HARVARD COLLEGE OBSERVATORY, CIRCULAR NO. 6

NEW VARIABLE STARS.

An examination of the Henry Draper Memorial photographs of stellar spectra by Mrs. Fleming has led to the discovery of fourteen new variable stars of long period, in addition to those previously announced. The spectrum of the fifth star in the following list is of the fourth type. All of the others have spectra of the third type having also the hydrogen lines bright, and it was this peculiarity which led to their discovery. The variability has been shown by comparison of a large number of photographs, and the variation has been confirmed in each case by the writer. The following table gives the constellation, the catalogue designation of the star, the approximate right ascension and declination for 1900, the number of plates examined, the photographic magnitude, when brightest and faintest as derived from these plates, and the epoch and period as obtained from the material now available. The epoch is expressed in Julian Days omitting the constant 2,410,000. It is needless to caution astronomers, that these elements cannot safely be used to predict future maxima with accuracy. They generally represent the photographic magnitudes during the last eight years, with an average deviation of one or two tenths of a unit. As, however, the periods and light curves in many cases change, the true law can be determined only from long series of observations. The date of the next maximum, as indicated by the formula, is given in the final column.

Constellation	Designation	R. A. 1900	Dec. 1900	No. Plates	Magn.		Epoch	Period	Maximum 1896
					Br.	Ft.			
Sculptor	—39° 16	0h 3m.6	—39° 47′	43	8.9	<12.1	165	295	May 25
Columba	*A.G.C.* 6135	5 15 .6	—33 48	24	7.6	11.3	134	225	June 23
Canis Minor	.....	7 1 .5	+ 9 1	40	10.3	<13.7	174	364	Sept. 11
Virgo	+5° 2708	12 57 .6	+ 5 43	51	8.8	9.7	...	...	.....
Apus	.....	14 59 .3	—71 40	58	9.0	<11.4	...	...	.....
Sagittarius	—33° 13234	18 21 .4	—33 23	48	8.2	12.3	267	316	July 2
Sagittarius	—19° 5347	19 8 .1	—19 2	47	9.7	11.1	...	...	.....
Sagittarius	.....	19 8 .7	—18 59	48	9.9	<13.3	...	...	.....
Pavo	.....	19 39 .5	—72 1	66	7.6	12.1	156	243	Aug. 29
Microscopium	*A.G.C.* 28038	20 21 .8	—28 35	49	7.4	8.4	...	...	.....
Pavo	.....	20 47 .2	—63 5	43	9.6	<12.3	...	...	.....
Grus	—38° 15044	22 19 .9	—38 4	57	8.6	11.0	...	...	.....
Grus	.....	22 19 .9	—48 57	48	7.2	12.3	90	400	May 10
Aquarius	—16° 6379	23 47 .1	—16 25	42	8.2	9.3	...	...	.....

The third of these stars is near the border of Monoceros.

-33° 13234 was suspected of variability by Dr. Thome (*Annals Cordoba Observatory*, Vol. XVII, page xiii).

A. G. C. 28038 is in Sagittarius according to the *Uranometria Nova* and Heis.

EDWARD C. PICKERING.

March 10, 1896.

The dates and corresponding magnitudes for the variable stars given in the above circular are here appended. When the object is not a catalogue star the position determined from a photographic chart is inserted.

—Sculptoris. -39° 16. The magnitudes of this star, as derived from photographs taken on September 2, September 6, September 6, October 1, October 8, October 28, October 29, November 27, 1889; September 8, September 15, 1890; August 9, August 20, August 28, September 17, September 17, October 2, October 25, 1891; July 12, August 5, September 26, 1892; July 22, August 19, August 21, August 21, September 11, September 16, September 27, October 28, November 1, 1893; August 14, August 24, August 25, September 11, October 19, November 10, November 12, 1894; July 10, July 19, August 1, August 3, August 14, September 11, and September 21, 1895, are <12.1, 11.64?, <11.2, <9.1, <10.7, <10.8, <10.3, <9.0; 9.64, 9.50; <9.1, 9.33, <9.3, 11.28, <10.7, <8.7, <8.5; 11.23, <9.4, <9.6; <9.3, <9.7, <11.8, <11.8, <9.0, <9.0, <11.8, 11.13, <9.3; 11.03, <9.2, <8.5, 9.64, 8.93, 9.26, 9.26; 10.82, 9.81, 9.23, 9.23, 9.52, 9.64, and <9.1 respectively.

—Columbae. *A. G. C.* 6135. The magnitudes of this star, as derived from photographs taken on October 8, October 10, October 10, November 13, 1889; September 24, 1890; November 7, December 2, 1891; August 12, September 28, 1892; March 8, September 27, November 18, 1893; September 19, November 5, November 10, November 19, November 26, December 13, December 14, 1894; September 7, September 10, September 19, September 20, and October 5, 1895, are 7.71, 8.25, 7.71, 8.92; <8.4; 10.66, <8.6; 9.23, 7.59; <8.8, 11.26, 9.43; 8.58, <8.7, 10.17, 10.61, <8.4, 11.22, 11.08; 9.53, 9.48, 8.92, 8.86, and 8.56 respectively.

—Canis Minoris. R. A. $6^h\ 59^m\ 5^s$ Dec. $+9^\circ\ 5'.4$ (1855). The magnitudes of this star, as derived from photographs taken on January 16, January 21, 1888; November 14, 1889; February 6, 1890; January 26, February 22, December 10, December 10, 1891; January 20,

February 5, February 6, February 12, February 13, February 18, March 13, 1892; January 19, February 4, February 5, February 15, March 16, November 1, November 24, December 26, December 27, 1893; March 2, March 16, March 24, April 18, October 31, November 6, November 25, November 28, 1894; January 22, February 26, March 30, October 5, October 22, October 24, October 29, and November 12, 1895, are <9.2, <9.9; 11.24; <13.0; <10.9, <13.3, 12.13, <11.2; 13.50, <13.2, <12.8, <11.9, <13.0, <13.3, <13.7; <12.4, 13.55, <13.5, <13.6, <11.3, <10.8, 11.22, <13.7, <11.8; <10.3, <11.9, <11.8, <13.7, <10.3, <9.9, <10.1, <10.0; <10.7, <10.7, <10.3, 10.27, 10.42, 10.63, 10.58, and 11.05 respectively.

—Virginis. $+5^{\circ}$ 2708. The magnitudes of this star, as derived from photographs taken on April 10, 1886; January 13, February 6, April 7, April 16, April 22, April 25, May 12, December 14, December 22, 1890; January 8, March 1, April 24, May 23, May 25, May 28, 1891; January 21, February 4, February 9, February 17, March 20, April 20, April 25, May 13, May 13, May 27, 1892; January 25, April 19, May 9, May 17, May 31, May 31, June 12. June 14, June 29, June 29, 1893; January 19, February 26, May 3, May 14, May 21, May 22, 1894; May 9, May 10, May 10, May 11, May 22, June 6, July 3, July 3, and July 9, 1895, are 9.15; 9.00, 9.10, 9.05, 9.33, 9.33, 9.55, 9.50, 9.20, 9.30; 9.20, 9.05, 9.40, 9.10, 9.27, 9.33; 9.20, 9.20, 9.65, 9.20, 8.95, 9.10, 8.95, 8.90, 8.80, 9.00; 9.05, 8.80, 9.70, 9.20, 8.80, 9.08, 9.20, 9.00, 9.27, 9.05; 9.42, 9.10, 9.00, 9.50, 9.23, 9.35; 9.45, 9.20, 9.36, 9.20, 9.30, 9.24, 9.00, 8.80, and 8.90 respectively.

—Apodis. R. A. $14^{h}\ 56^{m}\ 54^{s}$ Dec. $-71^{\circ}\ 34.'4$ (1875). The magnitudes of this star, as derived from photographs taken on May 31, July 7, July 8, July 9, July 9, July 12, July 12, 1889; June 12, August 2, 1890; June 16, June 16, June 19, June 19, June 27, June 27, 1891; July 24, 1892; May 1, May 1, May 2, May 2, May 2, May 4, May 4, June 23, July 26, 1893; April 18, April 21, May 3, May 14, May 14, May 17, May 17, May 17, June 20, July 7, July 13, August 1, August 9, August 13, August 13, August 14, 1894; February 22, March 5, April 3, April 6, April 8, May 6, May 6, May 7, May 9, June 1, July 8, July 16, July 17, August 2, August 10, August 12, and September 11, 1895, are 9.54, 9.49, 9.69, 9.49, 9.64, 9.59, 9.59; 10.82, <11.4; 9.44, 9.59, 9.69, 9.54, <9.4, 9.38; <9.3; 9.90, 10.00, 9.79, 9.85, 9.85, 9.85, 9.64, 9.38, 9.23; 8.99, 8.99, 9.09, 9.28, 9.28, 9.09, 8.96, 8.94, 9.23, 9.18, 8.94, <8.6, 9.64, 9.09, 8.99, 9.09; <9.0, <9.9, <8.7, 9.90, 9.59, 9.74,

9.59, 9.69, 9.59, 9.49, 9.38, 9.05, 8.79, 9.38, 9.05, 9.09, and 9.43 respectively.

—Sagittarii. -33° 13234. The magnitudes of this star, as derived from photographs taken on June 13, June 26, July 2, July 8, July 24, August 6, August 8, August 8, September 4, October 10, 1889; May 11, May 13, May 22, 1890; May 29, May 29, May 30, May 30, August 5, August 7, September 17, 1891; June 6, July 30, 1892; June 5, June 9, June 14, June 15, June 15, June 24, July 5, July 21, July 22, August 3, 1893; July 7, August 7, August 16, 1894; March 6, June 3, June 4, June 18, June 26, June 29, July 9, July 9, August 15, September 5, September 5, September 6, and September 14, 1895, are <9.8, <8.7, <8.5, 8.72, 8.33, 8.23, 8.43, 8.63, 9.24, <10.2; <8.9, <8.8, 9.18; 8.93, 8.78, 8.83, 8.93, <9.6, <8.7, <10.6; <9.2, <9.2; <9.7, <9.9, <10.1, 12.12, 12.12, 12.08, <10.6, <12.0, 12.26, <9.4; <9.6, 10.90, 10.46; <10.6, 11.40, 11.34, <10.5, <9.8, 9.68, 10.02, 10.12, 8.80, 8.53, 8.57, 8.88, and 8.98 respectively.

—Sagittarii. -19° 5347. The magnitudes of this star, as derived from photographs taken on September 5, November 7, November 11, November 11, 1888; June 29, August 16, September 7, 1889; October 30, 1890; June 1, June 1, June 9, July 15, September 7, September 18, 1891; May 25, June 1, August 18, 1892; April 30, April 30, June 7, July 17, July 31, July 31, 1893; June 27, September 25, November 13, November 13, 1894; June 3, June 4, June 14, June 14, June 18, July 2, July 10, July 10, July 12, July 15, July 21, July 23, July 27, July 30, August 14, August 16, September 7, September 13, September 16, and September 20, 1895, are <8.7, 9.77, 9.67, 9.77; <9.1, 10.58, 10.87; 10.85; 9.81, 9.77, <10.5, <10.0, <9.9, <10.0; <10.1, <9.4, 10.48; 11.12, 10.86, 9.82, <10.1, 10.11, 10.26; 10.11, 10.02, 11.06, 10.68; 10.68, 10.66, 10.65, 10.40, 10.32, 9.82, 9.91, 9.85, 9.81, 10.68, 10.06, 10.01, 9.82, 10.01, 10.21, 10.01, 10.21, 10.11, 9.92, and 10.26 respectively.

—Sagittarii. R.A. $19^{h}\ 6^{m}\ 4^{s}$ Dec. $-19^{\circ}\ 3'.2$ (1855). The magnitudes of this star, as derived from photographs taken on September 5, November 7, November 11, November 11, 1888; June 29, August 16, September 7, 1889; October 30, 1890; June 1, June 1, June 9, July 15, September 7, September 18, 1891; May 25, May 27, June 1, August 18, 1892; April 30, April 30, June 7, July 17, July 22, July 22, July 31, 1893; June 27, September 25, November 13, November 13, 1894; June 3, June 4, June 14, June 14, June 18, July 2, July 10, July 10, July 12,

July 21, July 23, July 27, July 30, August 14, August 16, September 7, September 13, September 16, and September 20, 1895, are <8.7, <11.5, <9.9, <9.9; <9.1, 12.30, <13.2; <11.0; <10.6, <12.0, <10.5, 10.02, <9.9, <10.0; <10.1, <10.2, <9.4, 13.29; 12.20, <13.3, <10.2, <10.1, <12.4, <12.4, <11.4; <10.1, 9.92, 11.46, 11.01; 12.02, 11.90, 11.72, <10.5, <11.4, <10.0, 10.01, 10.81, 10.85, <10.8, 10.68, 10.02, 10.52, 9.96, 10.16, 9.96, 10.18, <10.0, and 10.68 respectively.

—Pavonis. R.A. $19^h\ 36^m\ 40^s$, Dec. $-72^\circ\ 4'.2$ (1875). The magnitudes of this star, as derived from photographs taken on June 7, June 13, June 13, July 8, July 13, August 2, August 12, August 30, 1889; May 28, May 29, 1890; June 11, June 11, June 11, June 13, June 13, June 13, August 24, August 25, August 27, August 29, September 19, 1891; June 24, July 3, 1892; May 2, May 2, May 2, May 2, May 3, June 23, August 26, August 26, October 24, 1893; July 14, July 16, July 16, July 16, July 21, July 23, July 31, July 31, August 1, August 10, August 13, August 14, August 22, September 4, September 10, September 12, November 12, 1894; April 9, April 9, April 10, May 9, May 9, May 9, May 31, June 3, June 15, June 15, July 2, July 2, July 31, August 1, August 3, September 7, and September 15, 1895, are <9.0, 9.12, 9.12, 9.70, 9.96, 10.34, 10.61, <8.1; 12.06, <9.0; 8.38, 8.32, 8.32, 8.96, 9.06, 8.92, <9.7, <10.0, 9.91, <9.9, <10.3; <10.0, <10.4; 7.98, 7.73, 7.73, 7.89, 7.58, 10.34, 11.01, <10.5, <10.9; 11.70, <10.6, 11.62, <10.7, 11.18, <9.7, <9.3, <9.3, <9.3, <11.4, 10.14, 10.06, 9.43, 10.24, 9.12, 10.38, 10.11; 9.50, 9.60, 9.41, 8.23 8.27, 8.02, 8.62, 8.68, 9.33, 9.43, 9.84, 9.73, 10.46, 10.84, <10.4, 11.76, and <9.9 respectively.

—Microscopii. *A.G.C.* 28038. The magnitudes of this star, as derived from photographs taken on July 17, 1888; June 10, July 1, July 2, July 8, August 2, August 5, August 22, September 9, September 20, October 7, 1889; May 14, May 24, June 7, 1890; May 30, May 30, July 16, 1891; June 11, June 13, September 23, 1892; April 30, April 30, July 14, July 17, July 19, July 21, July 21, July 21, August 4, 1893; April 19, April 30, August 11, August 21, October 1, November 12, 1894; April 25, May 10, June 1, June 4, June 6, June 6, June 14, June 27, July 2, August 20, September 6, September 6, September 20, and October 14, 1895, are 7.94; 7.90, <7.9, <8.0, 7.74, 7.80, 7.94, 7.70, <8.2, 7.54, 7.74; 7.94, 8.00, <8.4; 7.94, 8.15, 7.94; 8.00, 8.00, 8.02; 7.92, 7.80, 7.90, 7.90, 8.00, 8.00, 7.67, 7.94, 7.80; 8.18, 8.10,

7.61, 7.80, 8.15, 8.15; 8.31, 8.36, 8.38, 7.94, 7.94, 7.70, 7.84, 7.82, 7.43, 7.90, 8.04, 8.15, 7.94, and 8.15 respectively.

—Pavonis. R. A. $20^h\ 45^m\ 4^s$, Dec. $-63^\circ\ 10'.7$ (1875). The magnitudes of this star, as derived from photographs taken on June 17, July 13, August 16, 1889; September 8, 1890; June 10, June 10, June 10, June 11, June 11, August 19, 1891; June 23, June 23, August 17, September 8, September 8, September 8, September 26, 1892; August 5, August 26, August 26, October 24, October 24, 1893; July 2, July 6, July 9, July 10, July 10, July 14, July 16, August 1, August 10, August 23, September 4, September 15, September 22, 1894; May 9, May 9, May 31, June 3, June 15, July 10, July 31, and August 1, 1895, are <12.0, <10.9, 11.78; <9.3; 10.14, 9.97, 10.31, 10.12, 10.31, <8.9; <8.9, <8.4, <9.8, <12.2, <12.2, <11.3, <10.4; <9.8, <10.5, 11.98, 9.62, 9.77; <9.4, <8.9, <9.8, <10.4, <10.3, <12.3, <11.2, <9.0, 10.62, 9.58, <9.8, 10.02, <9.1; 11.99, 11.84, <9.1, <9.8, 9.60, 9.82, 9.92, and 10.02 respectively.

—Gruis. -38° 15044. The magnitudes of this star, as derived from photographs taken on July 17, July 19, July 22, August 5, August 18, August 19, August 21, September 11, September 30, October 8, 1889; June 12, July 22, September 9, September 15, September 19, October 1, October 2, October 3, 1890; June 14, June 14, July 2, July 18, August 1, August 1, August 6, August 7, August 18, September 6, September 29, October 2, 1891; June 25, July 30, August 23, September 16, 1892; July 12, July 17, July 24, July 27, July 27, July 27, September 15, September 27, September 27, 1893; May 22, May 23, July 14, August 7, August 11, September 27, September 29, 1894; June 7, June 8, June 29, July 3, August 1, October 5, and October 12, 1895, are 8.76, 8.80, 8.76, 8.95, <8.7, <8.5, 9.28, 10.46, <10.0, <10.2; 10.39, <8.4, 8.76, <8.7, 9.13, <8.5, <8.7, <8.6; 8.86, 8.70, <8.7, <9.1, 11.04, 10.73, <9.0, <8.4, <10.8, <9.0, 8.86, 8.96; <8.8, 8.68, 9.44, <8.6; <9.0, 9.03, 9.65, 8.95, 8.95, 9.13, 8.70, 9.47, 9.40; 8.56, 8.80, 10.66, <8.8, 11.00, 8.86, 8.76; 9.37, 9.40, 8.66, 8.68, 8.95, 11.04, and <8.9 respectively.

—Gruis. R.A. $22^h\ 18^m\ 22^s$, Dec. $-49^\circ\ 4'.4$ (1875). The magnitudes of this star, as derived from photographs taken on July 5, July 8, July 13, July 18, July 22, August 3, August 3, August 20, September 11, September 28, September 30, October 10, 1889; May 29, June 10, July 21, July 21, September 12, 1890; June 13, June 13, July 9, August 9, August 10, 1891; August 4, 1892; July 12, July 12, July 27, September

16, September 27, September 27, 1893; May 21, May 22, July 14, July 16, July 30, August 11, September 26, November 5, 1894; May 9, July 3, July 16, July 31, August 1, August 1, August 13, August 20, August 20, October 24, and November 11, 1895, are <11.9, <11.1, <11.4, 11.58, <10.9, 8.73 ?, <8.4, 11.06, 10.66, <10.1, 10.03, 8.71; <8.5, <12.1, <8.3, <8.3, <8.5; <10.7, <11.5, <9.3, <8.4, <8.8; <9.0; <9.8, <9.4, 10.70, <9.8, 12.26, <12.0; 8.62, 8.42, 9.95, 9.80, <9.0, 10.29, <9.3, <9.8; 7.17, 8.47, 9.03, 8.94, 9.15, 9.70, 9.70, <9.8, <8.9, 10.86, and <9.5 respectively.

—Aquarii. -16° 6379. The magnitudes of this star, as derived from photographs taken on January 21, October 31, November 13, 1888; September 6, September 7, December 7, December 7, December 9, December 16, December 28, 1889; July 9, July 11, September 8, September 24, October 12, 1890; August 1, August 13, August 13, August 27, 1891; July 29, September 26, 1892; June 28, June 28, August 7, August 19, September 20, October 3, October 13, October 13, October 17, 1893; September 27, November 13, November 16, November 16, December 13, December 20, 1894; January 2, July 3, July 27, August 3, September 13, and October 18, 1895, are 8.54, 8.67, 9.24; 9.10, 9.10, 9.04, 9.24, 9.20, 9.30, 9.30; 8.34, 8.44, 9.14, 9.10, 9.30; 8.60, 8.54, 8.42, 8.34; 8.94, 8.44; 8.40, 8.52, 8.80, 8.70, 9.04, <8.3, 8.94, 8.70, 8.64; 8.80, 9.00, 9.14, 9.14, 8.37, 8.44; 8.64, 8.60, 9.04, 9.04, 8.15, and 8.64 respectively.