DISCOVERY AND OBSERVATIONS OF STARS OF CLASS Be: SECOND PAPER[1]

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ABSTRACT

This investigation is a continuation of that described in *Mt. Wilson Contr.* No. 294. The new data are in Tables I–V. Table I lists 138 stars found to have a bright $H\alpha$. Of these, 132 are of class B or closely related classes. Most of them are of magnitude 7, 8, or 9. Table II records the intensity of bright $H\alpha$ and of the dark ultra-violet hydrogen lines estimated from objective-prism spectrograms. Table III gives observations with slit spectrographs of the yellow-red spectral region. Approximate intensities of bright $H\alpha$ and of the dark (detached) D lines are indicated. Data from slit spectrograms of the blue-violet region are given in Table IV. The character and intensity of $H\beta$, $H\gamma$, and $H\delta$ are tabulated, and miscellaneous information is included in the notes. Bright $H\alpha$ and $H\beta$ are especially intense in classes Bo–B3 (Table V).

The region of the double cluster in Perseus abounds in Be stars; a single objective-prism photograph showed 48, of which 27 were not previously known.

Many faint Be stars appear reddish, an effect, possibly, of space absorption.

The investigation of bright-line stars of class B, upon which we reported for the years 1919–1924,[2] has been continued intermittently with essentially the same procedure as that described in the earlier paper.

In order to reach fainter stars, the exposures with the 10-inch telescope and objective prism have been increased to approximately four hours for a number of the more useful plates. Several observers have assisted with the work, and to them we express our thanks. The number of objective-prism plates taken since 1919 by various observers is as tabulated:

M. L. Humason	240	R. S. Richardson	8
P. W. Merrill	81	D. P. Morgan	8
N. U. Mayall	17	A. L. Buckman	5
W. C. Miller	10		

Special mention should be made of a remarkable photograph of the region of the double cluster in Perseus, taken by Mayall on October 24, 1930. This plate, 14×17 inches, exposure 4^h24^m, emulsion Ilford Special Rapid Panchromatic, hypersensitized by an am-

[1] *Contributions from the Mount Wilson Observatory, Carnegie Institution of Washington*, No. 456.

[2] *Mt. Wilson Contr.*, No. 294; *Astrophysical Journal*, **61**, 389, 1925.

monia bath, records a bright $H\alpha$ line in the spectra of 48 Be stars and 3 or 4 other objects. Twenty-seven of these stars were not previously known to have bright lines. This plate is probably one of the most valuable objective-prism photographs ever made.

In order to confirm the presence of bright hydrogen lines and to bring out more fully the character of the spectrum, all the stars showing a bright $H\alpha$ line on the objective-prism photographs were observed with a slit spectrograph attached to one of the large reflectors. Table I lists 131 bright-line stars discovered in this manner and, in addition, 7 stars (indicated in the notes) not detected on the objective-prism plates but found to have bright hydrogen lines directly from observations with slit spectrographs. In several of these, the bright $H\alpha$ is too feeble to attract attention on our objective-prism plates.

In a number of instances slit spectrograms failed to confirm the presence of bright hydrogen lines suspected from the objective-prism plates. With the exception of two,[1] these objects are not mentioned here, although a few may actually have had a bright $H\alpha$ at the time of the objective-prism observation.

Table I includes 132 stars of class B or closely related classes and (at the end) 6 miscellaneous objects with bright hydrogen lines. The numbers in the first column are in continuation of those in Table I of *Contribution* No. 294.

[1] H.D. 15570. Bright $H\alpha$ was suspected on an objective-prism plate taken October 24, 1930. A slit spectrogram, of August 1, 1931, shows $H\beta$, $H\gamma$, and $H\delta$ as dark lines, although $H\beta$ may perhaps have wide bright borders. λλ 4634, 4640, and 4686 (*He* II) are bright. The type according to Plaskett's nomenclature is O5f.

B.D.+56°2630. An isolated bright line which appears to be $H\alpha$ was seen on an objective-prism plate taken on August 17, 1928. Low-dispersion slit spectrograms of the blue-violet region, taken on September 21, 1929, and July 16, 1931, do not, however, show distinct bright lines.

TABLE I

DISCOVERY LIST OF STARS HAVING THE *Hα* LINE BRIGHT

M.W. No.	Star	α 1900	δ 1900	Mag.	Spec.
96	B.D.+59° 2829	$0^h\ 1^m.6$	+60° 4′	9.5	Boe
97	B.D.+61° 39	0 14.8	+61 54	8.9	B(0)e
98	H.D. 6343	0 59.4	+65 26	7.1	B5eβ
99	B.D.+60° 180	1 5.9	+60 47	9.4	B(3)e
100	B.D.+62° 285	1 32.2	+62 57	8.5	B(8)e
101	Anon.	1 40.8	+60 12	*12.2**	Bep!
102	B.D.+60° 358	1 42.7	+60 33	9.0	B(3)e
103	H.D. 11554	1 48.4	+57 24	9.2	B(3)e
104	H.D. 11606	1 48.8	+58 47	7.0	B3e
105	B.D.+63° 261	1 50.1	+63 33	9.1	Be
106	H.D. 12302	1 55.6	+59 12	8.2	B3e
107	H.D. 236935	1 57.2	+58 0	9.1	B4e
108	H.D. 12856	2 0.9	+56 38	8.4	B(2)e
109	H.D. 13051	2 2.6	+56 31	8.0	B(0)e
110	B.D.+57° 515	2 5.7	+57 13	9.3	B(3)e
111	H.D. 13661	2 8.1	+54 4	8.6	B(3)e
112	Utrecht 1319†	2 9.0	+56 32	10.8	Be
113	H.D. 14134	2 12.1	+56 40	6.7	cB3eα
114	B.D.+56° 534	2 12.4	+56 37	9.1	Be
115	B.D.+56° 559	2 14.2	+56 51	9.5	Be
116	B.D.+56° 582	2 15.3	+56 50	9.3	B(3)e
117	Utrecht 188†	2 16.2	+57 4	10.1	Be
118	B.D.+58° 458	2 16.2	+58 31	9.4	B(3)e
119	H.D. 14605	2 16.5	+56 8	9.7	B(2)e
120	B.D.+56° 624	2 19.6	+56 39	9.3	B(2)eα
121	H.D. 15238	2 22.2	+60 13	8.4	B8eα
122	Anon.	2 24.6	+60 56	*11.0**	Be
123	B.D.+60° 510	2 26.3	+60 33	9.0	B(9)eα
124	Anon.	2 27.5	+59 0	*11.2**	Be
125	B.D.+59° 516	2 28.4	+60 10	9.5	Be
126	B.D.+58° 492	2 29.3	+58 56	9.5	Be
127	B.D.+57° 607	2 32.8	+57 21	9.5	Be
128	Anon.	2 35.0	+60 50	*11.6**	Bep
129	B.D.+61° 487	2 42.3	+61 41	9.4	B(0)e
130	B.D.+56° 727	2 44.1	+56 32	9.5	B(5)e
131	B.D.+60° 606	2 51.5	+60 12	9.1	Be
132	H.D. 237060	2 56.7	+59 2	8.8	B(5)eα
133	H.D. 237091	3 7.3	+59 32	8.8	Be
134	H.D. 20017	3 7.9	+48 19	7.9	Be
135	H.D. 20134	3 9.1	+59 41	7.5	B2e
136	H.D. 237134	3 17.0	+59 54	8.8	Be
137	H.D. 21212	3 20.3	+62 9	8.7	B2e
138	H.D. 21650	3 24.6	+41 25	7.2	B(5)e
139	B.D.+61° 623	3 31.9	+61 31	8.7	B2e
140	H.D. 23982	3 44.3	+63 11	8.1	B3e
141	H.D. 24560	3 49.3	+44 38	7.8	B(3)e
142	H.D. 26420	4 5.7	+41 52	7.6	B3eα
143	Anon.	4 11.6	+55 46	*11.5**	Bep!
144	H.D. 232971	4 23.7	+53 36	9.0	B(5)e

* Approximate photographic magnitude. The visual magnitude may be brighter because many faint Be stars have fairly high color-indices.

† The Utrecht numbers are from van Maanen's monograph, "The Proper Motions of 1418 Stars in and near the Clusters *h* and χ Persei," *Recherches astronomiques de l'Observatoire d'Utrecht*, 5, 1911.

TABLE I—*Continued*

M.W. No.	Star	α 1900	δ 1900	Mag.	Spec.
145	H.D. 237299	4^h33^m0	+57°43′	8.8	B(3)e
146	Anon.	4 40.0	+46 3	*10.0**	Be
147	B.D.+41° 974	4 43.2	+41 30	9.2	Boe
148	H.D. 31293	4 49.4	+30 24	7.5	Aoep
149	B.D.+41° 1031	4 54.2	+41 7	9.0	B(3)e
150	H.D. 37330	5 32.7	+ 0 55	7.2	B8e
151	H.D. 37806	5 36.1	− 2 46	8.6	Aoe
152	H.D. 39557	5 48.3	+ 0 46	8.9	B(8)e
153	H.D. 42054	6 3.5	−34 18	5.9	B5e
154	H.D. 259440	6 27.6	+ 5 52	9.6	B(5)e
155	H.D. 259597	6 28.1	+ 8 24	8.8	B(3)e
156	H.D. 47054	6 31.6	− 5 8	5.5	B8eα
157	H.D. 49977	6 45.9	−14 0	7.9	B2e
158	H.D. 50123	6 46.6	−31 36	5.6	B8e
159	H.D. 52244	6 55.3	−16 3	9.0	B5e
160	H.D. 52721	6 57.2	−11 9	6.6	B3e
161	H.D. 57386	7 15.9	− 8 15	8.1	B5e
162	H.D. 64109	7 47.2	+ 4 5	8.3	B(8)e
163	H.D. 65079	7 51.9	+ 3 14	7.7	B3e
164	H.D. 65176	7 52.4	− 1 20	8.1	B(5)e
165	H.D. 66700	7 59.6	−31 24	8.0	B3e
166	H.D. 91120	10 26.1	−13 5	5.5	B9eα
167	H.D. 142983	15 52.6	−13 59	4.7	A3seα
168	Anon.	16 58.1	−33 50	*12.5**	Bep
169	H.D. 156325	17 11.8	−32 27	6.4	B6eα
170	C.D.−35°11482	17 13.8	−35 39	9.6	Be
171	H.D. 158319	17 23.5	−16 31	8.7	B5e
172	H.D. 159684	17 30.9	−35 17	7.6	B2e
173	H.D. 160529	17 35.3	−33 27	6.7	cA4eα
174	Anon.	17 39.5	−30 10	*11.5**	Bep
175	H.D. 162718	17 47.3	−24 45	9.0	B(0)e
176	H.D. 165285	18 0.1	−19 58	8.7	B(2)e
177	H.D. 166188	18 4.4	−18 13	9.4	B2e
178	H.D. 166256	18 4.7	+13 28	8.4	Aoe
179	B.D.−20° 5060	18 9.7	−20 23	9.0	B(0)e
180	H.D. 168135	18 13.2	−12 29	8.1	B(8)eα
181	Anon.	18 22.4	− 3 55	*11.0**	Be
182	Anon.	18 24.0	− 6 9	*10.0**	Bep
183	H.D. 171012	18 27.3	−18 26	7.0	Boeα
184	H.D. 171348	18 29.3	−22 10	8.1	B3e
185	H.D. 174886	18 47.7	−10 21	8.1	B3e
186	H.D. 177015	18 57.7	−20 16	7.6	B3e
187	Anon.	19 19.9	+29 28	*10.0**	Bep
188	H.D. 184279	19 28.6	+ 3 34	6.8	B2e
189	B.D.+ 5° 4285	19 41.3	+ 5 44	8.5	B5e
190	B.D.+26° 3723	19 51.1	+26 19	8.7	B5e
191	H.D. 190073	19 58.1	+ 5 28	7.9	Aoep!
192	H.D. 190603	20 0.7	+31 56	5.7	Boeα
193	H.D. 228041	20 6.2	+35 12	9.6	B(3)e
194	H.D. 228548	20 11.4	+39 40	10.8	B(2)e
195	Anon.	20 13.8	+36 34	*10.0**	B(2)e
196	B.D.+40° 4124	20 17.0	+41 2	9.5	B(2)e
197	Anon.	20 19.5	+39 10	*10.8**	Be
198	H.D. 194335	20 20.0	+37 10	5.7	B3e

TABLE I—*Continued*

M.W. No.	Star	α 1900	δ 1900	Mag.	Spec.
199	H.D. 229221	20h20m1	+38° 11′	10.0	Boe
200	H.D. 194883	20 23.0	+54 22	7.2	B2e
201	H.D. 195592	20 27.2	+43 59	7.2	B1e
202	H.D. 195907	20 29.0	+31 19	7.6	B2e
203	Anon.	20 29.2	+40 19	*13.2**	Bep
204	H.D. 198478	20 45.5	+45 45	4.9	B2ea
205	H.D. 198895	20 48.4	+55 7	8.3	B(2)e
206	H.D. 199478	20 52.4	+47 2	5.8	B8e
207	H.D. 201522	21 5.1	+46 51	7.8	B3e
208	H.D. 201733	21 6.4	+45 6	6.5	B(5)e
209	H.D. 203731	21 19.0	+40 16	7.4	B3e
210	H.D. 204722	21 25.5	+43 54	7.5	B3e
211	H.D. 239703	21 31.5	+59 1	9.0	Be
212	B.D.+47° 3487	21 32.2	+47 28	9.1	B3eq
213	H.D. 235565	21 34.3	+51 3	8.8	B(2)e
214	H.D. 208392	21 50.9	+62 8	7.1	B3e
215	H.D. 235683	21 55.6	+51 55	9.0	B(3)e
216	H.D. 209296	21 57.2	+56 14	8.1	B(5)e
217	H.D. 213088	22 23.9	+52 28	8.2	B(8)e
218	H.D. 216057	22 44.6	+53 53	6.1	B8e
219	H.D. 218393	23 2.6	+49 40	6.8	Var
220	H.D. 220058	23 15.7	+55 15	8.5	B(1)e
221	H.D. 220116	23 16.1	+57 43	8.8	B5e
222	H.D. 223387	23 44.0	+56 40	9.2	B(0)e
223	H.D. 223501	23 45.0	+61 39	8.2	B3e
224	H.D. 223960	23 48.9	+60 18	7.0	Aoea
225	H.D. 224055	23 49.7	+61 17	7.2	B2ea
226	H.D. 225094	23 58.3	+63 5	6.3	B2ea
227	H.D. 225160	23 58.9	+61 40	8.6	O8ea
	Miscellaneous				
228	Anon.	1h30m0	+53° 45′	*11.0**	Pec.
229	Anon.	6 13.0	+15 19	*11.2**	Pec.
230	H.D. 59067, 8	7 23.2	−11 21	5.9	Gopea
231	C.D.−30° 5135	7 45.2	−30 53	9.2	Pec.
232	Anon.	19 46.5	+35 26	*11.0**	Pec.
233	B.D.+40° 4220	20 28.8	+40 58	9.1	Oc

NOTES TO TABLE I

No.

101. Anon., 40s following and 2′ N. of B.D.+59°318. Southernmost and photographically faintest star of three.

110. B.D.+57°515. $H\beta$ and $H\gamma$ were discovered to be bright by A. H. Joy in 1924. Bright $H\alpha$ was later found independently by us on an objective-prism spectrogram.

113. Boss 519, H.D. 14134. A weak bright $H\alpha$ line was discovered on a plate taken with the grating spectrograph (see Table III).

119. H.D. 14605. $H\beta$ and $H\gamma$ are bright on a spectrogram taken by G. Strömberg in 1924, but this observation did not come to our attention until after our later independent discovery of a bright $H\alpha$ line on an objective-prism plate.

No.

122. Anon. First star following B.D.+60°500 with nearly the same declination.

124. Anon., 14^s following and 4′ N. of B.D.+58°487. North following of two stars having about the same photographic brightness.

128. Anon., 115^s following and 1′.3 S. of B.D.+60°541.

143. Anon., 30^s preceding and 6′ N. of B.D.+55°866.

146. Anon., 1^s following and 2′ S. of B.D.+46°912. The components of a double to the north point toward this star.

160. H.D. 52721, β G.C. 3795. Probably brighter component.

166. H.D. 91120. A weak bright $H\alpha$ line was discovered on a plate taken with a one-prism slit spectrograph (see Table III). Remark in *HD:* "On a photograph taken Dec. 16, 1904, the line $H\beta$ appears to be double." The Harvard observation might be explained by assuming the bright component of $H\beta$ to have been much stronger than on the Mount Wilson plates (see Table IV), apparently dividing the broad dark $H\beta$ line into two parts.

168. Anon., 9^s preceding and 9′ N. of C.D.−33°11706. Preceding star of three of nearly the same photographic magnitude.

173. H.D. 160529. Remark in *HD:* "Bright lines are suspected."

174. Anon., 51^s following and 1′.5 S. of C.D.−30°14654. North following and photographically fainter of two.

178. H.D. 166256. Brighter component of β G.C. 8385.

181. Anon., 1^s following and 5′ N. of B.D.−4°4470.

182. Anon., 10^s following and 8′.5 N. of B.D.−6°4772. It makes a nearly equilateral triangle with B.D.−6°4772 and B.D.−6°4773 (*Publications of the Astronomical Society of the Pacific*, **43**, 411, 1931).

187. Anon., 14^s preceding and 3′ N. of B.D.+29°3584. Preceding of two stars.

195. Anon., 8^s following and 0′.5 S. of B.D.+36°3990.

197. Anon., 5^s following and 8′ N. of B.D.+38°4053. Southernmost of three stars of about equal photographic brightness.

203. Anon., 22^s preceding and 3′ N. of B.D.+40°4226. A faint companion is approximately 2″ N. preceding.

206. Boss 5389, H.D. 199478. A weak bright $H\alpha$ line was discovered on a plate taken with the grating spectrograph (see Table III). Struve independently suspected $H\beta$ to be bright (*Astrophysical Journal*, **73**, 94, 1931).

218. H.D. 216057. $H\beta$ was independently found to be bright by W. J. S. Lockyer (*Monthly Notices of the Royal Astronomical Society*, **91**, 259, 1931).

219. H.D. 218393. See *Mt. Wilson Contr.*, No. 409; *Astrophysical Journal*, **72**, 315, 1930.

224. H.D. 223960. A weak bright $H\alpha$ line was discovered on a plate taken with the grating spectrograph (see Table III).

225. H.D. 224055. A weak bright $H\alpha$ line was discovered on a plate taken with the grating spectrograph (see Table III).

226. H.D. 225094. A weak bright $H\alpha$ line was discovered on a plate taken with the grating spectrograph (see Table III).

227. H.D. 225160. A weak bright $H\alpha$ line was discovered on a plate taken with a one-prism slit spectrograph (see Table III). The characteristics of the hydrogen lines are those which usually accompany the bright lines λλ 4634, 4640, and 4686. As these bright lines are not definitely seen in this spectrum, however, the classification symbol "e" is used and the star is included with the Be stars.

No.

228. Anon., 21^s preceding and 1′ N. of B.D.+53°340 (*Publications of the Astronomical Society of the Pacific*, **44**, 56, 1932).

229 Anon., 20^s preceding B.D.+15°1151 (same declination); 21^s following and 7′.6 N. of B.D.+15°1146. North preceding and photographically fainter of two stars.

232. Anon., 12^s following and 1′ N. of B.D.+35°3825 (*Publications of the Astronomical Society of the Pacific*, **44**, 56, 1932). NOTE ADDED TO PROOF: Miss Cannon's previous observation of bright lines (*Harvard Bulletin* 778) has just come to our attention. We regret having overlooked it. The star appears as CI Cygni in R. Prager's *Katalog und Ephemeriden veränderlicher Sterne für 1932* (*Kleinere Veröffentlichungen der Universitätssternwarte zu Berlin-Babelsberg*, No. 10, 1931).

Table I*a* shows the distribution in apparent magnitude of the Be stars in three discovery lists.

TABLE I*a*

DISTRIBUTION OF Be STARS IN APPARENT MAGNITUDE

Mag.	Harvard* 1912	M.W.† 1924	M.W. 1932
2.0– 2.9	6	.....	.....
3.0– 3.9	5	2	.....
4.0– 4.9	25	7	2
5.0– 5.9	17	1	7
6.0– 6.9	13	19	9
7.0– 7.9	6	21	24
8.0– 8.9	6	29	37
9.0– 9.9	8	10	35
10.0–10.9	2	1	9
11.0–11.9	.....	.....	6
12.0–12.9	.....	.....	2
13.0–13.9	.....	.....	1
	88	90	132

* *Annals of the Harvard College Observatory*, **56**, 182, 1912.

† *Mt. Wilson Contr.*, No. 294; *Astrophysical Journal*, **61**, 389, 1925.

Table II, arranged in order of right ascension, gives estimates made from objective-prism plates of the intensity of the bright *Hα* and the dark ultra-violet hydrogen lines in these stars. M.W. numbers not appearing in the accompanying Table I refer to Table I of *Contribution* No. 294. The numerical estimates are on the same basis as that for Table II of *Contribution* No. 294. The symbol <2 in the third column means that *Hα* was not definitely seen; v indicates variable. Our plates fail to show a bright *Hα* in a few miscellaneous objects included because of published reports of bright lines. In some of these stars the intensity of the bright lines may have decreased since the earlier observations.

TABLE II

OBJECTIVE-PRISM OBSERVATIONS

M.W. No.	STAR	INTENSITY		DATES	REMARKS
		Bright $H\alpha$	Dark U.V. Hyd.		
				J.D. 2420000+	
1..	H.D. 108	3	o	4414, 4821, 5480	
96..	B.D.+59° 2829	3	.....	4821	
91..	B.D.+61° 8	3	.....	4414, 4821	
2..	H.D. 698	3	(2)	4464, 5480, 6276	
97..	B.D.+61° 39	3	.....	4821	
3..	H.D. 2789	3	.....	4414, 4821	
	H.D. 5394	4	o	4414, 4821, 5476, 5480	γ Cass.
98..	H.D. 6343	2	2	2548, 2578, 4414, 4821, 5476, 5480	
99..	B.D.+60° 180	3	.....	4822	
4..	H.D. 7636	4	(1)	4822, 5476, 5480, 6276	
	H.D. 9105	<2	.....	4822, 5476, 5480, 6274	
5..	B.D.+62° 271	4	.....	4822, 6274	
228..	Anon.	4	.....	6274	
100..	B.D.+62° 285	2	.....	4822, 6274	
	H.D. 10516	4	o	5476, 6274	ϕ Persei
101..	Anon.	5	.....	4822, 5476, 6274	
102..	B.D.+60° 358	3	.....	6274	
6..	H.D. 232552	3v?	(o)	4822, 5476, 6274	B.D.+54°398
103..	H.D. 11554	3	.....	6274	
104..	H.D. 11606	4	1	4822, 5476, 6274	
105..	B.D +63° 261	3	.....	2586, 4822, 6274	
106..	H.D. 12302	3	.....	4822, 5474, 5476, 6274	
107..	H.D. 236935	2	.....	6274	
108..	H.D. 12856	3	(o)	4822, 5476, 6274	
7..	H.D. 12882	3	1	4822, 5476, 6274	
109..	H.D. 13051	3	(o)	4822, 5476, 6274	
110..	B.D.+57° 515	3	.....	6274	
111..	H.D. 13661	3	(o)	2233, 2586, 4822, 5474, 5476, 6274	
112..	Utrecht 1319	3	.....	6274	
114..	B.D.+56° 534	3	.....	6274	
115..	B.D.+56° 559	4	.....	6274	
	B.D.+56° 573	4	.....	6274	
116..	B.D.+56° 582	3	.....	6274	
117..	Utrecht 188	3	.....	6274	
118..	B.D.+58° 458	2	.....	6274	
119..	H.D. 14605	2	.....	6274	
120..	B.D.+56° 624	2	.....	6274	
121..	H.D. 15238	4	.....	6274	
	H.D. 15325	<2	.....	5474	
	H.D. 15450	3	(o)	5476, 6274	
122..	Anon.	4	.....	6274	
123..	B.D.+60° 510	2	.....	6274	
124..	Anon.	2	.....	6274	
125..	B.D.+59° 516	4	.....	6274	
126..	B.D.+58° 492	3	.....	6274	
127..	B.D.+57° 607	3	.....	6274	

TABLE II—*Continued*

M.W. No.	Star	Intensity		Dates	Remarks
		Bright *Hα*	Dark U.V. Hyd.		
				J.D. 2420000+	
128..	Anon.	5	.....	6274	
129..	B.D.+61° 487	3	.....	6274	
	H.D. 17505	<2	.....	4414, 4464, 4493, 5474, 5476, 6247, 6274	
130..	B.D.+56° 727	2	.....	6274	
131..	B.D.+60° 606	4	.....	6274	
132..	H.D. 237060	2	.....	6274	
8..	H.D. 19243	3v?	1	4414, 4464, 4493, 5474, 5476, 5918, 6247, 6274	
133..	H.D. 237091	3	.....	6274	
134..	H.D. 20017	2	.....	6276	
135..	H.D. 20134	2	(2)	2233, 2578, 4464, 5474, 6247, 6274	
	H.D. 20336	4	(1)	4414, 5476, 6247	
136..	H.D. 237134	4	.....	6274	
137..	H.D. 21212	3	(0)	2578, 4414, 4464, 4493, 5474, 6247, 6274	
138..	H.D. 21650	2	(2)	6276, 6333	
	H.D. 22192	4	2	4464, 4493, 5474, 5918, 6276, 6333	ψ Persei
9..	H.D. 22298	<2	(1)	4464, 4493, 5474, 6247, 6274, 6276	
139..	B.D.+61° 623	3	(0)	6247, 6274	
11..	H.D. 23480	3	2	4848, 6334	Merope
140..	H.D. 23982	3	(2)	4414, 5474, 6247, 6274	
	H.D. 24534	3	(0)	4848, 5294, 6334	X Persei
141..	H.D. 24560	2	.....	6323	
12..	H.D. 25348	(3) v?	0	4464, 4493, 6247, 6276	
	H.D. 25940	3	2	4464, 4493, 4936, 5474, 6323	c Persei
142..	H.D. 26420	3	(0)	6323, 6333	
	H.D. 26906	3	(3)	4936, 6276, 6323, 6333	
143..	Anon.	4	.....	6247, 6276	
144..	H.D. 232971	3	.....	6276	
145..	H.D. 237299	2	.....	6247	
13..	H.D. 29866	3	2	6323	
146..	Anon.	3	.....	6276, 6323, 6333	
147..	B.D.+41° 974	3	.....	6323, 6333	
148..	H.D. 31293	3	.....	5295, 6334	
149..	B.D.+41° 1031	3	.....	6323	
	H.D. 32343	(3)	2	6247	11 Camelop.
	H.D. 32991	4	(1)	4415, 5295	
15..	H.D. 33152	4	.....	4936, 6248, 6323	
16..	H.D. 33232	3	(1)	4936, 6248, 6323	
17..	H.D. 33461	2	.....	6248, 6323	
18..	H.D. 33604	2	(1)	6248, 6323	
	H.D. 34921	4	(0)	4936, 6248, 6323	
	H.D. 35345	3	.....	4936, 6248, 6323	
	H.D. 35439	3	.....	5293, 6338	25 Orionis
	H.D. 36576	3	(2)	4415, 4465	120 Tauri

TABLE II—*Continued*

M.W. No.	Star	Intensity: Bright *Hα*	Intensity: Dark U.V. Hyd.	Dates	Remarks
				J.D. 2420000+	
19..	H.D. 37115	2	.....	6338	
	H.D. 37202	3	1	4415, 4465	ζ Tauri
150..	H.D. 37330	2	.....	6338	
20..	H.D. 37490	2	(2)	5293	ω Orionis
21..	H.D. 37657	3	(1)	6248, 6275, 6323	
151..	H.D. 37806	2	.....	6338	
22..	H.D. 37967	3	(2)	4415, 4822	
152..	H.D. 39557	2	.....	6338	
27..	H.D. 41117	<2	(0)	4465, 4822	χ^2 Orionis
	H.D. 41335	3	2	5293, 5659, 6338	
153..	H.D. 42054	3	2	4946	
92..	H.D. 42474	4	.....	4822	
29..	H.D. 43285	v?	2	4822, 5293, 5659, 6338	
229..	Anon.	4	.....	4822, 6340	
	H.D. 44458	3	0	4945	
30..	H.D. 44637	3	.....	4822, 6340	
31..	H.D. 45314	3	(1)	4822, 6340	
32..	H.D. 45542	<2	2	4465	ν Geminorum
	H.D. 45677	5	.....	4945, 5296, 6335	
	H.D. 45725	4	1	4848, 5293, 5296, 6338	Brightest comp. β Mono.
33..	H.D. 45910	4	.....	4822, 4848, 5293, 5659, 6338, 6340	
34..	H.D. 45995	3	2	4465, 4822, 6340	
	H.D. 259431	3	.....	4822, 6340	N.G.C. 2247
154..	H.D. 259440	3	.....	2624, 6340	
155..	H.D. 259597	2	.....	6340	
156..	H.D. 47054	2	3	4848, 5293, 5659, 6338	
	H.D. 47129	<2	(0)	4822, 4848, 5293, 5659	
	H.D. 48917	4	1	4939, 4946, 5652	
157..	H.D. 49977	4	(0)	2700, 5296, 6335	
	H.D. 50013	4	1	4939, 4946, 5652	κ Can. Maj.
	H.D. 50083	3v?	(1)	4848, 5326, 5659, 6337, 6340	
158..	H.D. 50123	3v?	2	4939, 4946, 5652	
35..	H.D. 50138	3	(3)	4848, 5296, 5326, 5659, 6335	
36..	H.D. 50209	2	.....	5326, 5653, 6337	
37..	H.D. 51354	2	2	4965, 6340	
	H.D. 51480	4	.....	4848, 5296, 6335	
	H.D. 51585	5	.....	6340	
159..	H.D. 52244	3	.....	5296, 6335	
160..	H.D. 52721	3	2	5296, 6335	
	H.D. 53179	4	.....	5296, 6335	
	H.D. 53367	2	(0)	4848, 5296, 6335	
	H.D. 54309	3	1	5652	
38..	H.D. 55135	3	.....	5296, 6335	
39..	H.D. 55271	3	3	5296, 6335	
	H.D. 56014	2	1	4939, 5652	27 Can. Maj.
	H.D. 56139	3	0	4939, 5652	ω Can. Maj.
	H.D. 57150	3	2	4937, 4938, 4939, 5652, 6334	v^1 Puppis

TABLE II—*Continued*

M.W. No.	Star	Intensity		Dates	Remarks
		Bright *Hα*	Dark U.V. Hyd.		
				J.D. 2420000+	
161..	H.D. 57386	2	.....	5296, 6335, 6338	
	H.D. 58011	3	(1)	4939, 5652, 5654, 6334	
	H.D. 58343	2	2	5296, 5654	
	H.D. 58978	3	(1)	5296, 5652, 5654, 6334	
230..	H.D. 59067, 8	3	.....	5296, 6335	
42..	B.D.−13° 2040	2	.....	6335	
44..	H.D. 59773	<2	.....	6334, 6335	
	H.D. 60606	4	2	4937, 4938, 5652, 6334	z Puppis
	H.D. 60848	2	(0)	4965, 6340	
45..	H.D. 62753	3	(0)	4937, 4938	
	H.D. 63462	2	0	5654, 6334	o Puppis
231..	C.D.−30° 5135	(2)	.....	6334	
162..	H.D. 64109	3	2	6337, 6338	
163..	H.D. 65079	3	2	5326, 6337, 6338	
164..	H.D. 65176	3	.....	6338	
	H.D. 65875	4	1	5326, 6338	
165..	H.D. 66700	3	.....	4938, 6334	
	H.D. 68980	4	1	4937, 4938, 6334	r Puppis
167..	H.D. 142983	3	1	5326	
	H.D. 148184	4	1	5326	χ Ophiuchi
	H.D. 151804	3	0	4259, 5064	
	H.D. 152408	3	0	4259, 5064	
46..	H.D. 154218	4	2	4259, 5064	
47..	H.D. 154243	4	(1)	4259, 5064	
168..	Anon.	4	.....	5064	
48..	H.D. 154450	4	(0)	4259, 5064	
	H.D. 155806	4	0	4259, 4652, 5064	
	H.D. 155851	4	.....	4259, 4652, 5064, 5065	
169..	H.D. 156325	3	2	4652, 5064	
49..	H.D. 156468	3	1	4259, 4652, 5064	
170..	C.D.−35°11482	3	.....	5064	
171..	H.D. 158319	3	(1)	4676	
172..	H.D. 159684	3	(0)	2878, 4652, 5064	
50..	H.D. 160095	<2	(0)	4652	
51..	H.D. 160202	4	2	4259, 4652, 5064	
173..	H.D. 160529	3	.....	4259, 4652, 5064	
52..	H.D. 161103	3	.....	4259, 4319, 4652, 5064, 5065	
	H.D. 161114	4	.....	4653, 4676, 5083, 5474	XX Ophiuchi
174..	Anon.	5	.....	2541, 2542, 2877, 2878, 4652, 5064, 5065	
53..	H.D. 161306	4	.....	4288, 4653, 4676, 4730, 5066, 5083	
54..	C.D.−27°11944	5!	.....	4259, 4288, 4652, 5064, 5065	
	H.D. 162586	<2	.....	4652, 5064	
175..	H.D. 162718	4	.....	2877, 2878, 4288, 5065	
55..	H.D. 163181	3	0	4652, 5051, 5064, 5065	
56..	H.D. 163296	3	3	4288, 4653, 5065, 5066, 5804	
57..	H.D. 163454	3	.....	4652, 5064	
58..	H.D. 163868	3	(2)	4652, 5051, 5064, 5065	

TABLE II—*Continued*

M.W. No.	Star	Intensity: Bright *Hα*	Intensity: Dark U.V. Hyd.	Dates	Remarks
				J.D. 2420000+	
	H.D. 164794	<2	.....	4319, 4652, 5065, 5476	
59..	H.D. 164906	3	.....	4288, 4319, 5065	
176..	H.D. 165285	3	.....	4288, 4319, 4653, 5065, 5804	
177..	H.D. 166188	2	.....	4288, 4653	
178..	H.D. 166256	(2)	.....	2550	
60..	H.D. 166566	3	.....	4288, 4319, 5066	
61..	H.D. 166666	2	.....	4653, 5066	
62..	H.D. 166734	<2	.....	4288, 4653, 5066, 6507	
179..	B.D.−20° 5060	4	.....	4288	
	H.D. 167362	4	.....	4652, 5051, 5065	
180..	H.D. 168135	2	(2)	2903, 4288, 4653, 6507	
63..	H.D. 168229	3	.....	4288, 4653, 5065, 5066, 5476	
64..	H.D. 168607	3	.....	4288, 4319, 4653, 5066, 5804	
65..	H.D. 169226	2	.....	4653, 5066, 6507	
66..	H.D. 169454	3	0	4288, 4319, 4653, 5066, 5479, 6507	
67..	H.D. 169515	3	.....	4288, 4319, 4653, 5066, 5479, 6507	RY Scuti
68..	H.D. 169805	3	.....	4288, 4319, 4653, 5066, 5479	
181..	Anon.	5	.....	5475, 6507	
69..	H.D. 170061	3	.....	4319, 5066	
	H.D. 170235	3	0	4288, 4319, 5476	
182..	Anon.	3	.....	6507	
183..	H.D. 171012	2	.....	2411, 5476, 5479	
184..	H.D. 171348	3	(0)	5415, 5476	
70..	H.D. 172694	3	(0)	4653, 5036, 5066, 5479	
	H.D. 173219	(3)v?	(0)	4288, 5036, 5475, 6507	
71..	H.D. 174105	2	3	4730, 5037, 5090	
185..	H.D. 174886	3	2	5036, 5479, 6507	
186..	H.D. 177015	2	(0)	5036, 5476	
	H.D. 178175	2	2	4676, 4732, 5476, 5479	
73..	H.D. 180398	<2	(2)	4317, 4329, 4730, 5068, 5090, 5383	
	H.D. 181615, 6	3v?	1	4651, 4676, 4732	*υ* Sagittarii
74..	B.D.+14° 3887	4	.....	4329, 5068, 5090	
187..	Anon.	4	.....	4415, 6248	
75..	B.D.+22° 3687	4	.....	4329, 4415, 4730, 5090	
76..	H.D. 183143	2	(0)	4329, 4730, 5090	
	H.D. 183362	4	1	6535	
188..	H.D. 184279	3	.....	5804	
189..	B.D.+ 5° 4285	3	(2)	5068, 5804	
77..	H.D. 187399	3	1	4414, 4415, 4730, 5090, 6248	
78..	H.D. 187567	4	2	4675, 5068, 5090, 5804	
232..	Anon.	5	.....	6535	
190..	B.D.+26° 3723	3	(0)	5090, 6248	
191..	H.D. 190073	3	3	5068, 5804	
192..	H.D. 190603	3	0	4678, 5090	
79..	H.D. 227611	4	.....	4414, 4415, 4678, 6248, 6535	B.D.+35°3950
	H.D. 190944	4	(0)	4678, 4731, 6247, 6535	

TABLE II—*Continued*

M.W. No.	Star	Intensity		Dates	Remarks
		Bright *Hα*	Dark U.V. Hyd.		
				J.D. 2420000+	
	H.D. 191610	3	2	4414, 4415, 4678	b^2 Cygni
193..	H.D. 228041	2	.....	6248	
	H.D. 191917	2	(2)	4414	
	H.D. 192044	3	2	4415, 5090, 5805	
80..	H.D. 192445	3	2	4414, 4415, 4678, 6248, 6535	
81..	H.D. 228438	v	.....	4414, 4415, 4678, 6535	B.D.+36°3946
194..	H.D. 228548	3	.....	6535	
	H.D. 193009	3	(1)	4414, 4415, 4678, 5090, 6535	
195..	Anon.	3	.....	6535	
93..	H.D. 193182	3	3	4414, 4415, 4678, 6248, 6535	
	H.D. 193237	4	0	4414, 4415, 4678, 5918, 6535	P Cygni
	H.D. 193516	<2	.....	4678, 6535	
196..	B.D.+40° 4124	4	.....	6535	
	H.D. 193911	3	2	5090, 5805	
197..	Anon.	4	.....	4414, 4678	
198..	H.D. 194335	3	2	2579, 2580, 4414, 4678	
199..	H.D. 229221	4	.....	4678, 6535	
200..	H.D. 194883	4	.....	4788, 6247	
82..	H.D. 195407	4	(0)	4414, 4678, 6535	
201..	H.D. 195592	2	.....	2489, 4678, 5475, 6247	
202..	H.D. 195907	3	.....	2580, 4678, 6535	
203..	Anon.	4	.....	2579, 2961, 4678, 6535	
	H.D. 198183	3	2	4678	λ Cygni
94..	H.D. 198287, 8	4	2	4414, 4678, 5475, 6535	
204..	H.D. 198478	2	1	4414, 5475	55 Cygni
83..	H.D. 198512	3	(0)	4731, 4788, 4789, 5475, 5476, 6247	
205..	H.D. 198895	3	.....	2996, 4731, 4788, 4789, 5476, 6247	
84..	H.D. 199218	2	2	4414, 4678, 4789, 5475, 6535	
	H.D. 199356	3	(0)	4414, 4678, 4789, 5475, 6535	
	H.D. 200120	3v?	1	4414, 4678, 4788, 5475, 6247	f^1 Cygni
	H.D. 200775	4	1	5917, 6274	N.G.C. 7023
207..	H.D. 201522	2	3	5475, 6247	
208..	H.D. 201733	2	2	5475, 6247	
	H.D. 202904	3	2	5918	υ Cygni
85..	H.D. 203025	2	1	4789, 5474, 5476, 5479, 6274	
	H.D. 203374	4	0	4731, 4788, 5476, 5479, 5917, 6274	
	H.D. 203467	3	1	4495, 4731, 5476, 5479, 5917, 6274	6 Cephei
	H.D. 203699	<2	.....	5480	
209..	H.D. 203731	3	.....	5475	
210..	H.D. 204722	2	1	5475, 5915	
211..	H.D. 239703	3	.....	5479, 6274	
212..	B.D.+47° 3487	3	.....	5475	
213..	H.D. 235565	3	(0)	2996, 4789, 5474, 5476, 5915	
	H.D. 206773	v	0	4495, 4731, 4789, 5474, 5476, 5479, 6274	

TABLE II—*Continued*

M.W. No.	Star	Intensity: Bright *Hα*	Intensity: Dark U.V. Hyd.	Dates	Remarks
				J.D. 2420000+	
86..	H.D. 207232	<2	2	4415, 4789, 5474, 5475, 5915	
	H.D. 207757	5	(2)	5480	B.D.+11°4673
214..	H.D. 208392	3	1	5476, 5479, 6274	
	H.D. 208816	3	0	4495	Boss 5650
215..	H.D. 235683	2	.....	5474	
216..	H.D. 209296	2	.....	5479, 6274	
	H.D. 209339	<2	1	4495, 5476, 5479, 6274	
88..	H.D. 212044	3	1	4495, 5474, 5475, 5476, 5479, 5915	
	H.D. 212076	3	2	5480	31 Pegasi
217..	H.D. 213088	2	(2)	5474	
	H.D. 214168	3	1	4415, 5915	8 Lacertae
95..	H.D. 214369	V	.....	4495, 5474, 5476, 5479, 5917, 6274	W Cephei
218..	H.D. 216057	3	2	5474, 5479	
	H.D. 217050	3	2	4415, 4495, 5474, 5915	
219..	H.D. 218393	2	(1)	2647, 4495, 5474, 5915, 6276	
220..	H.D. 220058	3	(0)	4821, 5474, 6276	
221..	H.D. 220116	2	.....	2997, 4821, 5474, 5479, 6276	
222..	H.D. 223387	(3)	.....	2548	
223..	H.D. 223501	3	2	2566, 4414, 4821, 5480	
90..	H.D. 224559	4	2	4464, 6276	
	H.D. 225095	V	0	4414, 4821, 5480, 6276	

NOTES TO TABLE II

No.

H.D. 9105. See *Publications of the Astronomical Society of the Pacific*, **34**, 180, 1922.

6. H.D. 232552, B.D.+54°398. *Hα* was probably more intense on the last date than on the earlier dates, including J.D. 2524, 2586.*

104. H.D. 11606. *Hα* was apparently less intense (estimated 2) on J.D. 2580 and 2586 than on the dates given in the table.

7. H.D. 12882. *Hα* was possibly weaker on the second date than on the other two. H.D. 15325, β G.C. 1277 Br. Bright *Hα* is not certainly seen.*

8. H.D. 19243. The observations suggest that the intensity of *Hα* is subject to rapid fluctuations.

9. H.D. 22298. The intensity of *Hα* was possibly greater on J.D. 2730,* but the observation is doubtful.

12. H.D. 25348. *Hα* was possibly more intense on the last date than on the other three.

22. H.D. 37967. *Hα* appeared to be more intense than on J.D. 2728, 3104.*

29. H.D. 43285. *Hα* was probably more intense on the last two dates than on the earlier dates, including J.D. 3080.*

31. H.D. 45314. *Hα* was possibly more intense than on earlier dates.*

H.D. 50083. *Hα* was probably less intense on the first date than on the other four.

* *Mt. Wilson Contr.*, No. 294; *Astrophysical Journal*, **61**, 389, 1925.

No.

158. H.D. 50123. $H\alpha$ appeared less intense on the last date than on the other two.
H.D. 161114, XX Ophiuchi. See *Mt. Wilson Contr.*, No. 444; *Astrophysical Journal*, **75**, 133, 1932.
H.D. 173219. $H\alpha$ was probably more intense on the last date than on the earlier dates, including J.D. 2903.*

73. H.D. 180398. $H\alpha$ was probably less intense than on J.D. 2938 (*Mt. Wilson Contr.*, No. 409; *Astrophysical Journal*, **72**, 98, 1930).*
H.D. 181615, 6, υ Sagittarii. Estimates of the intensity of $H\alpha$ are: J.D. 4651, <2; 4676, 3; 4732, 3.

81. H.D. 228438, B.D.+36°3946. Estimates of the intensity of $H\alpha$ are: J.D. 4414, 3; 4415, 3; 4678, 4; 6535, <2. This variation corresponds to that shown by $H\beta$ and $H\gamma$.
H.D. 200120, f[1] Cygni. Estimates of the intensity of $H\alpha$ are: J.D. 4414, 2; 4678, 3; 4788, 2−; 5475, 4; 6247, 3.
H.D. 206773. $H\alpha$ was less intense on the first and last dates than on the others, including J.D. 2996.*

88. H.D. 212044. The intensity of $H\alpha$ may vary slightly, but the estimate of 1 for J.D. 2996* appears upon re-examination to be too low.

95. H.D. 214369, W Cephei. Estimates of the intensity of $H\alpha$ are: J.D. 4495, 3; 5474, <2; 5476, 3; 5479, 4; 5917, 2; 6274, 2.
H.D. 225095. $H\alpha$ was weaker on the first date than on the others, including those listed in *Mt. Wilson Contr.* No. 294.

Our objective-prism observations extend over more than twelve years, and changes in the intensity of $H\alpha$ are suspected in numerous stars. Variations in the width and definition of the images and in the photographic excellence of the plates give rise, however, to many apparent changes which are difficult to separate from intrinsic changes in the stellar spectra. The notes to Table II indicate those instances in which changes are strongly suspected.

The dark sodium lines in the spectrum of No. 231, C.D.−30°5135, may originate in the stellar atmosphere; in nearly all the other spectra they are probably detached.

We have not systematically observed the $H\alpha$ region of all the new bright-line stars with slit spectrographs, but a number of objects were photographed in this region to confirm the presence of bright lines or for miscellaneous reasons. These stars are listed in Table III. The numbers in the fourth column refer to 10-inch and 18-inch cameras used with one-prism spectrographs, while "G" indicates the grating spectrograph. The linear dispersions at $H\alpha$ are approximately 320, 150, and 66 A per millimeter, respectively. Because the

TABLE III

OBSERVATIONS OF *Hα* WITH SLIT SPECTROGRAPHS

M.W. No.	STAR	DATE	DISP.	INTENSITY	
				Bright *Hα*	Dark D1,2
		J.D. 2420000+			
	H.D. 5394	5607	18	vs	.....
228.....	Anon.	6617	10	vs	.....
100.....	B.D.+62° 285	6617	10	m	.....
106.....	H.D. 12302	5168	18	s	s
107.....	H.D. 236935	6617	10	m	pr
112.....	Utrecht 1319	6644	10	s	pr
113.....	H.D. 14134	6232	G	vw	vs
114.....	B.D.+56° 534	6644	10	s	pr
115.....	B.D.+56° 559	6645	10	s	.....
116.....	B.D.+56° 582	6618	10	s	.....
117.....	Utrecht 188	6645	10	vs	.....
118.....	B.D.+58° 458	6705	10	s	s
120.....	B.D.+56° 624	6618	10	s	.....
121.....	H.D. 15238	6646	18	m	pr
122.....	Anon.	6645	10	vs	pr
123.....	B.D.+60° 510	6676	10	m	.....
124.....	Anon.	6645	10	s	.....
125.....	B.D.+59° 516	6677	10	s	.....
126.....	B.D.+58° 492	6677	10	s	.....
127.....	B.D.+57° 607	6644	10	vs	pr
130.....	B.D.+56° 727	6705	10	s	.....
132.....	H.D. 237060	6676	10	m	.....
133.....	H.D. 237091	6617	10	s	pr
134.....	H.D. 20017	6646	18	s	m
136.....	H.D. 237134	6617	10	vs	.....
138.....	H.D. 21650	6615	18	m	.....
141.....	H.D. 24560	6646	18	m	pr
142.....	H.D. 26420	6646	18	m	m
144.....	H.D. 232971	6617	10	vs	.....
145.....	H.D. 237299	6618	10	s	.....
146.....	Anon.	6644	10	vs	pr
147.....	B.D.+41° 974	6617	10	vs	pr
149.....	B.D.+41°1031	6617	10	vs	.....
150.....	H.D. 37330	6675	10	s	.....
151.....	H.D. 37806	6676	10	s	.....
153.....	H.D. 42054	5196	18	s	.....
154.....	H.D. 259440	6617	10	vs	pr?
155.....	H.D. 259597	6706	10	vs	.....
156.....	H.D. 47054	5196	18	m	pr
230.....	H.D. 59067, 8	5323	18	w	.....
231.....	C.D.−30°5135	6706	10	vs	vs
162.....	H.D. 64109	6646	18	s	.....
163.....	H.D. 65079	5580	18	vs	.....
164.....	H.D. 65176	6676	10	m	.....
166.....	H.D. 91120	5348	18	w	.....
167.....	H.D. 142983	5385	18	w	.....
169.....	H.D. 156325	5440	18	w	.....
173.....	H.D. 160529	4723	18	m	vs
178.....	H.D. 166256	4686	18	m	.....

TABLE III—*Continued*

M.W. No.	Star	Date	Disp.	Intensity	
				Bright *Hα*	Dark D1,2
		J.D. 2420000+			
180.....	H.D. 168135	4723	18	m	.....
182.....	Anon.	6618	10	vs	.....
183.....	H.D. 171012	5440	18	vw	m
188.....	H.D. 184279	5841	18	m	s
191.....	H.D. 190073	5841	18	s	e
192.....	H.D. 190603	4778	18	w	s
194.....	H.D. 228548	6618	10	vs	.....
195.....	Anon.	6618	10	vs	.....
196.....	B.D.+40°4124	6618	10	vs!	.....
201.....	H.D. 195592	5866	18	w	s
204.....	H.D. 198478	4510	18	vw	s
206.....	H.D. 199478	6168	G	vw	vs
208.....	H.D. 201733	5784	18	s	.....
85.....	H.D. 203025	6170	G	vw	vs
209.....	H.D. 203731	5869	18	s	pr
210.....	H.D. 204722	5869	18	m	.....
	H.D. 206773	4810	18	s	.....
214.....	H.D. 208392	5866	18	m	pr
216.....	H.D. 209296	5813	18	s	.....
87.....	H.D. 209409	5838	18	s	.....
217.....	H.D. 213088	5813	18	s	.....
219.....	H.D. 218393	4062	G	vs	.....
223.....	H.D. 223501	4812	18	s	.....
224.....	H.D. 223960	5895	G	vw	vs
225.....	H.D. 224055	4813	18	vw	vs
226.....	H.D. 225094	6198	G	vw	s
227.....	H.D. 225160	4813	18	w	s

NOTES TO TABLE III

No.

H.D. 5394, γ Cassiopeiae. In addition to the very intense *Hα* line, several faint emission lines appear in the red.

228. Anon. D3 (*He*) is bright.

106. H.D. 12302. *Hα* is a strong double bright line whose components are 8.0 A apart. The component of longer wave-length is about two-thirds as intense as the other. The D lines of sodium and D3 of helium are strong, well-defined dark lines.

113. H.D. 14134, Boss 519. *Hα* is a narrow bright line of very low intensity. The sodium lines (detached?) are remarkably intense.

121. H.D. 15238. *Hα* is a double bright line whose components are about 7.5 A apart. The component of shorter wave-length appears to be nearly twice as intense as the other.

151. H.D. 37806. *Hα* is perhaps double.

231. C.D.−30°5135. The great intensity of D1,2 indicates a late-type spectrum.

166. H.D. 91120. *Hα* is a narrow bright line superposed on broad absorption.

167. H.D. 142983. Additional dates of observation (grating spectrograph) J.D. 5461, 6169, 6170, 6498. Bright *Hα* has two nearly equal components about 7.3 A apart, separated by a strong, sharply defined minimum (see illustration in *Mt. Wilson Contr.*, No. 432, Pl. IX; *Astrophysical Journal*, **74**, Pl. VIII, 1931).

182. Anon. The forbidden lines of neutral oxygen λλ 6300, 6364 are bright (see *Publications of the Astronomical Society of the Pacific*, **43**, 411, 1931).

No.

191. H.D. 190073. Additional dates of observation, J.D. 5869 (18), 6169 (G), 6197 (G). *Hα* is a strong bright line. The D lines of sodium are bright. This is the only star aside from novae in whose spectrum the sodium lines have been observed in emission.
192. H.D. 190603. Additional dates of observation, J.D. 5197 (18), 6168 (G).
201. H.D. 195592. The continuous spectrum is strong in the red as is well shown by the objective-prism plates.
204. H.D. 198478, 55 Cygni. *Hα* has weak bright edges, the one of shorter wave-length being the stronger.
206. H.D. 199478. D1,2, D3 and the *Si* II lines λλ 6347, 6371 are very strong.
208. H.D. 201733. The separation of the bright components of *Hα* is approximately 7.8 A.
85. H.D. 203025, β G.C. 10898. *Hα* is a weak double bright line with components about 5.0 A apart. Spectroscopic binary (see Sanford, *Mt. Wilson Contr.*, No. 317; *Astrophysical Journal*, **64**, 172, 1926).
219. H.D. 218393. Additional date of observation J.D. 5895 (G). On two plates taken with the grating on J.D. 4062 and 5895, *Hα* is a very intense emission line with a narrow, nearly central reversal. Strong D lines give a mean displacement of −27 km/sec. These lines may or may not be detached (see *Mt. Wilson Contr.*, No. 409; *Astrophysical Journal*, **72**, 98, 1930).
224. H.D. 223960. D1,2 are very intense. The *Si* II lines λλ 6347, 6371 are well marked.
225. H.D. 224055. Additional date of observation J.D. 5897 (G). D1,2 are very intense. The ionized carbon lines λλ 6578, 6582 are present.
226. H.D. 225094. The ionized carbon lines λλ 6578, 6582 are present.

photographs are with different dispersions and on emulsions having various degrees of contrast, it is possible to give only a general indication of the intensity of the bright *Hα* line and of the dark D lines. The notation in the fifth and sixth columns is as tabulated:

pr = present	s = strong
w = weak	v = very
m = medium intensity	e = emission

Data concerning *Hβ*, *Hγ*, and *Hδ* are given in Table IV, in the same form as in Table V of *Contribution* No. 294. An emission line whose classification is uncertain is denoted by "E." Additional information concerning the blue-violet portion of the spectrum will be found in the notes following the table. The notation in the last column of Table IV, referring to the spectrograph employed, is as shown in the accompanying tabulation:

Designation	Camera Focus	No. of Prisms	Telescope	Dispersion at *Hγ*
18	18 in.	1	60- or 100-inch	35 A per mm
10	10	1	100-inch	70
7	7	1	60-inch	71
V	3	3	60- or 100-inch	120
D VI	1	2	60- or 100-inch	350

TABLE IV

DATA FROM SLIT SPECTROGRAMS OF THE BLUE-VIOLET REGION

M.W.No.	STAR	Hβ		Hγ		Hδ		SPEC.	DATE*	DISP
		Ch.	Int.	Ch.	Int.	Ch.	Int.			
									J.D. 2420000+	
96	B.D.+59° 2829	S	3	S	2	S?	....	Boe	4840	18
97	B.D.+61° 39	S	1	C	....	C	....	B(0)e	5166	10
98	H.D. 6343	S	1	A	....	A	....	B5eβ	4046	18
99	B.D.+60° 180	D?	2	C	....	A	....	B(3)e	5166	10
228	Anon.	E	5	E	4	E	3	Pec.	6617	10
100	B.D.+62° 285	C	....	A	....	A	....	B(8)e	6586	18
101	Anon.	E	5	E	4	E	2	Bep!	5177	D VI
102	B.D.+60° 358	D?	1	C	....	A	....	B(3)e	6553	18
103	H.D. 11554	S	1	S	0.5	C	....	B(3)e	6586	18
104	H.D. 11606	D	1	D	0.5	A	....	B3e	4046	18
105	B.D.+63° 261	S	4	D?	2	D?	1	Be	4840	18
106	H.D. 12302	V	....	A	....	A	....	B3e	4839	18
107	H.D. 236935	C	....	A	....	A	....	B4e	6588	10
108	H.D. 12856	D?	2	C	....	C	....	B(2)e	5601	18
109	H.D. 13051	D?	3	D?	1	(C)	....	B(0)e	5602	18
110	B.D.+57° 515	S	3	S	1	C	....	B(3)e	3801	10
111	H.D. 13661	D?	2	C	....	A	....	B(3)e	4067	18
114	B.D.+56° 534	D?	2	D?	1	C	....	Be	6677	10
115	B.D.+56° 559	E	3	....	....	....	....	Be	6645	10
116	B.D.+56° 582	E	2	C	....	C	....	B(3)e	6643	10
118	B.D.+58° 458	D?	2	C	....	C	....	B(3)e	6706	10
119	H.D. 14605	D?	2	D?	1	C	....	B(2)e	3804	10
120	B.D.+56° 624	A	....	A	....	A	....	B(2)eα	6643	10
121	H.D. 15238	A	....	A	....	A	....	B8eα	6554	18
123	B.D.+60° 510	C	....	A	....	A	....	B(9)eα	6674	7
128	Anon.	E	4	E	3	E	2	Bep	6655	V
129	B.D.+61° 487	D?	3	D?	2	C?	....	B(0)e	6677	10
130	B.D.+56° 727	E	3	E	2	(C)	....	B(5)e	6706	10
131	B.D.+60° 606	D?	3	D	1	....	....	Be	6552	10
132	H.D. 237060	A	....	A	....	A	....	B(5)eα	6642	18
133	H.D. 237091	E?	....	C	....	C	....	Be	6588	10
134	H.D. 20017	D	1	A	....	A	....	Be	6702	7
135	H.D. 20134	D?	2	D?	1	A	....	B2e	4047	18
136	H.D. 237134	C?	....	A	....	A	....	Be	6643	10
137	H.D. 21212	S	3	S	2	S	1	B2e	4398	18
138	H.D. 21650	D?	1	A	....	A	....	B(5)e	6555	18
9	H.D. 22298	D?	0.5	A	....	A	....	B2e	4399	18
139	B.D.+61° 623	S	3	S	2	S	1	B2e	6674	7
140	H.D. 23982	D?	2	D	0.5	A	....	B3e	4511	18
141	H.D. 24560	E	1	C	....	C	....	B(3)e	6702	7
142	H.D. 26420	C	....	A	....	A	....	B3eα	6616	18
	H.D. 26906	S	1	C	....	A	....	Be	4073	10
143	Anon.	E	5	E	4	E	3	Bep!	6655	V
144	H.D. 232971	D?	2	E	1	A	....	B(5)e	6702	7
145	H.D. 237299	E	2	C	....	C	....	B(3)e	6702	7
147	B.D.+41° 974	D?	2	D	1	A	....	Boe	6706	10
148	H.D. 31293	....	....	....	....	....	....	Aoep	5524	18
149	B.D.+41° 1031	E	2	E	1	A	....	B(3)e	6706	10
18	H.D. 33604	S	2	D?	1	A	....	B2e	4133	18
	H.D. 35345	S	5	S	4	S	3	B2e	4045	18

* Additional dates of observation will be found in the notes.

TABLE IV—*Continued*

M.W.No.	Star	Hβ		Hγ		Hδ		Spec.	Date*	Disp.
		Ch.	Int.	Ch.	Int.	Ch.	Int.			
									J.D. 2420000+	
	H.D. 36576	D?	2	C	....	A	....	B1e	4063	18
19	H.D. 37115 Br.	E	....	?	....	A	....	B(5)e	4157	10
	Fr.	A	....	A	....	A	....	Ao	2747	18
150	H.D. 37330	D?	2	D	1	A	....	B8e	6735	10
21	H.D. 37657	D	2	C	....	A	....	B3e	4070	18
151	H.D. 37806	D	0.5	A	....	A	....	Aoe	6676	10
22	H.D. 37967	S	2	A	....	A	....	B3e	4133	18
24	H.D. 39340	D?	2	E	0.5	A	....	B3e	4156	18
26	H.D. 39478	D?	1	D	0.5	A	....	B2e	4225	18
152	H.D. 39557	S	1	S	0.5	A	....	B(8)e	6677	10
153	H.D. 42054	D	1	A	....	A	....	B5e	5196	18
229	Anon.	E	5	E	4	E	3	Pec.	5296	D VI
30	H.D. 44637	S	2	A	....	A	....	B3e	4156	18
154	H.D. 259440	D?	3	D?	2	....	....	B(5)e	6677	10
155	H.D. 259597	C	....	C	....	A	....	B(3)e	6674	7
156	H.D. 47054	A	....	A	....	A	....	B8eα	4963	18
157	H.D. 49977	S	2	C	....	A	....	B2e	5348	18
	H.D. 50083	S	3	S	1	C	....	B2e	4155	18
158	H.D. 50123	E	1	A	....	A	....	B8e	4957	18
36	H.D. 50209	S	1	A	....	A	....	B(5)e	4814	18
159	H.D. 52244	S	2	C	....	....	....	B5e	5602	18
160	H.D. 52721	D?	1	A	....	A	....	B3e	5552	18
	H.D. 54309	(D?)	2	(C)	....	C	....	B3e	4211	18
38	H.D. 55135	D?	3	D	1	A	....	B3e	4156	18
39	H.D. 55271 Br.	D?	2	D	0.5	A	....	B5e	5253	18
	Fr.	A	....	A	....	....	....	Ao	3809	18
161	H.D. 57386	D?	2	D	0.5	....	....	B5e	5603	18
230	H.D. 59067, 8	(A)	....	A	....	A	....	Gopeα	5323	18
43	H.D. 59497	D?	2	D	0.5	A	....	B3e	5196	18
44	H.D. 59773	D?	1	A	....	A	....	B3e	5195	18
45	H.D. 62753	D?	2	E	0.5	....	....	B2e	5603	18
231	C.D.−30° 5135	E	2	....	....	....	....	Pec.	6706	10
162	H.D. 64109	D	1	A	....	A	....	B(8)e	6646	18
163	H.D. 65079	D?	3	D	1	A	....	B3e	5580	18
164	H.D. 65176	E	0.5	C	....	C	....	B(5)e	6433	10
165	H.D. 66700	S	2	S	1	....	....	B3e	5959	18
166	H.D. 91120	A	....	A	....	A	....	B9eα	5018	18
167	H.D. 142983	A	....	A	....	A	....	A3seα	4248	18
	H.D. 148184	S	4	S	3	S	2	B3e	5068	18
168	Anon.	E	4	E	3	E	2	Bep	6538	D VI
	H.D. 155851	D?	2	D?	0.5	....	....	B(0)e	5729	18
169	H.D. 156325	A	....	A	....	A	....	B6eα	5134	18
170	C.D.−35°11482	E	3	....	....	....	....	Be	5113	D VI
171	H.D. 158319	S	1	A	....	A	....	B5e	5426	18
172	H.D. 159684	D?	2	C	....	....	....	B2e	4721	18
173	H.D. 160529	A	....	A	....	....	....	cA4eα	4339	18
52	H.D. 161103	D?	2	....	....	....	....	Be	4688	18
53	H.D. 161306	S	3	S	1	....	....	B(0)e	4665	18
174	Anon.	E	5	E	4	E	3	Bep	4699	D VI
175	H.D. 162718	S	3	S	1	....	....	B(0)e	5813	18
176	H.D. 165285	S	3	E	1	....	....	B(2)e	4666	18

TABLE IV—*Continued*

M.W.No.	Star	Hβ		Hγ		Hδ		Spec.	Date*	Disp.
		Ch.	Int.	Ch.	Int.	Ch.	Int.			
									J.D. 2420000+	
177	H.D. 166188	S	3	S	1	....	....	B2e	4722	18
178	H.D. 166256	D	0.5	A	....	A	....	Aoe	4686	18
60	H.D. 166566	S	1	A	....	A	....	B2e	5068	18
179	B.D.−20° 5060	E	2	E	1	(A)	....	B(0)e	4739	10
180	H.D. 168135	A	....	A	....	A	....	B(8)eα	4723	18
181	Anon.	S	3	E	2	....	....	Be	6527	10
182	Anon.	E?	2?	A?	....	....	....	Bep	6527	10
183	H.D. 171012	A	....	A	....	A	....	Boeα	4318	18
184	H.D. 171348	D?	3	D	0.5	....	....	B3e	4689	18
	H.D. 173219	D?	1	C	....	C	....	B1e	4047	18
185	H.D. 174886	S	2	S	1	A	....	B3e	5103	18
72	H.D. 175863	A	....	A	....	A	....	B3e	4273	18
186	H.D. 177015	D?	1	A	....	A	....	B3e	5103	18
187	Anon.	E	4	E	4	E	3	Bep	6534	D VI
188	H.D. 184279	A	....	A	....	A	....	B2e	5841	18
189	B.D.+ 5° 4285	D	2	E	0.5	A	....	B5e	5134	18
232	Anon.	E	5	E	4	E	4	Pec.	6643	10
190	B.D.+26° 3723	D?	2	D	0.5	A	....	B5e	5134	18
191	H.D. 190073	D?	3	D	1	A	....	Aoep!	5489	18
192	H.D. 190603	(A)	....	A	....	A	....	Boeα	4778	18
	H.D. 190944	D?	3	D?	2	D	1	B2ep	4399	18
193	H.D. 228041	D?	1	C	....	C	....	B(3)e	6492	18
81	H.D. 228438	V	....	V	....	....	....	Boe	4756	18
194	H.D. 228548	E	3	E	1	C	....	B(2)e	6644	10
195	Anon.	E	2	E	1	C	....	B(2)e	6645	10
	H.D. 193516	A	....	A	....	A	....	B1	5114	18
196	B.D.+40° 4124	E	3	....	....	....	....	B(2)e	6644	10
197	Anon.	E	4	E	3	E	2	Be	4670	D VI
198	H.D. 194335	D	0.5	C	....	A	....	B3e	4044	18
199	H.D. 229221	E	3	E	2	E	2	Boe	5049	10
200	H.D. 194883	D?	2	A	....	A	....	B2e	5050	18
201	H.D. 195592	E	1	A	....	A	....	B1e	5559	18
202	H.D. 195907	S	3	D?	1	C	....	B2e	4757	18
203	Anon.	E	5	E	3	....	....	Bep	5435	D VI
204	H.D. 198478	A	....	A	....	A	....	B2eα	4510	18
205	H.D. 198895	D?	3	D?	1	....	....	B(2)e	5068	18
206	H.D. 199478	A	....	A	....	A	....	B8e	6263	18
207	H.D. 201522	D?	1	A	....	A	....	B3e	5785	18
208	H.D. 201733	D	0.5	A	....	A	....	B(5)e	5784	18
209	H.D. 203731	D	2	D	0.5	A	....	B3e	5869	18
210	H.D. 204722	D?	1	A	....	A	....	B3e	5869	18
211	H.D. 239703	D?	3	C	....	....	....	Be	5812	18
212	B.D.+47° 3487	P	3	P	2	P	1	B3eq	5812	18
213	H.D. 235565	D?	2	E	(1)	....	....	B(2)e	5068	18
	H.D. 206773	.....	.....	.....	.....	.....	.....	B(3)e	6642	V
214	H.D. 208392	C	....	C	....	A	....	B(3)e	5559	18
215	H.D. 235683	S	1	S	0.5	A	....	B(3)e	5813	18
216	H.D. 209296	E	0.5	A	....	A	....	B(5)e	5813	18
87	H.D. 209409	D	1	D	0.5	A	.. .	B8e	5838	18
217	H.D. 213088	D	1	A	....	A	....	B(8)e	5813	18
218	H.D. 216057	D	0.5	A	....	A	....	B8e	5551	18

TABLE IV—*Continued*

M.W.No.	Star	Hβ		Hγ		Hδ		Spec.	Date*	Disp.
		Ch.	Int.	Ch.	Int.	Ch.	Int.			
									J.D. 2420000+	
219	H.D. 218393	D	V	(A)	....	A	....	Var	3299	18
220	H.D. 220058	E	2	C	....	C	....	B(1)e	5103	18
221	H.D. 220116	D?	2	D	0.5	C	....	B5e	4399	18
222	H.D. 223387	D?	2	E	1	C	....	B(0)e	4399	18
223	H.D. 223501	D?	1	D	0.5	A	....	B3e	4724	18
224	H.D. 223960	A	....	A	....	A	....	Aoeα	6264	18
225	H.D. 224055	A	....	A	....	A	....	B2eα	4813	18
226	H.D. 225094	A	....	A	....	A	....	B2eα	6261	18
227	H.D. 225160	A	....	A	....	A	....	O8eα	4813	18

NOTES TO TABLE IV

No.

96. B.D.+59°2829. The velocity derived from $H\beta$ and $H\gamma$ is $-65\pm$km/sec.
97. B.D.+61°39. H and K are strong.
98. H.D. 6343. J.D. 6525 (18). $H\beta$ is a weak emission line centrally superposed on a broad, intense absorption line.
99. B.D.+60°180. The dark lines are weak.
228. Anon. J.D. 6655 (V). The spectrum is very peculiar. Several bright lines in addition to those of hydrogen are present. These include λ 4363 [*O* III], λ 4686 *He* II, and other nebular lines. The continuous spectrum shows the dark bands of titanium oxide (*Publications of the Astronomical Society of the Pacific*, **44**, 56, 1932). The spectrum will be more fully described in a future *Contribution*.
100. B.D.+62°285. J.D. 6617 (10). Perhaps a very weak bright portion at $H\beta$.
101. Anon. The bright hydrogen lines are very intense and numerous. Other bright lines are outstanding even with low dispersion. Chief among these are ionized iron lines (with the forbidden lines relatively strong as in η Carinae) and the nebular line of unknown origin, λ 4658, with its companion line, λ 4701.
102. B.D.+60°358. J.D. 6586 (18). The spectrum is nearly continuous and the classification uncertain.
103. H.D. 11554. The plate is poor and the type uncertain.
104. H.D. 11606. The measured separation of the bright components of $H\beta$ is 4.6 A.
105. B.D.+63°261. Aside from the hydrogen lines, the spectrum is nearly continuous.
106. H.D. 12302. J.D. 5168, 5253 (18). The hydrogen lines show slight changes possibly similar to those in ϕ Persei. A weak bright edge on the violet side of the narrow dark $H\beta$ was less distinct on J.D. 4839 than on the other dates. Dark $H\beta$ and dark $H\gamma$ are narrow; they appear more intense on J.D. 5168 than on the other dates. The velocity derived from the dark lines is probably variable. Measured values are J.D. 4839, −9.2 km/sec.; J.D. 5168, −7.9; J.D. 5233, +7.7.
108. H.D. 12856. The dark lines are weak and diffuse.
109. H.D. 13051. The dark lines are weak. *HD:* "The lines are barely seen."
111. H.D. 13661. The dark lines are weak.
114. B.D.+56°534. The dark lines are weak.
118. B.D.+58°458. The type is uncertain. Aside from the hydrogen lines, the spectrum is nearly continuous.

No.

119. H.D. 14605. The type is uncertain.
121. H.D. 15238. J.D. 6348 (7).
128. Anon. J.D. 6598, 6629 (D VI). $H\beta$, $H\gamma$, and $H\delta$ are strong bright lines. Several indistinct maxima in the continuous spectrum may be additional bright lines.
129. B.D.+61°487. The dark lines are weak and the type is uncertain.
130. B.D.+56°727. The spectrum is narrow and the type uncertain.
131. B.D.+60°606. No dark lines are definitely seen in the narrow spectrum and the type is uncertain.
132. H.D. 237060. The dark lines are weak and diffuse.
133. H.D. 237091. The dark lines are weak.
134. H.D. 20017. Aside from the hydrogen lines the spectrum is nearly continuous.
136. H.D. 237134. $H\beta$ is indistinct, but probably consists of a weak bright line superposed on a wide dark line. Aside from the hydrogen lines the spectrum is nearly continuous.
137. H.D. 21212. J.D. 5168 (18). The radial velocity is −7.1 km/sec.
138. H.D. 21650. $H\gamma$ is a very wide dark line apparently with a narrow central core. This appearance is probably caused by the superposition of a double bright line of low intensity. The lines other than those of hydrogen are very weak and diffuse and the type is uncertain.
9. H.D. 22298. The spectrum is probably the same as on J.D. 2926.* *HD:* "The lines are wide."
143. Anon. J.D. 6629 (D VI). The bright hydrogen lines are very strong, and, in addition, the lines of neutral helium are bright.
144. H.D. 232971. Aside from the hydrogen lines, the spectrum is nearly continuous and the type uncertain.
145. H.D. 237299. The spectrum is narrow and the type uncertain.
148. H.D. 31293. Numerous plates between J.D. 5523 and 6315. The structure of the hydrogen lines is peculiar and variable. At $H\gamma$ an intense dark core changes its position relative to the wide diffuse wings. A detailed description will be given in a future *Contribution.*
149. B.D.+41°1031. The dark lines are weak.
18. H.D. 33604. J.D. 5526 (18). The bright components of the hydrogen lines do not seem quite so strong as on J.D. 2690,* but the difference is not marked. The measured displacements of various lines on the same plate do not agree and there appear to be changes from plate to plate. The star may be a spectroscopic binary.

H.D. 35345. J.D. 4399 (18). The bright hydrogen lines are unusually narrow and intense. The spectrum resembles that of χ Ophiuchi (H.D. 148184), but the bright lines are even sharper. The dark helium lines are fairly well defined. The radial velocity derived from the bright hydrogen lines is 0 km/sec.

H.D. 36576, 120 Tauri. The dark lines are weak and diffuse. The spectrum seems to be the same as on J.D. 2973.* *HD:* "$H\beta$ is a well-marked bright line superposed on a faint dark band. $H\gamma$ appears to be double, consisting of two equal dark portions. The central line is of the same intensity as adjacent portions of the continuous spectrum. $H\delta$ and $H\epsilon$ are very wide. The helium lines are not wider than normal."

19. H.D. 37115 Br., β G.C. 2850. As nearly as can be judged from this overexposed plate, the spectrum is the same as on J.D. 2626.*

* *Mt. Wilson Contr.*, No. 294; *Astrophysical Journal*, **61**, 389, 1925.

No.

H.D. 37115 Fr. J.D. 4157 (10).

150. H.D. 37330. The dark lines are wide and diffuse. The companion star, H.D. 37342, observed on J.D. 6734 (10) is of type B8.

21. H.D. 37657. The spectrum appears to be the same as on J.D. 2694.*

151. H.D. 37806. J.D. 6736 (10) $H\beta$ is probably a broad, weak dark line with a central core whose edges are marked by weak emission. $H\gamma$ and $H\delta$ have strong well-defined central minima with weak wings which extend for several angstroms on either side.

22. H.D. 37967. The spectrum is much the same as on J.D. 2746,* but bright $H\beta$ may be slightly stronger.

24. H.D. 39340. The spectrum appears the same as on J.D. 3808.*

26. H.D. 39478. The spectrum is probably the same as on J.D. 2953.*

153. H.D. 42054. J.D. 5524 (18).

229. Anon. The bright hydrogen lines are extraordinarily intense. The type is uncertain.

30. H.D. 44637. J.D. 5256 (18). $He\,\lambda\,4471$ seems narrower on J.D. 4156 than on J.D. 2748* but intermediate on J.D. 5256; the change may not be real. The hydrogen lines are probably the same on all three dates.

154. H.D. 259440. The dark lines are weak and the type is uncertain.

155. H.D. 259597. The dark stellar lines are indistinct. K is sharp.

156. H.D. 47054. J.D. 5196 (18). The dark lines are diffuse; with the exception of the Balmer series, they are weak.

H.D. 50083. J.D. 6642 (18). The structure of the hydrogen lines may be slightly different from that on J.D. 3725.*

158. H.D. 50123. J.D. 6736 (18). The central absorption of the hydrogen lines is less intense on the second date. $H\beta$Er appears on both; $H\beta$Ev is apparently absent on J.D. 4957, and on J.D. 6736 has perhaps one-third the intensity of Er. There may be slight changes in other features of the spectrum.

36. H.D. 50209. The dark lines aside from those of hydrogen are weak and the type is uncertain. The spectrum is probably the same as on J.D. 2694.*

159. H.D. 52244. *HD:* "The line K is strong for this class."

160. H.D. 52721, β G.C. 3795. Combined spectrum of both components.

H.D. 54309. The plate was taken for the ultra-violet. The $H\beta$ region is over-exposed and out of focus, but a bright $H\beta$ is clearly visible.

38. H.D. 55135. The dark lines are diffuse. The spectrum is probably the same as on J.D. 2720.*

39. H.D. 55271, Br. β G.C. 3887. The dark lines are very wide. The spectrum is probably the same as on J.D. 2718.*

230. H.D. 59067, 8. *HD:* "The spectrum is composite."

43. H.D. 59497. The spectrum is apparently the same as on J.D. 2980.*

44. H.D. 59773. The spectrum is nearly the same as on J.D. 3038,* but the bright $H\beta$ may be slightly weaker. There are traces of bright components within the broad dark $H\gamma$ line.

45. H.D. 62753. On J.D. 3810 and 5603 the bright components of $H\beta$ had nearly equal intensity. On J.D. 3036, the component toward the violet was the stronger.*

231. C.D.$-30°5135$. J.D. 6736 (10) The type is uncertain,but is apparently later than A. Both plates are underexposed.

162. H.D. 64109. J.D. 6433 (10) The dark lines are weak and diffuse and the type is uncertain.

No.

163. H.D. 65079. J.D. 5601 (18). The violet component of bright $H\gamma$ is the stronger. At $H\beta$ the two components are not separated, but the one toward the violet appears to be the stronger. Traces of bright components can be seen within the dark $H\delta$ line.

164. H.D. 65176. The blue-violet spectrum is nearly continuous and the type uncertain. *HD:* "The spectrum is nearly continuous."

165. H.D. 66700. Bright $H\beta$ is unusually narrow.

166. H.D. 91120. J.D. 5348, 6736 (18). Remark in *HD:* "On a photograph taken Dec. 16, 1904, the line $H\beta$ appears to be double." This observation might be explained by assuming the bright component of $H\beta$ to have been much stronger than on the Mount Wilson plates, apparently dividing the broad dark $H\beta$ line into two parts.

167. H.D. 142983. J.D. 4638, 5385 (18).
H.D. 148184, χ Ophiuchi.
H.D. 155851. The dark lines are very weak and the type is uncertain.

169. H.D. 156325. J.D. 5440 (18). The dark $H\beta$ is weak as if partially neutralized by emission.

173. H.D. 160529. J.D. 4666, 4723 (18). Classified Oe5 by Harvard. *HD:* "The line K is strong for this class." The spectrum is like that of α Cygni. The dark $H\beta$ line is weak as if partly neutralized by emission. The spectrum may have changed since the Harvard observation.

52. H.D. 161103. The plate is underexposed. The spectrum is probably the same as on J.D. 2914.*

53. H.D. 161306. The spectrum is nearly the same as on J.D. 2913,* although it is possible that the lines are slightly narrower.

175. H.D. 162718. J.D. 4337 (10). The dark lines are weak and the type is uncertain.

176. H.D. 165285. The plate is underexposed and the type uncertain.

178. H.D. 166256. J.D. 4636 (10). The dark lines other than those of hydrogen are very weak.

60. H.D. 166566. Bright $H\beta$ is very narrow. It appears narrower than on J.D. 2917,* but this may be a photographic effect. The dark helium lines are strong, particularly λ 4388.

179. B.D.$-20^\circ5060$. The dark lines are weak and the type is uncertain.

180. H.D. 168135. J.D. 4636 (10). The lines other than those of hydrogen are weak and the type is uncertain.

182. Anon. The spectrum is narrow and underexposed and appears nearly continuous. $H\beta$ is probably bright but is not outstanding. $H\gamma$ is probably dark.

183. H.D. 171012. J.D. 5440 (18). The dark lines are strong.

72. H.D. 175863. J.D. 4638 (18). $H\beta$ is essentially an absorption line. Bright portions, if present, are extremely weak; they have evidently decreased in intensity since J.D. 2570.* Probably the intensity grew gradually less from 1920 to 1926.

188. H.D. 184279. The dark hydrogen lines are narrow. $H\beta$ may have very weak bright edges. H and K are strong.

189. B.D.$+5^\circ4285$. The violet component of bright $H\beta$ is the stronger. The dark $H\gamma$ line contains a narrow weak maximum which is probably the violet component of a double bright line.

232. Anon. The spectrum is very peculiar. Besides the bright hydrogen lines, bright helium lines including the ionized line at λ 4686 are superposed on a weak continuous spectrum which shows absorption bands of titanium oxide (*Publications of the*

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Astronomical Society of the Pacific, **44**, 56, 1932). The spectrum will be more fully described in a future *Contribution*.

191. H.D. 190073. Several plates between J.D. 5489 and 6529. Numerous lines of ionized iron are bright. The structure of the H and K lines is abnormal; a strong dark component is displaced 2 or 3 A toward the violet. The peculiarities of this spectrum, which include bright sodium lines, will be described in a future *Contribution*.

192. H.D. 190603. J.D. 5197, 6137 (18). Dark $H\beta$ is weak and perhaps has a trace of emission on the red side. H and K are strong.

H.D. 190944. The spectrum is slightly peculiar. It contains numerous indistinct bright lines, several of which can be identified with ionized iron. *HD:* "The line $H\beta$ is bright. The dark lines are indistinct, perhaps due to the faintness of the star."

193. H.D. 228041. The dark lines are weak and the type is uncertain.

81. H.D. 228438, B.D.+36°3946. J.D. 6585 (18). On J.D. 4756, the spectrum is narrow and underexposed, but bright $H\beta$ is clearly seen and is at least as strong as on J.D. 2917. There is a trace of bright $H\gamma$. On J.D. 6585 a marked difference is seen. $H\beta$ and $H\gamma$ are now dark lines. (On objective-prism plates taken in 1925 and 1926, $H\alpha$ is a strong bright line, while on a plate taken in 1931, $H\alpha$ is not seen [see notes to Table II].)

194. H.D. 228548. The dark lines are weak and the type is uncertain.

195. Anon. The dark lines are very weak and the type is uncertain.

H.D. 193516. Bright $H\beta$ seems to have disappeared since the Harvard observations. (Bright $H\alpha$ is not seen on objective-prism plates taken in June, 1926, and July, 1931.) The radial velocity from the slit spectrogram on J.D. 5114 is −75 km/sec. Possibly the star is a spectroscopic binary.

196. B.D.+40°4124. The dark lines are very weak and the type is uncertain.

198. H.D. 194335. Re-examination of a plate taken by W. S. Adams on J.D. 1094 shows $H\beta$ to be a weak double bright line.

201. H.D. 195592. J.D. 5866 (18). The dark lines are well defined. The spectrum has a general resemblance to that of H.D. 183143, although of an earlier type (*Mt. Wilson Contr.*, No. 409; *Astrophysical Journal*, **72**, 98, 1930). *HD:* "The lines are very faint and indistinct." The spectrum may have changed since the Harvard observations.

203. Anon. In addition to the hydrogen lines, the bright nebular line at λ 4658 is well marked and the companion line λ 4701 is visible. Bright lines of neutral helium also are present and possibly λ 4583 of ionized iron.

204. H.D. 198478, 55 Cygni. J.D. 6163 (18). H and K are sharp. The other dark lines are also well defined.

205. H.D. 198895. The spectrum is narrow and the type not well determined.

206. H.D. 199478. Very weak bright components may be present at $H\beta$, but the observation is uncertain.

208. H.D. 201733. J.D. 6554 (18). Dark cores of $H\beta$, $H\gamma$, and $H\delta$ are strong and well defined. λ 4481 *Mg* appears to be weaker on J.D. 6554 than on J.D. 5784. The type may be earlier than B5.

209. H.D. 203731. The separations of the bright components are: $H\beta$, 3.6 A; $H\gamma$, 4.1 A.

No.

211. H.D. 239703. The spectrum is narrow and aside from the bright $H\beta$ line appears practically continuous. The type is uncertain.

212. B.D.+47°3487. The spectrum is of the P Cygni type.
H.D. 206773. On J.D. 2955 and 3947,* the two bright components of both $H\gamma$ and $H\delta$ have nearly equal intensity, but on a plate taken by R. F. Sanford on J.D. 6642 the violet components of both lines are much the stronger.

214. H.D. 208392. J.D. 5866 (18). The dark lines are weak.

216. H.D. 209296. J.D. 6586 (18). The dark lines are weak and the type is uncertain.

87. H.D. 209409, o Aquarii. The bright components of $H\beta$, 4.0 A apart, are separated by a well-defined minimum.

217. H.D. 213088. J.D. 6588 (10). The dark lines other than those of hydrogen are weak and the type is uncertain. The bright components of $H\beta$ are approximately 4.8 A apart.

218. H.D. 216057. The wide, dark $H\beta$ line has a narrow core, the effect probably of traces of bright components.

219. H.D. 218393. Numerous plates between J.D. 3299 and 5895 (*see Mt. Wilson Contr.*, No. 409; *Astrophysical Journal*, **72**, 98, 1930).

220. H.D. 220058. The dark lines are weak and the type is uncertain.

221. H.D. 220116. Bright $H\beta$ is probably double, with the violet component much the stronger.

222. H.D. 223387. The dark lines are weak and the type is uncertain.

223. H.D. 223501. J.D. 4812 (18). H and K are sharp.

225. H.D. 224055. J.D. 6613 (18). The dark hydrogen lines are narrow and fairly strong with the exception of $H\beta$, which appears to be partially neutralized by emission. *HD:* "The lines are poorly defined."

226. H.D. 225094. J.D. 6611 (18), 6612 (V). The lines are unusually narrow. H and K are strong.

227. H.D. 225160. The radial velocity is −26 km/sec. (see also notes to Table I).

GENERAL REMARKS

Table V shows that the average intensities of bright $H\alpha$ and $H\beta$ (computed from individual values in Tables II and IV of the present article and Tables II and V of *Contribution* No. 294) are higher in spectra of classes Bo–B3 than in those of earlier or later subdivisions. This might be expected from the fact that emission-line stars are especially numerous in classes Bo–B3. The low values for class B1 have no obvious explanation. The slightly high values for classes Ao–A4 are based on meager and unhomogeneous material and probably do not indicate typical behavior of the lines in these classes. Spectra classed as "peculiar" have very intense bright lines; or, in other words, many spectra with unusually intense bright hydrogen lines differ also in other features from the standard types. The last column in Table V gives the average intensities of the dark ultra-

violet Balmer lines, particularly $H\zeta$–$H\kappa$, as estimated from the objective-prism plates. The values progress with spectral subdivision as one would expect, except the value for B8–B9, which is slightly less than that for B4–B6. The reason for this exception is not clear.

The red color of faint Be stars has repeatedly attracted our attention at the telescope, and we have occasionally recognized the effects of the exceptional color in the photographed spectra. The photo-

TABLE V

AVERAGE INTENSITIES OF HYDROGEN LINES

SPECT.	BRIGHT $H\alpha$		BRIGHT $H\beta$		DARK U.V.	
	Int.	No.	Int.	No.	Int.	No.
O6–O9	2.4	7	1.0	4	0.1	7
Bo	3.3	25	2.0	20	0.2	14
B1	2.7	13	1.1	17	0.6	7
B2	3.0	55	1.9	44	0.8	36
B3	2.9	69	1.6	41	1.3	48
B4–B6	2.5[4]	35	1.4	20	1.9	22
B8–B9	2.4[6]	24	0.5	21	1.8	18
Ao–A4	2.7	8	0.8	5	2.3	3
Peculiar	4.0	26	4.1	18	0.8	5

electric observations of Elvey[1] and Stebbins[2] have shown many faint B-type stars to be highly colored, and it will therefore be important to determine whether the effect has any relationship to the presence of emission lines. Interstellar absorption may account for all instances of color excess, but this is not yet certain.

A catalogue and bibliography of all known Be stars and similar objects of classes O (not including Wolf-Rayet stars) and A is in preparation for early publication as a Mount Wilson *Contribution*. Observers are invited to send in lists of references as well as notes on unpublished discoveries in order that the data may be as complete as possible.

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[1] *Astrophysical Journal*, 74, 298, 1931.

[2] Unpublished.