.4	41.6	64.6	385.0
14	» July 22	4493.0	61.0	11.2	43.5	63.7	135.8	59	» Oct. 29	6783.0	42.0	20.0	30.0	39.4	174.5
15	» Sept. 9	4542.0	49.0	19.2	34.9	46.1	331.2	60	1905 Jan. 11	6857.0	74.0	16.0	55.0	75.0	320.4
16	» Nov. 13	4607.0	58.0	10.4	48.2	67.4	130.4	61	» May 2	6968.0	111.0	10.5	96.5	112.5	231.9
17	1899 Jan. 10	4665.0	58.0	21.6	46.0	56.4	321.4	62	» June 10	7007.0	39.0	21.4	24.6	35.1	183.0
18	» March 9	4723.0	58.0	8.2	38.4	60.0	132.7	63	» Aug. 1	7059.0	52.0	10.6	33.0	54.4	394.8
19	» May 4	4779.0	56.0	19.1	47.1	55.3	338.1	64	» Sept. 13	7102.0	43.0	17.8	27.6	43.6	192.4
20	» July 5	4841.0	62.0	15.3	41.9	61.0	172.2	65	» Oct. 27	7146.0	44.0	11.0	27.6	45.4	294.0
21	» Aug. 27	4894.0	53.0	20.0	37.0	52.3	349.5	66	» Nov. 26	7176.0	30.0	23.0	13.0	24.0	109.9
22	» Oct. 26	4954.0	60.0	13.0	43.0	63.0	149.0	67	1906 Jan. 12	7223.0	47.0	11.0	28.0	51.0	310.4
23	» Dec. 2	4991.0	37.0	20.6	13.0	26.0	156.2	68	» Febr. 17	7259.0	36.0	21.0	25.0	36.0	175.0
24	1900 Jan. 5	5025.0	34.0	20.0	20.4	41.0	156.2	69	» March 28	7298.0	39.0	14.0	18.0	39.0	345.5
25	» March 9	5088.0	63.0	18.0	43.0	63.0	318.6	70	» May 1	7332.0	34.0	13.0	19.0	33.0	152.6
26	» Apr. 27	5137.0	49.0	11.0	34.6	52.6	277.3	71	» June 8	7370.0	38.0	20.0	24.0	37.0	187.0
27	» July 4	5205.0	68.0	20.6	53.8	64.8	137.6	72	» July 20	7412.0	42.0	10.5	25.5	45.5	372.0
28	» Oct. 24	5317.3	112.3	4.2	95.8	116.4	370.5	73	» Sept. 1	7455.0	43.0	26.4	23.6	34.1	139.0
29	» Nov. 10	5334.0	16.7	20.3	8.7	12.9	14.3	74	» Oct. 25	7509.0	54.0	14.0	36.0	62.4	353.1
30	» Dec. 24	5378.0	44.0	10.7	27.3	47.6	361.0	75	» Dec. 4	7549.0	40.0	25.0	18.0	32.0	174.6
31	1901 Febr. 5	5421.0	43.0	29.8	29.8	40.5	118.8	76	1907 Jan. 11	7587.0	38.0	25.0	21.4	46.4	214.4
32	» March 29	5473.0	52.0	17.2	36.0	53.2	329.1	77	» Febr. 11	7618.0	31.0	15.6	13.5	29.1	215.3
33	» May 12	5517.0	44.0	18.7	30.6	42.3	142.3	78	» March 28	7663.0	45.0	11.0	29.2	46.7	248.2
34	» July 9	5575.0	58.0	11.7	41.3	60.0	346.1	79	» May 20	7716.0	53.0	18.0	34.8	45.8	110.0
35	» Aug. 23	5620.0	45.0	18.8	31.2	42.9	142.3	80	» June 23	7750.0	34.0	23.0	18.0	36.0	134.8
36	» Oct. 16	5674.0	54.0	11.0	38.0	56.8	306.8	81	» Aug. 16	7804.0	54.0	14.0	33.0	56.0	359.6
37	» Dec. 8	5727.0	53.0	40.0	40.0	51.0	161.9	82	» Oct. 23	7872.0	68.0	20.0	55.0	69.0	240.8
38	1902 Febr. 5	5786.0	59.0	11.6	42.4	60.4	324.0	83	» Dec. 10	7920.0	48.0	20.0	29.5	49.5	317.7
39	» Apr. 6	5846.0	60.0	19.0	47.0	58.6	164.1	84	1908 Jan. 31	7972.0	52.0	15.5	32.0	47.5	196.3
40	» May 20	5890.0	44.0	17.0	20.0	39.0	338.1	85	» March 10	8011.0	39.0	22.0	21.8	43.8	326.5
41	» July 20	5951.0	61.0	20.0	47.0	64.0	154.3	86	» Apr. 10	8042.0	31.0	16.2	11.5	25.7	70.0
42	» Sept. 9	6002.0	51.0	7.7	34.3	54.3	347.0	87	» May 12	8074.0	32.0	32.0	12.0	28.2	73.5
43	» Nov. 10	6064.0	62.0	20.0	52.0	59.7	129.7	88	» July 24	8147.0	73.0	32.0	47.0	79.0	388.8
44	» Dec. 30	6114.0	44.0	13.3	31.7	51.7	394.2	89	» Sept. 18	8203.0	56.0	22.0	22.0	44.0	200.9
45	1903 Febr. 12	6158.0	49.0	18.5	24.0	37.3	206.1	90	» Nov. 13	8259.0	56.0	26.0	20.0	62.0	431.8
46	» Apr. 2	6207.0	49.0	25.0	33.0	51.5	156.5	91	» Dec. 18	8294.0	35.0	48.0	4.0	30.0	219.0
47	» May 21	6256.0	49.0	12.0	29.5	54.5	421.2	92	1909 Febr. 6	8344.0	50.0	30.0	2.0	50.0	334.2
			36.0		21.0	33.0	143.9				41.0		14.0	44.0	226.5

Succ. Number.	Cal. Date	of Maximum brightness.	Julian Date of Maximum brightness.	Duration of period P in days.	Duration of maximum M in days.	Duration of following minimum in days.	Duration of period P <sub>1</sub> in days.	Amount of light during maximum	Succ. Number.	Cal. Date	of Maximum brightness.	Julian Date of Maximum brightness.	Duration of period P in days.	Duration of maximum M in days.	Duration of following minimum in days.	Duration of period P <sub>1</sub> in days.	Amount of light during maximum
93	»	March 19	8385°		28°			247·8	157	1918	Febr. 4	1629°		22°			328°
94	»	Apr. 27	8424°	39°	31°	10°	38°	374·9	158	»	Apr. 4	1688°	59°	18°	38°	60°	191·9
95	»	June 14	8472°	48°	17°	23°	54°	147°	159	»	June 5	1750°	62°	23°	44°	62°	351·7
96	»	Aug. 3	8522°	50°	28°	28°	45°	320·6	160	»	Aug. 6	1812°	62°	24°	35°	58°	171·3
97	»	Sept. 20	8570°	48°	16°	25°	53°	145·1	161	»	Sept. 8	1845°	33°	18°	16°	40°	145°
98	»	Oct. 14	8594°	24°	12°	6°	22°	93·5	162	»	Nov. 6	1904°	59°	20°	40°	58°	351·7
99	»	Dec. 8	8649°	55°	24°	39°	51°	341·4	163	»	Dec. 16	1944°	40°	12°	21°	41°	116·6
100	1910	Jan. 30	8702°	53°	14°	32°	56°	121°	164	1919	Jan. 24	1983°	39°	14°	28°	40°	165·6
101	»	Febr. 25	8728°	26°	14°	13°	27°	135·1	165	»	Febr. 19	2009°	26°	22°	10°	24°	305·4
102	»	Apr. 16	8778°	50°	20°	33°	47°	335·4	166	»	March 24	2042°	33°	22°	13°	35°	127·4
103	»	May 26	8818°	40°	12°	24°	44°	114·1	167	»	May 1	2080°	38°	17°	11°	28°	415·7
104	»	June 25	8848°	30°	13°	17°	29°	134·8	168	»	June 22	2132°	52°	35°	23°	58°	180°
105	»	Aug. 6	8890°	42°	22°	24°	37°	394·9	169	»	July 17	2157°	25°	13°	4°	27°	78·3
106	»	Oct. 23	8968°	78°	17°	59°	81°	180·2	170	»	Sept. 6	2208°	51°	24°	36°	49°	305·2
107	»	Dec. 14	9020°	52°	19°	34°	51°	293·5	171	»	Nov. 2	2265°	57°	14°	37°	61°	140·3
108	1911	Febr. 5	9073°	53°	14°	38°	57°	157·6	172	1920	Jan. 12	2336°	71°	21°	55°	69°	358·2
109	»	Apr. 22	9149°	76°	21°	59°	73°	331·1	173	»	March 20	2404°	68°	17°	48°	69°	309·3
110	»	July 5	9223°	74°	14°	55°	76°	163·5	174	»	May 17	2462°	58°	14°	42°	59°	130·2
111	»	Aug. 28	9277°	54°	20°	38°	52°	296·7	175	»	June 23	2499°	37°	25°	20°	34°	320·1
112	»	Oct. 31	9341°	64°	13°	46°	66°	134°	176	»	Sept. 4	2572°	73°	20°	49°	74°	291·1
113	»	Dec. 20	9391°	50°	19°	35°	48°	303·9	177	»	Nov. 13	2642°	70°	13°	55°	75°	158·1
114	1912	Jan. 30	9432°	41°	15°	25°	44°	120·3	178	1921	Jan. 30	2720°	78°	20°	60°	73°	314·7
115	»	March 15	9477°	45°	19°	33°	48°	276°	179	»	Apr. 28	2808°	88°	22°	68°	88°	326·1
116	»	May 23	9546°	69°	19°	45°	64°	289°	180	»	July 5	2876°	68°	13°	57°	70°	159·9
117	»	July 30	9614°	68°	14°	51°	70°	162·1	181	»	Sept. 15	2948°	72°	22°	57°	70°	350·4
118	»	Oct. 9	9685°	71°	24°	53°	67°	340·4	182	»	Nov. 22	3016°	68°	25°	46°	68°	159·4
119	»	Dec. 10	9747°	62°	20°	36°	60°	298·9	183	1922	Febr. 4	3090°	74°	22°	46°	71°	360·6
120	1913	Febr. 5	9804°	57°	18°	37°	57°	202·9	184	»	March 25	3139°	49°	16°	25°	47°	162·6
121	»	March 17	9844°	40°	20°	23°	41°	202·9	185	»	May 1	3176°	37°	15°	25°	41°	145·9
122	»	May 23	9911°	67°	22°	44°	64°	315·9	186	»	June 26	3232°	56°	21°	39°	54°	391·7
123	»	July 14	9963°	52°	18°	31°	53°	167·8	187	»	Sept. 9	3307°	75°	13°	55°	76°	160·9
124	»	Sept. 11	0022°	59°	20°	42°	60°	299·9	188	»	Oct. 22	3350°	43°	28°	19°	32°	380°
125	»	Nov. 10	0082°	60°	20°	41°	61°	183·6	189	»	Dec. 3	3392°	42°	29°	18°	46°	191·5
126	1914	Jan. 21	0154°	72°	20°	52°	72°	303·2	190	1923	Jan. 23	3443°	51°	24°	26°	55°	317·8
127	»	March 11	0203°	49°	13°	33°	53°	134°	191	»	March 14	3493°	50°	12°	26°	50°	165·7
128	»	May 5	0258°	55°	21°	39°	52°	350·3	192	»	Apr. 14	3524°	31°	16°	16°	28°	175·5
129	»	July 5	0319°	61°	14°	42°	63°	175·8	193	»	May 21	3561°	37°	9°	25°	375·9	
130	»	Aug. 21	0366°	47°	26°	27°	41°	175·8	194	»	July 1	3602°	41°	33°	20°	53°	139·4
131	»	Oct. 3	0409°	43°	20°	14°	40°	331·9	195	»	Aug. 2	3634°	32°	15°	17°	32°	129·3
132	»	Nov. 7	0444°	35°	14°	24°	44°	113·7	196	»	Sept. 23	3686°	52°	14°	35°	49°	359·2
133	»	Dec. 30	0497°	53°	22°	37°	51°	301°	197	»	Nov. 11	3735°	49°	25°	28°	53°	130·6
134	1915	March 16	0573°	76°	13°	57°	79°	142·3	198	»	Dec. 11	3765°	30°	14°	15°	29°	79·9
135	»	May 15	0633°	60°	22°	45°	58°	383·9	199	1924	Jan. 12	3797°	32°	11°	10°	21°	372°
136	»	June 29	0678°	45°	19°	19°	41°	173°	200	»	March 7	3852°	55°	29°	25°	56°	215·3
137	»	Aug. 26	0736°	58°	24°	38°	57°	368°	201	»	Apr. 20	3896°	44°	32°	20°	49°	359·2
138	»	Oct. 25	0796°	60°	16°	43°	67°	128·5	202	»	May 27	3933°	37°	20°	4°	36°	132°
139	»	Dec. 16	0848°	52°	16°	39°	55°	326·2	203	»	June 26	3963°	30°	17°	14°	34°	161·4
140	1916	Jan. 31	0894°	46°	13°	24°	45°	133·6	204	»	July 31	3998°	35°	15°	22°	39°	120·5
141	»	March 29	0952°	58°	26°	36°	49°	383°	205	»	Sept. 3	4032°	34°	15°	15°	30°	340·2
142	»	May 14	0998°	46°	18°	24°	50°	173·8	206	»	Oct. 25	4084°	52°	23°	32°	55°	145·8
143	»	June 16	1031°	33°	25°	13°	31°	336·2	207	»	Dec. 5	4125°	41°	14°	21°	35°	180·4
144	»	July 21	1066°	35°	16°	16°	41°	161°	208	»	Jan. 9	4160°	35°	21°	16°	37°	167·1
145	»	Aug. 27	1103°	37°	31°	12°	28°	439·2	209	1925	March 12	4222°	62°	18°	40°	58°	438·5
146	»	Sept. 28	1135°	32°	13°	9°	40°	82·1	210	»	Apr. 27	4268°	46°	19°	21°	49°	154·6
147	»	Oct. 24	1161°	32°	13°	15°	28°	126·7	211	»	June 2	4304°	36°	24°	17°	36°	185·4
148	»	Nov. 25	1193°	29°	14°	19°	32°	139·2	212	»	July 13	4345°	41°	22°	17°	41°	188·5
149	»	Dec. 24	1222°	29°	11°	15°	29°	102·5	213	»	Aug. 29	4392°	47°	27°	25°	47°	336·5
150	1917	Febr. 6	1266°	44°	20°	28°	39°	297·7	214	»	Nov. 16	4471°	79°	15°	57°	84°	136·8
151	»	Apr. 15	1334°	68°	23°	47°	67°	312·2	215	1926	Jan. 18	4534°	63°	31°	39°	54°	394·2
152	»	June 21	1401°	67°	22°	46°	69°	345·6	216	»	March 17	4592°	58°	15°	36°	67°	158·6
153	»	July 25	1435°	34°	13°	13°	35°	69·1	217	»	May 16	4652°	60°	25°	37°	52°	323·2
154	»	Aug. 23	1464°	29°	20°	14°	27°	182·7	218	»	July 13	4710°	58°	16°	41°	66°	173·1
155	»	Oct. 22	1524°	60°	21°	44°	64°	345·3	219	»	Sept. 5	4764°	54°	23°	35°	51°	218·7
156	»	Dec. 11	1574°	50°	13°	29°	50°	133·6	220	»	Nov. 19	4839°	75°	23°	51°	74°	356·3