PUBLICATIONS OF THE ASTRONOMICAL SOCIETY OF THE PACIFIC
93:614–620, October 1981

LINE IDENTIFICATION IN THE SPECTRUM OF HD 213918

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Received 1981 March 26

We studied the spectrum of the star HD 213918. We identified the atomic species present on three coudé spectrograms of the star. We found Fe in the first three stages of ionization, P II, P III, Cl II, Sr II, and Hg II among others. HD 213918 has a temperature around 14,800 K and we compared its spectrum with other silicon and He-weak stars.

Key words: metallic-line star—He-weak star

I. Introduction and Observations

The star HD 213918 is a member of the Lacerta OB1 association. Its spectrum was found peculiar by Adelman (1968). He assigned the star to the λ4200-Si class. Levato and Abt (1976) classified in B6 IVp with Si, Sr, Fe, and other elements strong, He I weak as in type B9.5. HD 213918 is the only peculiar star found among the probable members of the association.

Table I presents the observational parameters for HD 213918 taken from the literature, except the radial and rotational velocities whose values were determined in the present paper.

Levato obtained five spectrograms of HD 213918 during 1976. He used the coudé feed system at Kitt Peak. The spectrograms were recorded on Kodak IIa-O emulsion and they have a linear dispersion of 16.9 Å mm^{-1}. Three of the spectra were widened 0.6 mm and the other two 0.3 mm. Only the wider spectrograms were analyzed spectrophotometrically while the radial velocity was obtained by averaging all the available spectra. No obvious variation in radial velocity could be found. The spectrograms covered the normal blue-violet photographic region and they were calibrated on the same plates using the device described by Furenlid (1971).

II. Line Identification

The dispersion mentioned above has been chosen because at the time of observations it was the best compromise, with the coudé feed at KPNO, between dispersion and exposure time. However, going to a higher dispersion is not going to improve the situation very much, for a 60 km sec^{-1} rotator, for measuring the spectrum at the Grant comparator although we are going to get a better signal-to-noise ratio with the PDS.

In Table II we listed the wavelength measurements (λ) for HD 213918, the intensity (*I*), and the proposed identifications. The identifications were done on intensity tracings of the three wider spectra made with the PDS at Kitt Peak combined with wavelength measurements made with a Grant at La Plata. The intensities of the lines have been estimated using an arbitrary scale already published in Levato and Malaroda (1977). The sources for line identifications are given at the end of Table II.

All atomic species with ionization stages three or lower, for which line lists exist in the references given above were looked for. So the atomic species which do not appear in the summary given in Table III have not been found or the evidence of their presence is considered very weak. To be included in the final list of Table II a feature had to be present on the three tracings. The identifications between parentheses are tentative. The differences of 0.3 Å between the wavelengths of the line centers and the identifications are not large for this rotational broadening. Lines are not asymmetric.

TABLE I

Observational Parameters of HD 213918

B-V [a]	+0.03
E(B-V) [b]	0.20
U-B [a]	-0.53
Sp.T.(phot)	B5
M v [c]	-0.8
V sin i	60 km/sec
Rad. Vel.	-22.4 ± 2.2 km/sec (constant)
M K [c]	B6IVp
Sp T (HD)	A0

a - Hardie and Seyfert (1959)

b - Crawford (1961)

c - Levato and Abt (1976)

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TABLE II

Line Identifications

λ(Å)	I	Identifications
3700		
27.08	1	OII (3) 27.33, CrII (-) 27.36
28.23	2	CeII (-) 28.02, 28.18, 28.42
34.30	7	H13 34.37
50.17	8	H12 50.15
53.25	1	
57.57	2	TiII (-) 57.69
59.42	3	TiII (-) 59.29
60.61	1	
61.56	3	TiII (-) 61.32, CrII (-) 61.68, 61.90
62.52	3	FeII (192) 62.90
65.69	1	CrII (-) 65.61
70.51	8	H11 70.63
76.51	1	TiII (-) 76.06
78.18	2	MnII (-) 78.32
79.94	2	FeII (23) 79.58
80.69	2	ClII (-) 81.17
81.65	2	FeII (130) 81.51, CeII (-) 81.62
83.27	1	FeII (14) 83.35
83.96	3	CrII (-) 83.74, CeIII (-) 84.29, NdII (-) 84.25
86.34	1	TiII (-) 86.33
86.91	1	CeII (-) 86.63
88.72	3	CeII (-) 88.75
89.08	1	FeIII (-) 89.37
93.83	1	ClII (-) 93.64
97.68	8	H10 97.90
3800		
01.09	1	CrII (-) 01.21, CeII (-) 01.52
02.35	1	PIII (10) 02.08
04.71	1	ClII (-) 05.17, CsII (-) 05.10
06.82	3	FeII (153) 06.82, SiIII (5) 06.54
09.60	1	ClII (-) 09.46, 10.01
12.40	1	FeI (22) 12.96
14.31	3	FeII (153) 14.12, CrII (-) 13.99, TiII (-) 14.58
16.80	3	(ZrII (18) 17.59), (ErIII (-) 16.78)
19.27	1	HeI (22) 19.61, 19.76
20.23	3	ClII (-) 20.25, FeI (20) 20.43
21.82	2	FeII (14) 21.92
23.48	1	FeII (-) 22.74
24.73	1	FeII (29) 24.91, FeI (4) 24.44
26.55	1	(FeI (20) 25.88)
35.42	8/9	H9 35.39
42.57	1	AlII (49) 42.04, 42.21, SiIII (10.03) 42.46
45.37	4	ClII (-) 45.36, 45.65, 45.79
46.36	3	CII (33.02) 46.51, FeII (128) 46.31
48.89	1	CeII (-) 48.59
49.29	1	
49.98	3	CII (33.02) 50.42, FeI (20) 49.97
51.20	3	ClII (-) 50.97, 51.38, 51.69, NdII (-) 51.66, 51.74
54.07	3	SiII (1) 53.66
55.40	4	CeII (-) 55.29
56.31	4	SiII (1) 56.02, FeI (4) 56.37
57.47	1	CeII (-) 57.64
58.96	2	AlII (38) 59.33
60.69	1	FeII (-) 60.92, ClII (-) 60.80, 60.98
61.34	1	
61.98	2	CII (33.02) 62.18, ClII (-) 61.88
62.62	4	SiII (1) 62.60
63.62	1	FeII (152) 63.41, NdII (-) 63.33, 63.40
64.07	1	FeII (127, 152) 63.95
64.82	2	
66.03	3	CrII (-) 65.60, 66.01, (AlII (17) 66.16)
67.17	2	HeI (20) 67.48, 67.63
68.32	2	ClII (-) 68.57
68.98	2	CII (33.01) 68.87
72.31	3	TiIII (-) 72.21, HeI (60) 71.82, (CII (33.01) 71.67)
73.17	2	CII (33.01) 73.07
74.63	1/2	CII (33.01) 74.67
76.58	1	CII (33) 76.06, 76.19, 76.41, 76.66, CII (36) 76.53
77.52	1	CII (33) 78.03, PrII (-) 77.18
79.83	1	CII (33) 79.64, CeII (-) 79.97
81.08	2	CII (33) 80.59, 81.03, TiIII (-) 81.21
83.50	1	ClII (-) 83.78, CII (33) 83.82
85.42	1	PrII (-) 85.19
89.02	8/9	H8 89.05
93.73	1	TiIII (-) 93.63
94.69	1	
95.47	1	CeII (-) 95.11, FeI (4) 95.66
96.43	1	TiIII (-) 96.33, FeII (23) 96.11, ClII (-) 96.12
97.72	1	TiIII (-) 97.25, MnII (-) 97.62, 98.07
99.17	1	(FeI (20) 99.01)

TABLE II (Continued)

λ(Å)	I	Identifications
3900		
00.11	1	(NdII (-) 00.21), (FeI (4) 99.71)
00.84	1	AlII(1) 00.68, TiII (-) 00.54
05.21	2	(SiI (3) 05.52)
05.87	3	FeII (-) 06.04, CrII (-) 05.64
07.13	3	CeII (-) 07.29, EuII (-) 07.10, CsII (-) 06.94
07.81	1	PrII (-) 08.03
09.49	1	CrII (-) 09.25
11.69	3	OII (17) 11.96
14.32	3	FeII (3) 14.48
16.61	3	ClII (-) 16.63
18.23	1	CeII (-) 18.28, FeII (191) 18.51
19.43	3	CII (4) 18.98, SiII (21) 19.00
20.48	4	CII (4) 20.69, FeI (4) 20.26
21.53	3	TiIII (-) 21.38, 21.61, CeII (-) 24.64
25.07	1	TiIII (-) 24.86, PrII (-) 25.46, CsII (-) 25.58
27.63	1	ClII (-) 27.81, FeI (4) 27.92
28.48	1	ClII (-) 28.60
29.63	1	
30.21	3	EuII (-) 30.48, FeII (13) 30.31, (FeI (4) 30.30)
31.31	2	CeII (-) 31.09, 31.37
32.03	2	TiII (-) 32.02
33.20	3	
33.64	6	CaII (1) 33.66
34.73	2	CrII (-) 35.04
35.53	3	FeII (173) 35.94, PrII (-) 35.82
36.94	2	CrII (-) 36.95, CeIII (-) 36.80
37.82	2	CeII (-) 38.09
38.48	1	FeII (3) 38.29
39.32	1	FeII (190) 38.97
40.21	1	CeII (-) 40.34
41.20	1	NdII (-) 41.51
42.40	1	CeII (-) 42.15, 42.75
43.37	1	TiIII (-) 43.56
44.47	1	CII (32) 44.19
45.46	2	CII (32) 45.20, 45.00
46.68	1	CII (31) 46.41, CII (32) 46.28
47.55	1	CII (31) 47.72, CII (32) 47.08, 47.72, SiIII (10.08) 47.49
48.47	1	CII (32) 48.33, TiIII (-) 48.36
51.32	1	NdII (-) 51.16
52.13	1	CII (32) 52.06, CeII (-) 52.54, (SiIII (10.08) 52.24)
53.07	1	CII (32) 52.68, SiIII (10.08) 53.08
54.04	3	FeIII (120) 54.38, SiII (7.07) 54.51, 54.30
55.32	3	SiII (21) 55.74
56.38	2	SiIII (10.08) 56.66, 56.55 (CeII (-) 56.28)
59.63	1	CsII (-) 59.50
61.44	1	ClII (-) 61.63
62.48	1	
63.46	1	SiIII (8.05) 63.67, 63.84
68.47		CaII (1) 68.47
69.96	8	Hε 70.07
73.70	1	CII (37,38) 73.76, OII (6) 73.26
74.56	1	FeII (29) 74.16
75.49	1	CII (35) 75.95, CII (38) 75.34
76.43	1	FeIII (69) 76.88
77.53	2	CII (37) 77.27, SiII (19) 77.46
78.78	1	CII (37) 78.76, FeIII (120) 78.43, PIII (8) 78.28
79.70	2	FeIII (120) 79.42, CrII (-) 79.52
80.17	1	CII (37) 80.32, FeIII (120) 80.14
82.06	1	ClII (-) 81.89, PrII (-) 82.06
83.65	2	HgII (-) 83.96
85.71	1/2	
86.64	1	TiIII (-) 86.40
87.51	1	TiII (-) 87.63
88.63	1	
90.06	2	ClII (-) 90.15, PrII (-) 89.72
91.42	4	SiII (20) 91.77, ZrII (30) 91.14
93.63	2	CeII (-) 93.82
95.22	3	PrII (-) 94.83
95.65	3	TiII (-) 95.73
96.20	2	AlII (47) 95.86, 96.16, 96.38, Fe II (190) 96.36
97.61	2	P III (9) 97.17, Pr II (-) 97.05
98.30	2	Si II (20) 98.01
99.61	3	Ce II (-) 99.24
4000		
01.72	1	
02.39	2	Fe II (29) 02.07, Fe II (190) 02.55, Cr II (-) 02.48
03.53	2	FeIII (15) 03.41, CrII (-) 03.32, CeII (-) 03.77
04.88	3	(FeI (43) 05.25)
06.57	3	
07.28	3	FeII (189) 07.72, CrII (-) 07.55
08.37	2	PrII (-) 08.71
09.58	1	CII (27) 09.88, HeI (55) 09.27
10.37	2	SiIII (8.05) 10.10

TABLE II (Continued)

λ(Å)	I	Identifications
11.20	1	
12.09	2	TiII (-) 12.39, CeII (-) 12.39, NdII (-) 12.25
12.73	3	FeII (126) 12.47, CrII (-) 12.50
14.98	2	FeII (142) 15.20, CeII (-) 14.90
16.79	3	SiII (19) 16.22
17.22	2	CII (27) 17.28
20.31	1	ClII (-) 20.06
21.23	2	CII (27) 21.17
22.09	2	FeIII (45) 22.36, CrII (-) 22.37
23.90	1	HeI (54) 23.99
24.89	1	FeIII (53) 25.07, FeII (127) 24.55, CeII (-) 24.49
26.21	4	HeI (18) 26.19, 26.36
28.54	3	SII (45) 28.79
30.17	2	(ZrII (41) 29.68)
30.78	1	SiIII (8.05) 30.75, MnI (2) 30.76
31.38	3	FeII (151) 31.46, CeII (-) 31.34
32.57	2	SII (59) 32.81, FeII (126) 32.95
33.37	2	MnI (2) 33.07
34.14	2	MnI (2) 34.49
35.76	3	FeIII (119) 35.54, FeII (22) 35.54
37.50	2	PII (-) 37.04
38.24	1	CrII (-) 38.02
39.86	3	AlII (62) 39.30, 39.40
40.77	2	CeII (-) 40.76, NdII (-) 40.80
41.51	2/3	FeII (172) 41.64, FeII (13) 41.84
42.96	2	CeII (-) 42.58
43.59	2/3	(FeII (172) 44.01)
44.76	3	PII (-) 44.61, PrII (-) 44.82
46.22	3	CeII (-) 46.34, FeI (43) 45.82
48.13	1	CrII (-) 48.02
48.78	3	FeII (172) 48.83, CrII (-) 49.14, ZrII (43) 48.68
49.69	1	(ZrII (43) 50.32)
51.36	1	FeIII (98) 51.08, FeII (172) 51.21
52.20	2	CrII (-) 51.96
53.61	1	FeIII (98) 53.59, FeIII (119) 53.28, CeII (-) 53.51
54.23	2	(CrII (-) 54.10)
54.89	2	PrII (-) 54.86, CeII (-) 54.99
56.10	1	PrII (-) 56.54, CrII (-) 56.07
57.14	2	SiII (7.18) 56.99, PIII (1) 57.39
57.66	2	FeIII (33) 57.51, FeII (212) 57.46
58.58	2	(PIII (1) 59.27)
60.26	2	TiIII (-) 60.21
61.85	2	FeII (189) 61.79
63.07	3	(FeI (43) 63.60)
64.46	2	FeII (39) 64.75, SiIII (55) 64.11
66.17	2	FeII (214) 66.33
67.80	1	CsII (-) 67.96
69.37	2	TiIII (-) 69.54, (FeII (188) 69.88)
70.54	1	CrII (-) 70.88, (FeII (22) 70.03)
71.31	2	CeII (-) 71.81, FeI (43) 71.74
72.48	3	OII (10) 72.16, SiII (3.01) 72.71, CrII (-) 72.56
73.13	3	CeII (-) 73.48, CsII (-) 73.36
74.43	1	CII (36) 74.52, 74.85
75.60	3	OII (10) 75.87, FeII (21) 75.95, SiII (3.01) 75.45, CII (36) 75.85
76.87	4	SiII (3.01) 76.78, CrII (-) 76.87
77.56	4	SrII (1) 77.71, CII (35.01) 77.78, 77.62, CrII (-) 77.50
78.58	3	OII (10) 78.86, CeII (-) 78.32
79.65	1	TiIII (-) 79.96, PIII (1) 80.04
81.53	1	FeIII (119) 81.19, FeII (188) 81.42, CeII (-) 81.22
83.28	1	MnII (-) 83.66, CeII (-) 83.23
85.37	2	CeII (-) 85.23, (OII (10) 85.12)
87.28	1	(FeII (28) 87.27)
88.41	2	FeII (39) 88.75, CrII (-) 87.60
90.32	1	ZrII (29) 90.52
91.26	1	
92.48	1	OII (10) 92.94
94.06	1	
95.80	1	
97.41	1	OII(20) 97.26
4100		
01.73	8	Hδ 01.74
06.71	1	
11.11	1	SiIII (35) 11.26, CrII (-) 11.00
11.75	2	FeII (188) 11.90, SiIII (35) 11.51
12.46	1	CrII (-) 12.58
13.31	1	FeIII (-) 13.23, 13.45, CrII (-) 13.24
14.65	1	
16.84	1	(SiIII (12.04) 15.50)
17.84	1	CeII (-) 18.14
18.61	2	PrII (-) 18.48, FeI (801) 18.55
19.39	1	TiIII (-) 19.14, OII (17) 19.22, FeII (21) 19.53
20.35	3	CeII (-) 20.83
21.87	3	FeIII (118) 22.06
22.87	3	FeIII (118) 22.98, FeII (28) 22.64
23.89	1	ClII (-) 23.93, CeII (-) 23.87, 23.49

TABLE II (Continued)

λ(Å)	I	Identification
25.12	1	FeII (22) 24.79, CeII (-) 24.79
26.11	1	
28.05	5	SiII (3) 28.07
29.61	1	EuII (-) 29.73
31.15	5	SiII (3) 30.89
32.39	2	CrII (-) 32.41, CsII (-) 32.00, FeI (43) 32.06
33.06	2	FeI (357) 32.90
33.77	1	ClII (-) 33.64, CeII (-) 33.80
37.20	1	FeIII (118) 37.45
38.25	1	FeII (39) 38.40, FeII (150) 38.21
39.09	1	FeIII (118) 39.37
40.29	2	FeIII (118) 40.51
41.76	1	SII (44) 42.29
42.72	1	FeII (189) 43.07
43.58	2	HeI (53) 43.76, PrII (-) 43.14, FeI(43) 43.87
45.61	3	SII (44) 45.10, CeII (-) 45.77
46.40	3	CeII (-) 46.23
47.16	2	FeII (141) 47.26, ClII (-) 47.04
49.23	1	ZrII (41) 49.22
51.38	2	FeII (12) 51.79, FeII (149) 51.60, CrII (-) 51.00
53.19	3	SII (44) 53.10, FeII (45) 52.98
53.92	3	
54.73	1	FeIII (-) 54.98
56.70	2	(ZrII (29) 56.24)
58.48	2	FeII (12) 58.45
59.98	1	FeII (149) 60.28
60.86	2	FeII (39) 60.62, CrII (-) 61.07
61.64	3	SrII (3) 61.80
62.71	1	SII (44) 62.70
63.47	2	TiII (-) 63.64
64.68	2	FeIII (118) 64.79
66.02	1	CeII (-) 65.61
66.95	1	FeIII (118) 66.86, CeII (-) 66.88
67.63	3	FeII (149) 67.69
71.59	3	MnII (-) 71.51, (71.04), CrII (-) 71.92
72.47	3	FeII (148) 72.20, CrII (-) 72.60
73.35	4	FeII (27) 73.45
74.20	4	FeIII (-) 74.27, MnII (-) 74.31
74.90	2	
76.25	3	FeII (149) 76.44
78.84	4/5	FeII (28) 78.86, PII (-) 78.48
79.59	3	FeIII (-) 79.25, PrII (-) 79.42, CrII (-) 79.43
81.36	2	CrII (-) 81.50, (FeII (148) 80.97)
82.61	3	FeII (149) 82.69
83.22	2	FeIII (22) 84.09
86.91	4	SiII (7.17) 87.14, CeII (-) 86.60, FeI (152) 87.04
88.14	2	FeI (152) 87.80
89.81	2	SII (44,64) 89.71, OII (36) 89.79, PrII (-) 89.52
90.88	3	TiIII (-) 91.09, SiII (7.26) 90.72
95.66	3	(CrII (-) 95.33, 95.41)
97.27	1	
98.20	1	SiII (7.26) 98.13, FeI (152) 98.31
98.92	3	FeII (141) 99.09, CeII (-) 98.72
99.98	3	TiIII (-) 00.06
4200		
00.68	3	SiII (7.06) 00.66, 00.90
01.35	2	
05.64	3	FeII (22) 05.48, (EuII (-) 05.05)
06.47	2	MnII (-) 06.37, PrII (-) 06.71
10.80	1	FeIII (-) 10.87
12.04	1	FeII (21) 11.80, SiIII (34) 11.68
15.13	2	TiIII (-) 14.92
15.85	2	TiIII (-) 15.95, 15.52, CrII (-) 15.76, SrII (1) 15.52
17.46	1	(CrII (-) 17.07)
22.95	1	PrII (-) 22.98, CeII (-) 22.60
24.65	3	PII (-) 24.52, CrII (-) 24.85
25.45	3	PrII (-) 25.31
26.65	1	AlII (46) 26.83, CsII (-) 27.10, CaI (2) 26.73
28.08	3	AlII (46) 28.00, CsII (-) 28.35
32.93	4	FeII (27) 33.17, SiII (7.01) 32.86
33.51	3/4	CrII (-) 33.26, (ClII (-) 33.95)
35.32	3	FeIII (-) 35.54, ClII (-) 35.46
38.06	2	AlII (23) 37.57
38.62	2	FeIII (104) 38.78, MnII (-) 38.78
39.54	2	MnII (-) 39.19
40.56	1	AlII (36) 40.75
41.78	4	ClII (-) 41.38
42.59	2	MnII (-) 42.34, (CrII (-) 42.36)
46.28	3	CrII (-) 46.41
47.17	2	ScII (7) 46.83, FeII (125) 47.43, NdII (-) 47.38
49.38	3	FeIII (-) 49.95

TABLE II (Continued)

λ(Å)	I	Identification
51.09	2	GaII (-) 51.15, (FeI (42) 50.79)
52.40	3	CrII (-) 52.63
53.18	2	ClII (-) 53.38
54.17	1	GaII (-) 54.04, CrI (1) 54.35
55.36	2	FeIII (-) 55.20
56.01	2	CeII (-) 55.79, CrII (-) 56.17, (GaII (-) 55.70, 55.76, 55.64)
56.79	2	
59.21	3	SiII (7.01) 59.20, ClII (-) 59.49
61.59	4	
62.17	4	CrII (-) 61.92, GaII (-) 61.99
65.99	2	CrII (-) 66.23
66.77	3	CII (6) 67.00, 67.26
69.25	3	TiIII (-) 69.84, CrII (-) 69.29, 68.96
71.25	2	FeI (152) 71.15, (FeI (420) 71.76)
73.69	3	FeIII (121) 73.42, FeII (27) 73.32
74.53	2	CrI (1) 74.80
75.24	2	CrII (-) 75.58
76.18	2	ClII (-) 76.47
78.56	3	FeII (32) 78.13, (CrII (-) 78.11)
80.55	3	
82.35	3	MnII (-) 81.94, FeI (71) 82.41
84.24	2	CrII (-) 84.21
84.87	2	
85.66	3	TiIII (-) 85.61
86.55	3/4	FeIII (121) 86.13, FeII (-) 86.31
87.17	3	
88.61	3	MnII (-) 88.48, PII (-) 88.60, (TiIII (-) 88.66)
89.45	3	CII (41,42) 89.88
90.46	4	(ErIII (-) 90.09)
91.51	2	CII (41,42) 91.82, ClII (-) 91.71
93.00	3	
94.04	2/3	CII (41) 93.90
96.36	4	FeII (-) 96.57, (CII (41) 95.92), (TiIII (-) 96.70)
98.41	2	(PrII (-) 97.76)
99.49	4	CeII (-) 99.36, FeI (152) 99.24
4300		
00.56	3	CeII (-) 00.33, (TiII (-) 00.04)
01.59	3	TiII (-) 01.93
02.51	4	
03.42	4	FeII (27) 03.17, NdII (-) 03.58
04.31	3	TiIII (-) 04.51, ClII (-) 04.03
05.66	2	SrII (3) 05.45, PrII (-) 05.76
06.10	2	CII (12.02) 06.33
07.35	4	CII (12.02) 07.59, CrII (-) 06.95
08.43	2	MnII (-) 08.16
09.43	2	ClII (-) 09.01
10.75	2	FeIII (121) 10.37
13.32	2	CII (28) 13.10, (FeII (220) 13.03)
14.72	1	FeII (32) 14.29, (ScII (15) 14.08)
15.27	3	FeI (71) 15.09
16.98	2	CII (28) 17.26, OII (2) 17.14
18.57	2	CII (28) 18.60, FeII (220) 18.22
20.43	1	ScII (15) 20.75
21.65	2	CII (28) 21.65, (FeII (220) 21.34)
22.69	1	(CII (28) 23.10)
25.22	2	ScII (15) 25.01, MnII (-) 25.03, (CII (28) 25.82)
29.22	3	CrII (-) 28.91
31.02	2	CsII (-) 30.64
34.22	1	PrII (-) 33.91
40.43	8	Hγ 40.47
45.52	1	OII (2) 45.56, MnII (-) 45.78
47.41	1	PrII (-) 47.49
48.47	1	MnII (-) 48.39, (TiIII (-) 48.04)
50.42	2	TiII (-) 50.83
51.85	3	FeII (27) 51.76, SiIII (60) 51.97, PrII (-) 51.84
54.75	2	FeII (213) 54.36
55.46	2	FeII (202) 55.03, SiIII (61) 55.52, 55.28
56.25	3	SiIII (61) 56.10, (MnII (-) 56.63)
57.36	1	FeII (-) 57.57, (SiIII (61) 56.82)
58.51	3	
60.42	3	FeII (148) 60.03
61.75	1	FeII (-) 61.25
63.22	1	MnII (-) 63.26, CsII (-) 63.38
64.43	1	CeII (-) 64.66, (FeII (202) 64.89)
66.93	1	OII (2) 66.90
68.77	3	PrII (-) 68.33, (CII (45,46) 68.26)
69.90	2	CII (45) 69.86
70.42	2	(CII (46) 70.66)
71.93	3/4	FeII (33) 72.22
72.65	3	CII (45) 72.49, 72.35, CII (46) 72.35
74.15	2	CII (45) 74.27, ScII (14) 74.46
76.03	2	CeII (-) 75.92, (CII (45) 76.56)
77.07	3	SiII (7.16) 76.96, (SiIII (8.13) 77.63)
80.70	1	
81.27	2	FeII (9) 81.79

TABLE II (Continued)

λ(Å)	I	Identifications
82.51	1	(CeII (-) 82.17)
83.74	2	FeI (41) 83.55
84.85	3	CsII (-) 84.43
85.62	3	FeII (27) 85.38, PII (-) 85.35
86.41	2	FeII (26) 86.57, CeII (-) 86.84
88.25	2	HeI (51) 87.93
89.67	1	
90.89	2/3	
93.23	2	MnII (-) 93.39
93.96	2	
95.06	2	TiII (-) 95.02
95.72	3	FeIII (4) 95.78
96.42	2	CsII (-) 96.91
98.37	1	TiII (61) 98.31
99.80	1	FeII (20) 99.86
4400		
00.64	3	ScII (14) 00.36
01.81	1	
02.70	1	MnII (-) 03.51
03.30	2	PrII (-) 03.61
04.51	2	FeI (41) 04.75
05.80	3	PrII (-) 05.85
06.68	3	
08.12	3	
08.91	2	CII (40) 09.16, PrII (-) 08.84
09.87	2	CII (40) 09.98
11.27	3	CII (39) 11.16, 11.51
14.60	3	OII (5) 14.91
15.63	3	ScII (14) 15.56, (FeI (41) 15.12)
16.22	3	
17.27	3	OII (5) 16.98, PII (-) 17.30, (FeII (27) 16.82)
18.82	3	TiII (51) 18.34, CeII (-) 18.78
19.61	3	FeIII (4) 19.59
20.73	3	PII (-) 20.71
23.28	1	SiIII (58) 23.56
25.27	2	
29.42	2	PrII (-) 29.24, CeII (-) 29.27
30.13	2	
30.99	3	FeIII (4) 30.95
31.89	3	FeII (222) 31.63
35.34	2/3	EuII (-) 35.56, CsII (-) 35.71
36.28	1	
37.33	2	HeI (50) 37.55
44.47	2	FeII (201) 44.56, CeII (-) 44.39, 44.70
45.54	1	FeII (9) 45.26
48.17	2	
51.46	2	FeII (-) 51.55
52.46	3	OII (5) 52.38, PII (-) 52.46
53.42	2	
54.89	1	ZrII (40) 54.80, (FeII (-) 55.26)
56.65	3	TiII (-) 56.65, CrII (-) 56.84
62.60	2	FeIII (106) 62.90, PII (-) 63.00
64.32	2	TiII (-) 64.46
66.17	2	PII (-) 66.13
68.31	2	TiII (-) 68.48, PII (-) 67.98
69.61	1	HeI (15) 69.92 f
70.76	1	TiII (-) 70.86
71.48	2	HeI (14) 71.48, 71.69
72.77	2	FeII (37) 72.92
73.76	1	
74.49	1	FeII (171) 74.19
77.69	2	PrII (-) 77.26
78.60	1	MnII (-) 78.64
81.34	5	MgII (4) 81.13, 81.33
84.37	1	FeII (32) 84.33
85.11	2	FeII (9) 84.93
86.47	1	CeII (-) 86.91
88.11	1	TiII (-) 88.32
89.21	2	FeII (37) 87.19, CrII (-) 89.15
89.99	3	
91.11	2	FeII (37) 91.40
95.55	2	FeII (147) 95.52
96.38	2	PrII (-) 96.43, (ZrII (40) 96.96)
98.91	2	PII (-) 99.24
4500		
02.06	2	
03.24	3	
04.32	2	CrII (-) 04.52
05.72	1	
06.63	3	CsII (-) 06.83
09.16	2	
09.95	3	PrII (-) 10.16
12.67	2	
15.51	2	FeII (37) 15.38, FeII (20) 15.18, CrII (-) 15.83
16.77	3	CrII (-) 16.56
18.24	3	TiII (-) 18.30
19.58	3	ClII (-) 19.11

TABLE II (Continued)

λ(Å)	I	Identification
20.56	2	FeII (37) 20.23
22.60	2/3	FeII (38) 22.63
23.76	2	
25.40	2	SII (40) 24.95, FeII (9) 25.75
26.93	3	CsII (-) 26.73
28.24	1	CeII (-) 28.47
29.55	1	FeII (171) 29.56
31.15	2	(PII (-) 30.81)
32.95	3	TiIII (-) 33.26
34.08	2	FeII (37) 34.17, PrII (-) 34.15
35.56	3	CeIII (-) 35.73
36.54	2	ClII (-) 36.72
38.74	2	CsII (-) 38.94
39.21	2	CrII (-) 39.61
40.60	1	TiIII (-) 40.22
41.75	2	FeII (38) 41.52
43.15	2	
43.66	3	
46.74	2	CrII (-) 46.63
51.42	3/4	
52.57	2	SII (40,48) 52.38, SiIII (2) 52.62
54.91	3	PII (-) 54.83, CrII (-) 55.01
55.70	3	TiIII (-) 55.46, FeII (37) 55.89
57.32	3/4	
58.47	3	FeII (20) 58.58, PII (-) 58.07, CrII (-) 58.66
60.71	3	
61.94	3	PII (-) 62.27
66.42	2	
67.98	1	SiIII (2) 67.82
68.66	2	TiII (-) 68.31
70.07	3	FeIII (66) 70.34, FeIII (82) 69.82
70.89	2	
71.75	2	TiII (-) 71.97, ClII (-) 71.96
72.63	1	TiIII (-) 72.20, CeII (-) 72.28, CrII (-) 72.84
73.75	2	
74.61	2	SiIII (2) 74.76
76.29	1	TiIII (-) 76.53
77.01	1	
83.61	1	FeII (37) 82.84, FeII (38) 83.83
85.21	3	ClII (-) 85.00
88.18	1	PII (-) 88.04, CrII (-) 88.22
91.28	3	OII (15) 90.97
92.22	3	CrII (-) 92.07
94.28	3/4	CeII (-) 93.93
95.59	3	FeII (38) 95.68, PII (-) 95.51
96.61	1	FeIII (-) 96.09, (FeI (820) 96.06)
4600		
03.61	3	CsII (-) 03.76
05.23	2	
06.82	2	CeII (-) 06.40
10.39	1	TiIII (-) 10.48
12.19	1	
13.45	3	
16.07	2	TiIII (-) 15.93, CsII (-) 16.13
16.70	2	CrII (-) 16.64
19.60	2	CII (50) 19.23
21.41	2	SiII (7.05) 21.72, 21.42
25.38	4	CII (49) 25.56
28.07	1	CeII (-) 28.16
29.94	2	CII (49) 29.98
33.09	2	
33.85	2	TiIII (-) 34.17, CrII (-) 34.10
35.05	2	FeII (186) 35.33
38.07	2	(CII (12.01) 37.63)
46.86	3	CsII (-) 46.51
48.36	1	
52.68	2	TiIII (-) 52.86, FeII (219) 52.28
58.09	2	PII (-) 58.31

Table III is a summary of the elements definitely present and possibly present in the spectrum of HD 213918. An atomic species has been considered as possibly present when very few lines were identified or the main features appeared blended.

As can be seen from Table III the presence of P II, P III, Cl II, Fe I, Fe II, and Fe III is definitely abnormal.

III. Comparison with Other Peculiar Objects

The effective temperature of HD 213918 as derived from the $(U-B)$ color index is 14,800 K. At this temperature, the hottest magnetic-Ap stars, the Hg-Mn stars, and the cooler He-weak stars overlap. These are the CP2, CP3, and CP4 groups, respectively, in Preston's review (1974). For a general review element by element see Jaschek and Jaschek (1974). HD 213918 shares the general characteristics of the He-weak and of the silicon stars. In Table IV we compare qualitatively the behavior of some atomic species in the spectra of HD 213918, α Sculptoris, 3 Centaurus A, HD 34452, HR 7129, and HD 200311. In HD 213918 Fe is present in the first three stages of ionization as in HD 200311, and HD 168733 (see Little and Aller 1970).

TABLE II (Continued)

Sources of Line lists

H	*
He	*
C II	Moore, 1970
O II	*
Mg II	*
Al II	*
Si I	Moore, 1967
Si II, III	Moore, 1965
P II	Martin, 1959
P III	*
S II	*
Cl II	Radziemski and Kaufman, 1974
Ca II	*
Sc II	*
Ti II	*
Ti III	Edlen and Swensson, 1975
Cr I	*
Mn I	*
Mn II	Iglesias and Velasco, 1964
Fe I, II, III	*
Ga II	Bidelman and Corliss, 1962
Sr II	*
Zr II	Kiess, 1953
Cs II	Olthoff and Sawyer, 1932
	Wheatley and Sawyer, 1942
Ce II	Meggers et. al., 1975
Ce III	Sugar, 1965
Pr II	Meggers et. al., 1962
Nd II	Meggers et. al., 1975
Eu II	*
Er III	Spector, 1973

* Moore, 1945

TABLE III

Atomic Species in the Spectrum of HD 213918

Definitely Present	H I, He I, C II, O II, Mg II, Al II, Si II, Si III, P II, P III, S II, Cl II, Ca II, Ti II, Ti III, Cr II, Mn II, Fe I, Fe II, Fe III, Sr II, Ce II, Pr II, Hg II
Possibly Present	Sc I, Sc II, Cr I, Mn I, Ga II, Zr II, Cs II, Ce III, Nd II, Eu II, Er III

Ce II, Ce III, Nd III,, Er III, and Hg II are also present in HD 200311 and in HD 213918. However in HD 200311 there are several species detected which have not been detected in HD 213918. An important difference between HD 213918 and HD 200311 is the presence of P II and P III in the former and the absence of them in the latter. These two species are present also in the He-weak stars of Table IV (α Scl, 3 Cen A, HD 34452, and HR 7129).

As a conclusion we are inclined to believe that HD 213918 is related with the He-weak stars and with the silicon stars; but, as is very well known (see Cowley 1975), variety is one of the most conspicuous characteristics of the early-type peculiar stars when they are analyzed in detail. HD 213918 is not an exception to this.

This work has been supported by grants from the Comision de Investigaciones Científicas de la Provincia de Buenos Aires. This support is deeply appreciated. Many thanks are given to Mrs. Silvia Galliani de Picó for the typewriting, and also to the referee who helped to improve the presentation of the paper.

TABLE IV

Comparison with other Peculiar stars

	HD 213918	α Scl[a]	3 Cen A[b]	HD 34452[c,d]	HR 7129[e]	HD 200311[f]
(B-V)o	-0.17	-0.17	-0.16	-0.19	-0.20	-0.11
(U-B)o	-0.62	-0.55	-0.59	-0.63	-0.71	-0.50
H	B5	B4	B5	B4	B3	B5
He I	w	w	w	w	w	a
C II	n	n-ss	ss	n	n	ss
N II	a	n	n	n	p	a
O II	w	sw	w	a	p	pp
Ne II	a	n	n	a	a	a
Mg II	n-ss	n-ss	n	n	ss	ss
Al II	p	n-ss	a	a	a	pp
Si I	pp	a	a	a	a	a
Si II	s	ss	n	s	ss	s
Si III	ss	n	n	p	s	p
P II	p	p	p	p	p	a
P III	p	a	p	a	p	a
S II	p	n	a	p	a	p
Cl II	p	s	a	p	p	p
A II	a	n-ss	pp	a	a	pp
Ca II	ss	ss	n	n-sw	s	ss
Sc II	pp	s	n-ss	p	a	pp
Ti II	ss	s	s	p	p	p
Ti III	p	a	a	a	a	w
V II	a	s	s	a	a	a
Cr II	p	s	s	p	p	p
Mn I	pp	a	a	a	a	a
Mn II	sw	s	a	pp	a	p
Fe I	p	a	a	a	a	p
Fe II	s	s	ss	p	p	p
Fe III	s	p	a	a	s	p
Ni II	a	a	a	p	a	p
Ga II	pp	a	p	a	p	p
As II	a	a	a	a	p	a
Sr II	s	s	a	p	p	ss
Zr II	pp	a	a	a	a	a
Cs II	pp	a	a	a	a	a
Ce II	p	a	a	a	a	p
Ce III	pp	a	a	a	a	p
Pr II	p	a	a	a	a	p
Nd II	pp	a	a	a	a	pp
Eu II	pp	n	n	p	a	p
Er II	pp	a	a	a	a	p
Hg II	p	a	a	a	a	p

Symbols and Remarks to table IV

[a] Jugaku and Sargent, 1961

[b] Bidelman, 1960

[c] Jaschek and López García, 1966

[d] Tomley, Wallerstein and Wolff, 1970

[e] Balona, 1975

[f] Adelman, 1974

w : weak
n : normal
s : strong
ss : slightly strong
sw : slightly weak
a : absent
p : present
pp : possibly present

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