KG
11366
127

1924phae.proj.1128p

43

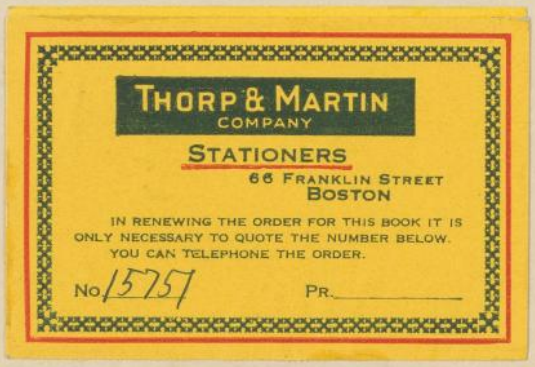
3

μφ of c stars

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1924phae..proj..1128P

KG 11366 .127



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1924phae.proj.1..23P

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α Reticuli μφ 2858
X-8342

Total = 55

N								
H 5	26	26.5	94	96	201	198	3	3
	25.5	26.5	93	96	203	198	5	4
	25	26	91	94	206	201	5	4
	24	26	87	94	213	201	12	10
	23	26	84	94	217	201	16	14
10	22	25.5	80	93	224	203	21	18
	21	25.5	76	93	231	203	28	23
	20.5	25.	74	91	234	206	28	23
	19.5	25	71	91	239	206	33	26
	18.5	25	67	91	246	206	40	31
15	17.5	25	64	91	251	206	45	34
	17	24.5	62	89	255	209	46	34
	17	24.5	62	89	255	209	46	34
	16	24	58	87	262	213	49	36
	15.5	24	56	87	265	213	52	38
20	14	24	51	87	274	213	61	43
	13	23.5	47	85	282	216	66	46
	12.5	23.5	45	85	286	216	70	48
	12.5	23.5	45	85	286	216	70	48
	12.5	23.	45	84	286	217	69	47
25	12.5	23	45	84	286	217	69	47
	12.5	23	45	84	286	217	69	47
	10.5	21.5	38	82	303	221	82	53
	10	22.5	36	82	308	221	87	55
	10.5	22	38	80	303	224	79	52
30	11	22	40	80	297	224	73	49
	11	22	40	80	297	224	73	49
	11	22	40	80	297	224	73	49
	11	22	40	80	297	224	73	49
34	11	21.5	40	78	297	228	69	47

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1924phae.proj.1102P

2

α Reticuli MG 2858
X-8342

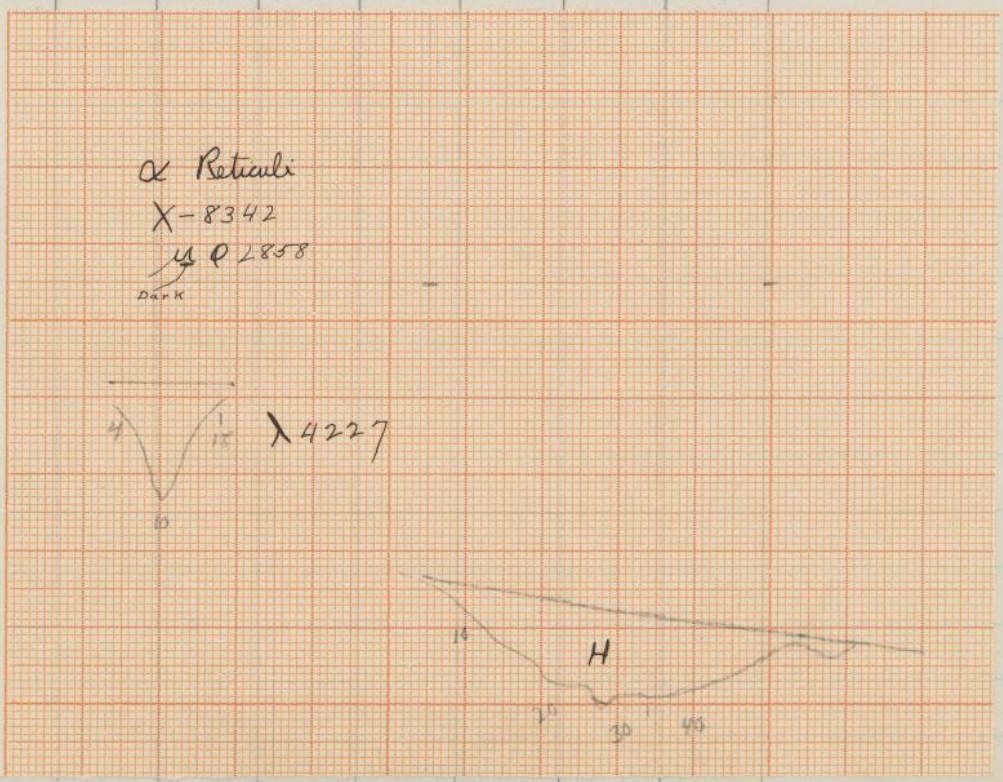
#			Total = 55					
35	11	21.5	40	78	297	228	69	47
	11	21.5	40	78	297	228	69	47
	11	21	40	76	297	231	66	46
	11.5	21	42	76	293	231	62	44
	11.5	21	42	76	293	231	62	44
40	12	21	44	76	288	231	57	41
	12	20.5	44	74	288	234	54	39
	12.5	20.5	45	74	286	234	52	38
	13	20.5	47	74	282	234	48	36
	13.5	20	49	73	278	236	42	32
45	14	20	51	73	274	236	38	30
	14	20	51	73	274	236	38	30
	15	20	55	73	267	236	31	25
	15	20	55	73	267	236	31	25
	16	19.5	58	71	262	239	23	19
50	16.5	19.5	60	71	258	239	19	16
	17	19.5	62	71	255	239	16	14
	17.5	19	64	69	251	243	8	7
	18	19	65	69	249	243	6	5
	18	19	65	69	249	243	6	5
55	17.5	19	64	69	251	243	8	7
	17	19	62	69	255	243	12	10
	16.5	18.5	60	67	258	246	12	10
	16	18.5	58	67	262	246	16	14
	16.5	18	60	65	258	249	9	8
60	17	18	62	65	255	249	6	5
	17.5	18	64	65	251	249	2	2
	18	18	65	65	249	249	0	0

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1924phae.proj.1128P

α Reticuli MΦ 2858
X - 8342

			Total = 57						
	4	39	42	137	1470	133	117	16	14
λ4227	5	38	42	133	147	140	117	23	19
		36.5	42	128	147	148	117	31	25
		35	42	123	147	156	117	39	30
		33	42	116	147	166	117	49	36
		29	42	102	147	188	117	71	48
	10	27	42	95		200		83	53
	5	26.5	42	93		203		86	55
	11	27.5	42	96		198		81	53
		29.5	42	103	147	187	117	70	48
		32	42	112		173		56	40
		34.5	42	121		159		42	32
		35	42	123	147	156	117	39	30
	15	36	42	126		151		34	27
		37.5	42	132		141		24	20
		38.5	42	135	147	137	117	20	17
		39.5	42	139	147	130	117	13	11



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1924phae.proj.1102BP

4

α Aquilae μφ 2852
X- 7907

	N		Total = 57						
H	5	31.5	31.5	110	110	176	176	0	0
		31.	31.5	109	110	178	176	2	2
		31	31.5	109	110	178	176	2	2
		31	31.5	109	110	178	176	2	2
		31	31.5	109	110	178	176	2	2
	10	30.5	31.5	108	110	180	176	4	4
		30.5	31	108	109	180	178	2	2
		30	31	105	109	184	178	6	5
		30	31	105	109	184	178	6	5
		30	31	105	109	184	178	6	5
	15	29.5	31	103	109	187	178	9	8
		29.5	31	103	109	187	178	9	8
		29	31	102	109	188	178	10	9
		29	31	102	109	188	178	10	9
		29	31	102	109	188	178	10	9
	20	28.5	31	100	109	192	178	14	12
		28	30.5	98	107	195	181	14	12
		28	30.5	98	107	195	181	14	12
		28	30.5	98	107	195	181	14	12
		28	30.5	98	107	195	181	14	12
	25	28	30	98	105	195	184	11	10
		28	30	98	105	195	184	11	10
		28	30	98	105	195	184	11	10
		27.5	30	96	105	198	184	14	12
		27.5	30	96	105	198	184	14	12
	30	27	30	95	105	200	184	16	14
		27	30	95	105	200	184	16	14
		26.5	30	93	105	203	184	19	16
		26.5	30	93	105	203	184	19	16
	34	26	30	91	105	206	184	22	18

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1924phae.proj.1128P

α Aquilae μφ 2857
X-7907

N			Total=57					
35	25.5	30	89	105	209	184	25	21
	25.5	30	89	105	209	184	25	21
	25	29.5	88	103	211	187	24	20
	24.5	29.5	86	103	214	187	27	22
	24	29.5	84	103	217	187	30	24
40	23.5	29.5	82	103	221	187	34	27
	23	29.5	81	103	223	187	36	28
	22.5	29	79	102	226	188	38	30
	22	29	77	102	229	188	41	31
	21.5	29	75	102	233	188	45	34
45	21	29	74	102	234	188	46	34
	20	29	70	102	241	188	53	39
	19	29	67	102	246	188	58	41
	18.5	29	65	102	249	188	61	43
	18	29	63	102	253	188	65	45
50	17	29	60	102	258	188	70	48
	16.5	29	58	102	262	188	74	49
	16	29	56	102	265	188	77	51
	15	28.5	53	100	271	192	79	52
	14	28.5	49	100	278	192	86	55
55	13.5	28.5	47	100	282	192	90	56
	12.5	28.5	44	100	288	192	96	59
	11.5	28.5	40	100	297	192	105	62
	10	28.5	35	100	311	192	119	67
	9	28	32	98	319	195	124	68
60	8	28	28	98	330	195	135	71
	7	28	25	98	341	195	146	74
	6.5	28	23	98	349	195	154	76
	6	28	21.	98	358	195	163	78
	5	28	18	98	374	195	179	81
65	5	28	18	98	374	195	179	81

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6

α Aquilae HP 2852
X-7907

	H				Tilt at 57				
		66	14	28	14	98	399	195	204	85
			13	28	11	98	421	195	226	88
			13	28	11	98	421	195	226	88
			13.5	28	12	98	413	195	218	87
		70	13.5	28	12	98	413	195	218	87
			14	27.5	14	96	399	198	201	84
			14.5	27.5	16	96	385	198	187	82
			15.5	27.5	19	96	369	198	171	79
			17	27.5	25	96	341	198	143	73
		75	18	27.5	28	96	330	198	132	70
			19	27	32	95	319	200	119	67
			20	27	35	95	311	200	111	64
			21	27	39	95	300	200	100	60
			22.5	27	44	95	288	200	88	56
		80	23	27	46	95	284	200	84	54
			24	27	49	95	278	200	78	51
			24.5	27	51	95	274	200	74	49
			25	27	53	95	271	200	71	48
			26	27	56	95	265	200	65	45
		85	27	27	60	95	258	200	58	41
			27	27	60	95	258	200	58	41
			27.5	26.5	61	93	256	203	53	39
			28	26.5	63	93	253	203	50	37
			28.5	26.5	65	93	249	203	46	34
		90	29	26.5	67	93	246	203	43	33
			29.5	26.5	68	93	244	203	41	31
			30	26.5	70	93	241	203	38	30
			30.5	26	72	91	238	206	32	26
			30.5	26	72	91	238	206	32	26
		95	31	26	74	91	234	206	28	23

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α Aquilae
X-7907

μφ 2852

N								
	Total = 57							
96	21	26	74	91	234	206	28	23
H	21	26	74	91	234	206	28	23
	21.5	26	75	91	233	206	27	22
	21.5	26	75	91	233	206	27	22
100	21.5	26	75	91	233	206	27	22
	21.5	26	75	91	233	206	27	22
	21.5	25.5	75	89	233	209	24	20
	22	25.5	77	89	229	209	20	17
	22	25.5	77	89	229	209	20	17
105	22	25.5	77	89	229	209	20	17
	22	25.5	77	89	229	209	20	17
	22	25.5	77	89	229	209	20	17
	22	25	77	88	229	211	18	15
	22	25	77	88	229	211	18	15
110	22	25	77	88	229	211	18	15
	22	25	77	88	229	211	18	15
	22.5	25	79	88	226	211	15	13
	22.5	25	79	88	226	211	15	13
	23	25	81	88	223	211	12	10
115	23	25	81	88	223	211	12	10
	23	25	81	88	223	211	12	10
	23	25	81	88	223	211	12	10
	23	25	81	88	223	211	12	10
	23	25	81	88	223	211	12	10
120	23.5	25	82	88	221	211	10	9
	23.5	25	82	88	221	211	10	9
	23.5	25	82	88	221	211	10	9
	23	25	81	88	223	211	12	10
	23	25	81	88	223	211	12	10
125	22.5	25	79	88	226	211	15	13

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8

α Aquilae HY 2852
X-7907

N		Total	157					
126	23	25	81	88	223	211	12	10
	23	25	81	88	223	211	12	10
	23	25	81	88	223	211	12	10
	23	25	81	88	223	211	12	10
130	23.5	24.5	82	86	221	214	7	6
	23.5	24.5	82	86	221	214	7	6
	23.5	24.5	82	86	221	214	7	6
	23	24.5	81	86	223	214	9	8
	23	24.5	81	86	223	214	9	8
135	22.5	24	79	84	226	217	9	8
	22	24	77	84	229	217	12	10
	22	24	77	84	229	217	12	10
	22	24	77	84	229	217	12	10
	22	24	77	84	229	217	12	10
140	22	24	77	84	229	217	12	10
	22	24	77	84	229	217	12	10
	22	24	77	84	229	217	12	10
	22.5	24	79	84	226	217	9	8
	22.5	24	79	84	226	217	9	8
145	23	24	81	84	223	217	6	5
	23	24	81	84	223	217	6	5
	23.5	23.5	82	82	221	221	0	0

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1924phae..proj..1128P

α Aquilae μφ 2852
X-7907

K

#		Total = 57						
0	22.5	22.5	79	79				
1	22.5	22.5	79	79	226	226	0	0
	22	22.5	77	79	229	226	3	3
	21.5	22.5	75	79	233	226	7	6
	21	22	74	77	234	229	5	4
5	21	22	74	77	234	229	5	4
	20	22	70	77	241	229	12	10
	20	22	70	77	241	229	12	10
	19	22	67	77	246	229	15	13
	18.5	22	65	77	249	229	20	17
10	18	22	63	77	253	229	24	20
	17.5	22	61	77	256	229	27	22
	17	22	60	77	258	229	29	23
	15.5	22	54	77	269	229	40	31
	14	22	49	77	278	229	49	36
15	12	22	42	77	293	229	64	44
	10	22	35	77	311	229	92	57
	8.5	22	30	77	324	229	95	58
	7	22	25	77	341	229	117	64
	6	21.5	21	75	358	233	125	68
20	5	21.5	18	75	374	233	144	73
	4	21.5	14	75	399	233	166	78
	3.5	21.5	12	75	413	233	180	81
	3	21.5	11	75	421	233	188	82
	3	21.5	11	75	421	233	188	82
25	3.5	21.5	12	75	413	233	180	81
	4	21.5	14	75	399	233	166	78
	4.5	21.5	16	75	385	233	152	75
	5.5	21	19	74	369	234	135	71
29	7	21	25	74	341	234	107	63

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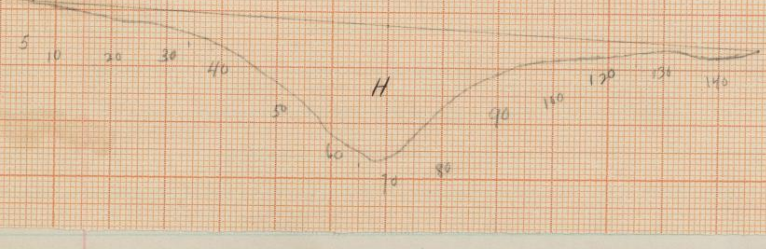
1924phae.proj.11212P

α Aquilae μφ 2852
X-7907

30	8	21	28	74	330	234	96	59
	9	21	32	74	319	234	85	54
	10.5	21	37	74	305	234	71	48
	11.5	21	40	74	297	234	63	44
	13	21	46	74	284		50	37
35	14	21	49	74	278		44	33
	14.5	21	51	74	274		40	31
	15	21	53	74	271		37	29
	16	21	56	74	265		31	25
	16	21	56	74	265		31	25
40	17	21	60	74	258	234	24	20
	17	20.5	60	72	258	238	20	17
	17.5	20.5	61	72	256		18	15
	18	20.5	63	72	253		15	13
	18	20.5	63	72	253		15	13
45	18	20.5	63	72	253		15	13
	18.5	20.5	65	72	249		11	10
	19	20.5	67	72	246	238	8	7
	19	20	67	70	246	241	5	4
	19	20	67	70	246		5	4
50	19	20	67	70	246		5	4
	19	20	67	70	246		5	4
	19	20	67	70	246		5	4
	19	20	67	70	246		5	4
	19	20	67	70	246		5	4
	19	20	67	70	246		5	4
55	19.5	20	68	70	244		3	3
	20	20	70	70	241	241	6	0

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α Aquilae
X - 7907
μφ 2852



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Dispersion of jeep tracings

	Hβ	Hγ	Hδ	Hε	K	H3	Hη	Hθ	Hι	Hκ	Hλ
λ4515 Meas.	0	72	118	147	156	167	182	192	200	206	209
A.U. per scale div.	76	53	48	43	41	39	38				27
λ 12380	0	80	131	164	~~184~~ 173	184	..	..	..	..	..
C 16006	0	60	96	120	136	148	156	162	167	172	..
C 19353	0	59	95	119	135	146	155	161	..	..	..

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Integrated contours

HD 93695, B5, 5.8, X14939 ($\beta - \varepsilon = 164$)

	β		γ		δ		ε		κ
Depth in %	Scale	A.U.	Scale	A.U.	Scale	A.U.	Scale	A.U.	
0	5.4	37	6.0	29	6.5	28	7.0	27	
10	2.9	20	3.2	15	3.5	15	3.8	14	
20	1.8	12	1.7	8	2.0	9	2.6	10	
30	1.2	8	1.1	5	1.2	5	1.7	6	
40	0.8	5	0.4	2	0.7	3	1.2	5	
50	0.3	2	0.2	1	..	..	0.8	3	

λ Cassiopeiae, C 19353, B5 ($\beta - \varepsilon = 119$)

0	4.5	42	3.5	23	4.0	23	5.0	26
10	2.8	17	1.7	11	2.1	12	2.7	14
20	0.8	8	1.2	8	1.4	8	1.6	8
30	0.5	5	0.8	5	1.1	6	1.2 / ~~0.8~~	6
40	0.2	2	0.4	3	0.6	4	0.8	4
50	..		..		..		0.3	2

ι Aquilae C 16006, B5 (3 - λ also on plot)

0	2.7	25	5.0	32	4.2	25	5.0	26	1.0	5.
10	1.2	11	1.9	12	2.0	12	2.0	11	..	
20	0.9	8.	0.9	6	1.2	7	1.3	7		
30	0.6	6	0.3	2	0.5	3	0.9	5		
40	..	..	..	..	..	..	0.4	2		
50	..	..	..	..	..	..	0.1	1		

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NH

β	γ	δ	ε	κ
–	18.6	18.6	18.6	–
19.4	19.2	19.2	19.1	
19.3	18.9	19.0	19.2	
19.2	18.8	18.8	18.9	
19.3	**19.0**	**19.0**	**19.1**	

18.8	18.5	18.5	18.5	
19.3	18.9	19.0	19.1	
18.9	18.9	18.9	18.9	
18.6	18.6	18.7	18.7	
18.9	**18.8**	**18.7**	**18.9**	

18.5	18.6	18.5	18.5	17.0
18.9	18.9	18.9	18.9	
18.9	18.8	18.8	18.8	
18.8	18.0	18.3	18.7	
18.9	**18.9**	**18.8**	**18.8**	

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1924phae.proj.11239P

53 Cas, cB5, C 19087 ($\beta-\varepsilon = 119$)

	β		γ		δ		ε		3	
0	..		3.0	19	2.7	16	2.7	14	2.7	13
10			1.2	8	1.4	8	1.2	6	1.0	5
20			0.7	5	0.9	5	0.7	4	0.7	3
30			0.3	2	0.5	3	0.5	3	0.2	1
40			..	..	0.1	0.6	0.3	2	..	..

$21^h 5^m$, +27.9, C 17054.2, B5

0	5.2	49	5.0	32	3.7	22	5.7	30	4.7	23
10	1.9	18	1.9	12	1.9	11	2.7	14	2.9	14
20	1.1	10	1.4	9	0.9	5	2.1	11	2.2	11
30	0.7	7	1.2	8	0.7	4	1.8	10	1.9	9
40	..		0.7	4	0.6	4	1.3	7	1.6	8
50			0.3	2	0.5	3	1.1	6	1.3	6
60					..	..	0.7	4	0.9	4

3 Cas, C 19353, B2

0	2.5	24	3.0	19	2.7	16	5.0	26	3.5	17
10	1.1	10	1.7	11	1.0	6	2.3	12	2.0 ~~2.4~~	10
20	0.7	7	0.8	5	0.7	4	1.2	6	1.3 ~~1.5~~	6
30	0.2	2	..	..	0.5	3	0.7	4	1.0 ~~1.1~~	5
40	..		..		..	..	0.3	2	0.8 ~~0.8~~	4
50	..		..		..	..	..		0.4 ~~0.5~~	2

AGC 11786, B5, X4515

0			3.8	20	3.2	15	4.2	18	-
10			1.3	7	1.5	7	1.8	8	
20			0.5	3	1.0	5	1.0	4	
30			0.2	1	0.6	3	0.6	3	
40							0.2	1	
50									

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7

NH

β	γ	δ	ε	ζ
1	18.2	18.1	18.0	17.9
	18.6	18.5	18.4	18.2
	18.6	18.6	18.5	18.2
	18.5	**18.4**	**18.3**	**18.1**

19.0	18.7	18.4	18.6	18.4
19.3	19.0	18.9	19.1	19.1
19.2	19.0	18.6	19.2	19.2
19.1	19.2	18.6	19.4	19.3
19.2	**19.1**	**18.7**	**19.2**	**19.2**

4.5	20	18.5	18.2	18.0	18.5	18.1	18.2
2.4	11	18.8	18.9	18.4	19.0	18.8	18.9
1.5	7	18.8	18.6	18.4	18.7	18.7	18.8
1.0	5	(18.0)	-	18.5	18.6	18.7	18.7
0.8	4	**18.8**	**18.7**	**18.4**	**18.8**	**18.7**	**18.8**
0.4	2						

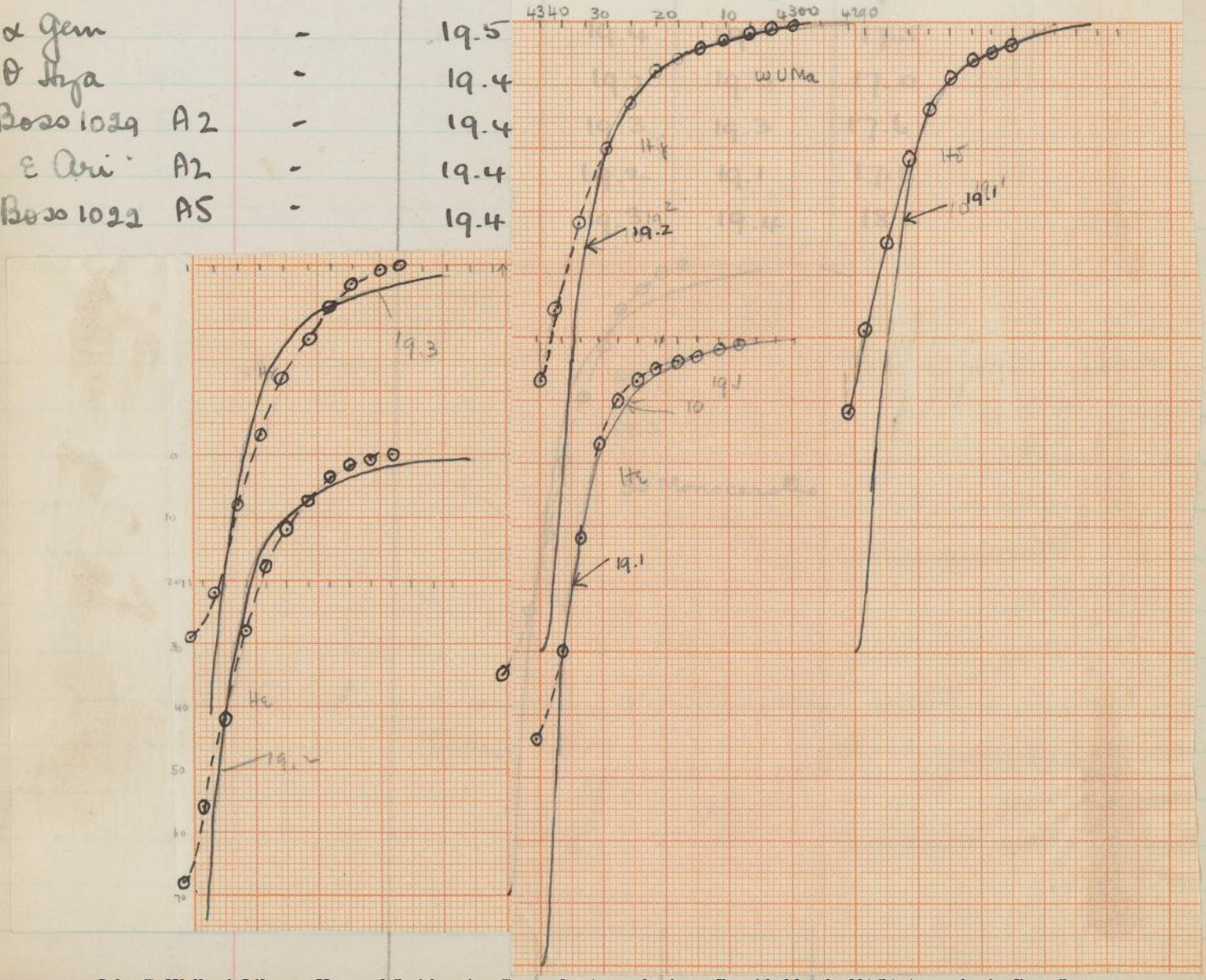
γ	δ	ε
18.2	18.0	18.2
18.5	18.5	18.6
18.2	18.6	18.5
18.3	**18.4**	**18.5**

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Dunham's data for A Stars . log NH

		β	γ	δ	ε	κ
α Lyrae		-	19.3	19.2	19.3	17.5
ω UMa		-	19.2	19.1	19.1	17.2
γ Cyc		-	19.4	19.4	19.4	17.6
30 Mon		-	19.3	19.3	19.2	17.4
γ UMa		-	19.3	19.2	19.3	17.7
δ Hya		-	19.4	19.3	19.2	17.0
α CMa		-	19.4	19.4	19.3	17.0
β UMa		-	19.3	19.2	19.2	17.1
α And		-	18.8	18.8	18.5	17.0
α Gem		-	19.5			
θ Hya		-	19.4			
Boss 1029	A2	-	19.4			
ε Ari	A2	-	19.4			
Boss 1022	A5	-	19.4			

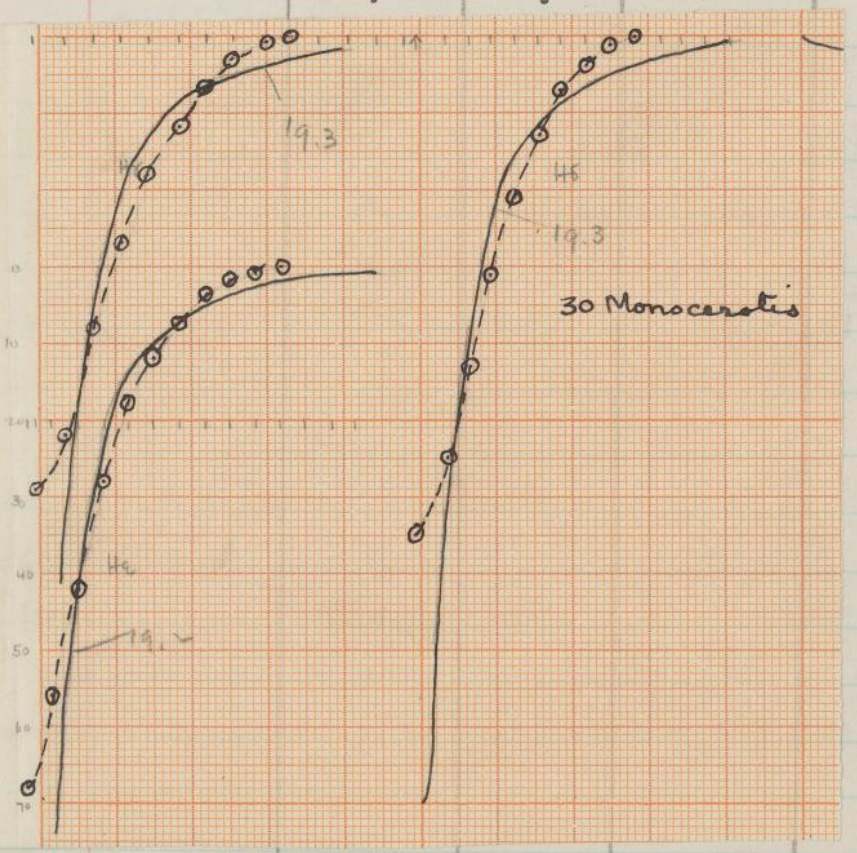


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Dunham's data for A stars . log NH

		β	γ	δ	ε	κ
α Lyrae		-	19.3	19.2	19.3	17.5
ω UMa		-	19.2	19.1	19.1	17.2
γ Cnc		-	19.4	19.4	19.4	17.6
30 Mon		-	19.3	19.3	19.2	18.4
γ UMa		-	19.3	19.2	19.3	17.7
δ Hya		-	19.4	19.3	19.2	17.9
α CMa		-	19.4	19.4	19.3	17.0
β UMa		-	19.3	19.2	19.2	17.1
α And		-	18.8	18.8	18.5	17.0
α Gem		-	19.5	19.4	19.3	17.5
θ Hya		-	19.4	19.2	19.3	17.0
Boss 1029	A2	-	19.4	19.3	19.3	17.6
ε Ari	A2	-	19.4	19.2	19.1	17.5
Boss 1021	A5	-	19.4	19.3	19.4	18.1

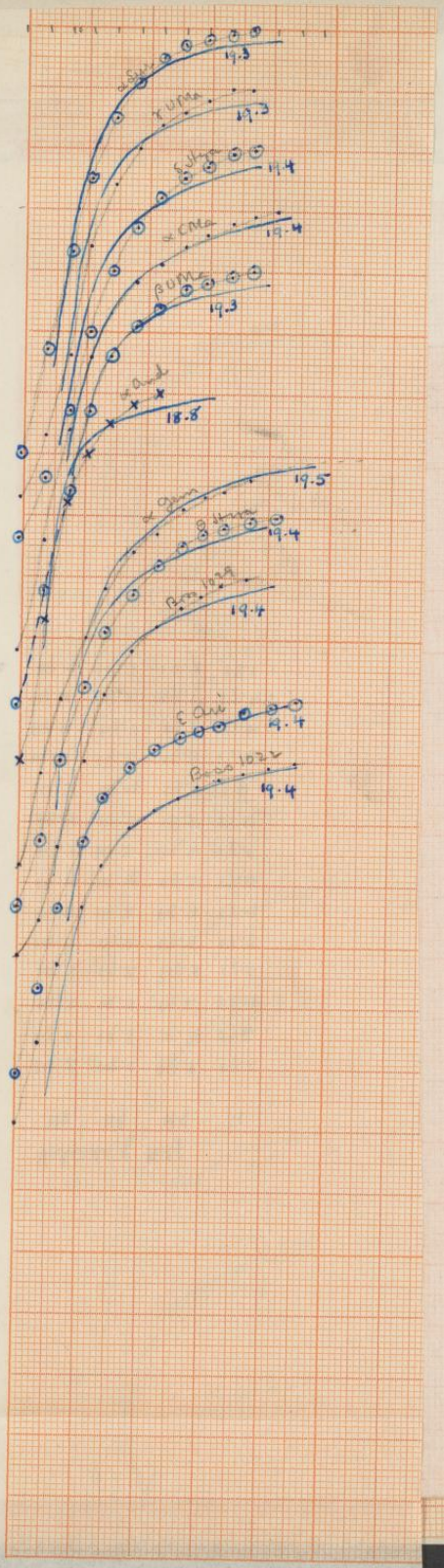


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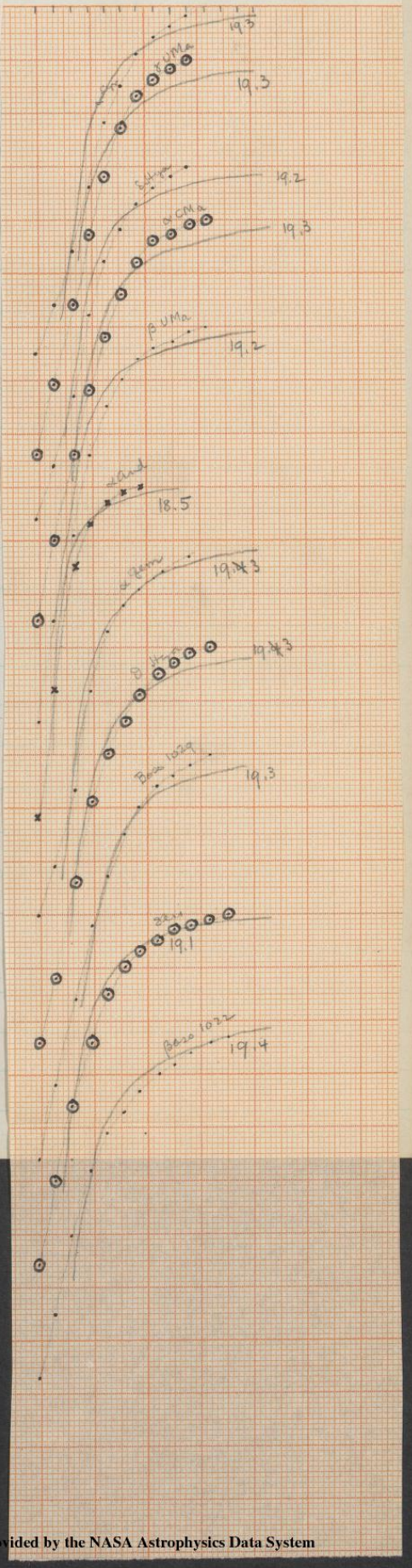
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Hε for various stars

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ENGRAVING 300. MILLIMETER
WHEN ORDERING STATE COLOR, DRAWING OR TRACING PAPER
PRINTED IN U.S.A.



H+Hε, various stars

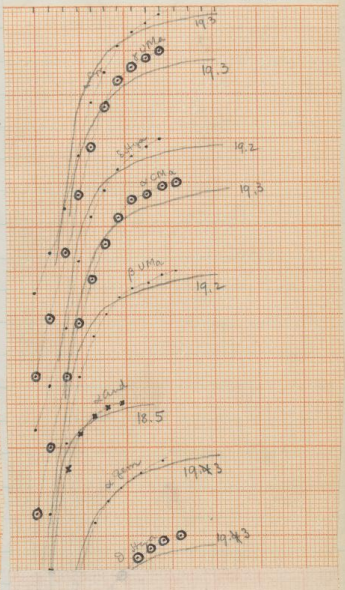


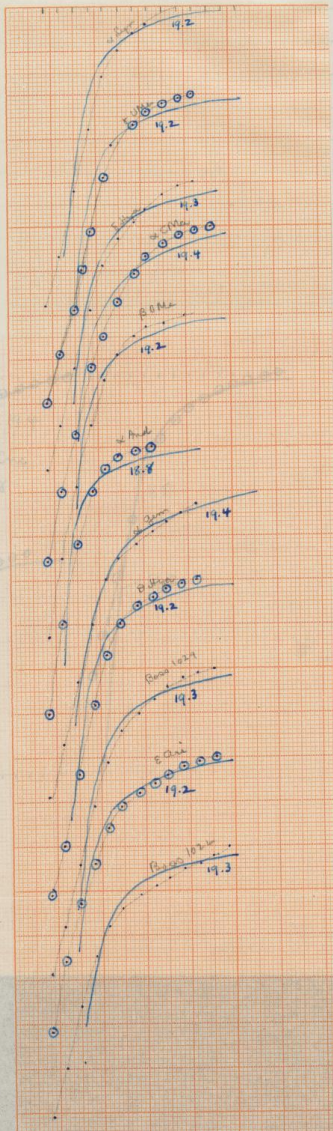
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Hε various stars Dunham's data

H+Hε, various stars





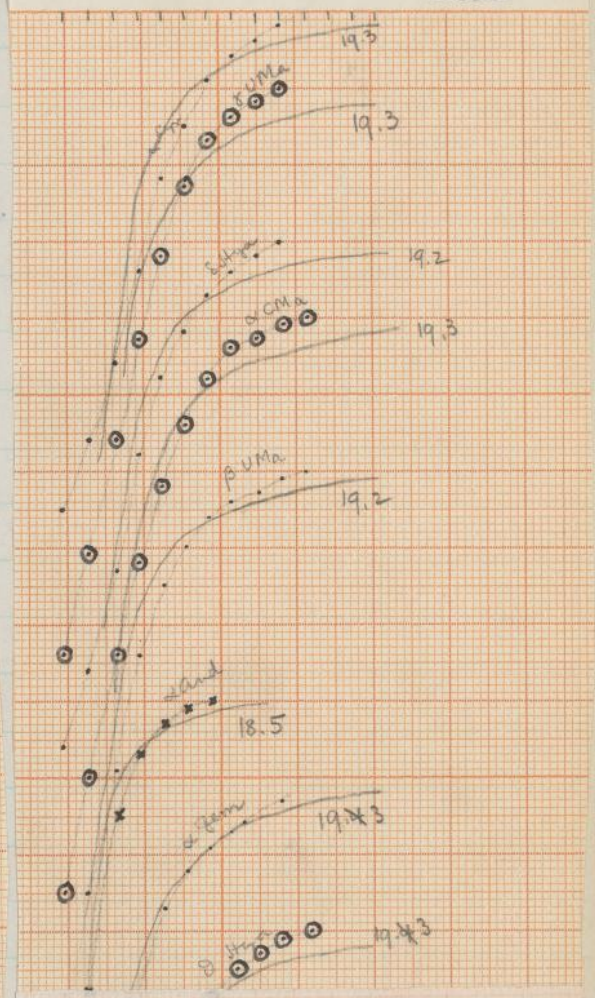
Star.	Values of log $N H_\xi$			
	H_8	H_9	H_ε	K
ω UMa	19.2	19.1	19.1	17.2
γ Cnc	19.4	19.3	19.3	17.6
30 Mon	19.3	19.3	19.2	17.4
α Lyr	19.3	19.2	19.3	17.5
γ UMa	19.3	19.2	19.3	17.7
δ Hya	19.4	19.3	19.2	17.9
α CMa	19.4	19.4	19.3	17.0
β UMa	19.3	19.2	19.2	17.1
α And	18.8	18.8	18.5	17.0
α Gem	19.5	19.4	19.3	17.5
θ Hya	19.4	19.2	19.3	17.8
Boss 1029	19.4	19.3	19.3	17.6
ε Ari	19.4	19.2	19.1	17.45
Boss 1022	19.4	19.3	19.4	18.1
Mean	19.327	19.228	19.207	
	1.327	1.228	1.21	

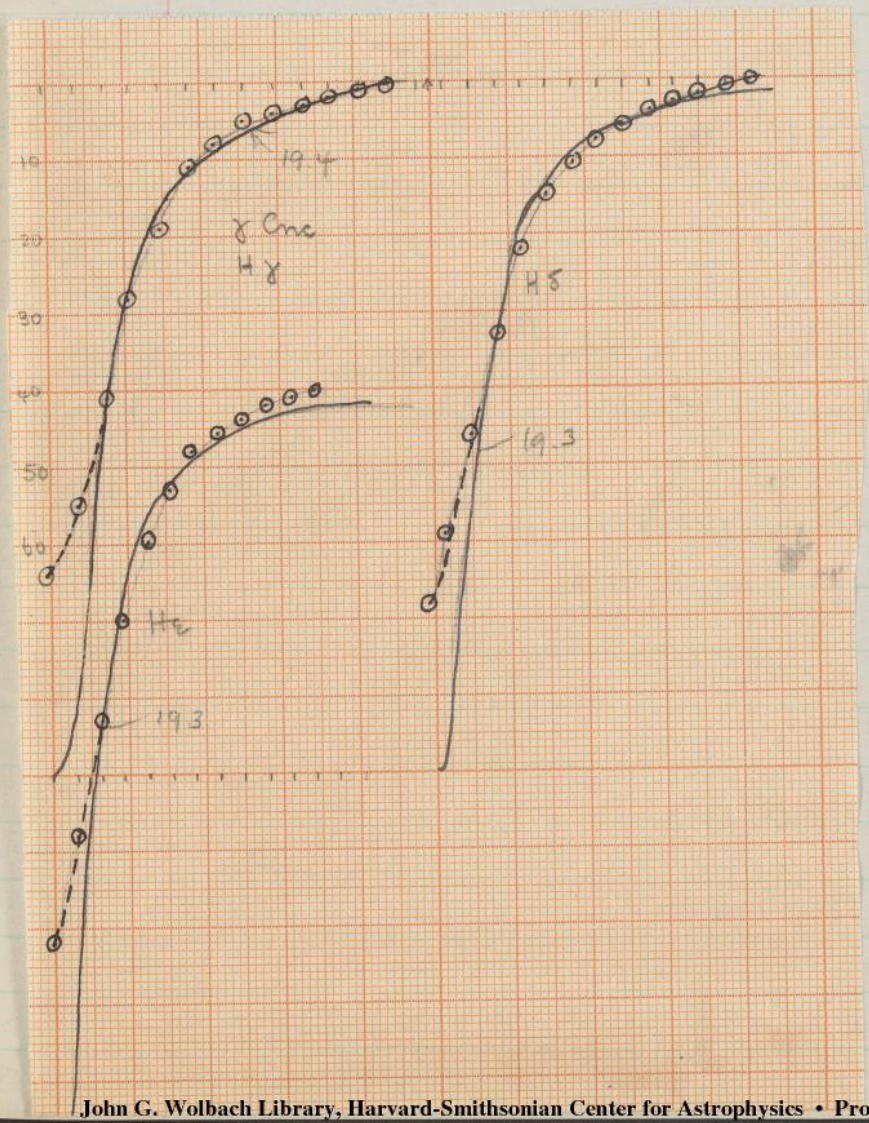
log $N H_\xi$ x10^{-18}

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H + Hε, various stars





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Contours of the for A stars. (CMP Bulletin 858)

Star	β Ori	α Lyr	α Cyg	α PsA	α Aql	α Cir
0	10	25	9	30+	19	22
10	5	16.5	5	23	13	17
20	2.5	12.5	3.5	17	9.5	10
30	1.7	10	2.5	13	7.5	7.5
40	..	8	..	10	6	6
50	..	6	..	8	4.5	4
60	..	4.5	..	6	3.5	3

log NH

β Ori	α Lyr	
17.6	18.5	
18.2	19.2	
17.9	19.3	
17.8	19.1	
~~17.9~~		
~~18.0~~	19.2	

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αC_{gg}	αP_{8A}	αO_{II}	αC_{iv}
17.5	18.7?	18.2	18.4
18.2	19.5	19.0	19.3
18.2	19.6	19.0	19.1
18.2	19.6	19.0	19.0
	19.6	19.0	
	19.6	19.0	
	19.5	19.0	
18.2	19.6	19.0	19.1

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Contours for A stars

NGC 467

× 7247, Mup 2645 $\beta - \varepsilon = 148$

HD 3003

Hundredths of a mag. below background	β		γ		δ		ε		k		ζ
0	2.9x2	44	21	110	18	87	10	8b	2.0	8	
	4.9	37	14.5	77	13	62	8.6	37	1.2	5	
20	3.8	29	9.0	48	9.4	45	8.9	38	0.9	4	
30	2.2	17	7.1	38	6.2	30	7.9	34	0.5	2	
40	..		5.4	29	5.6	27	5.9	26	0.2	1	
50	..		4.2	22	4.8	23	5.0	22			
60	..		3.9	21	4.0	19	4.4	19			
70			3.2	17	3.4	16	3.9	17			
80			2.7	14	2.9	14	3.2	14			
90			2.2	12	2.2	11	2.4	10			
100			2.0	11	1.9	9	2.0	9			
110			1.7	9	1.7	8	1.8	8			
120			1.2	6	1.1	5	1.2	5			
130			0.8	4	0.9	4	1.0	4			
140			..		0.6	3	0.9	4			
150					..						

Lines of this star very hazy, no metallic lines seen. Mup 2643 confirms the star in every detail.

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1924phae.proj.1123P

log NH

β	γ	δ	ε	k	
18.9	21:	20.4:	20.4:	17.4	
19.9	21:	20.4:	20.0	18.2	
19.9	20.2	20.4:	20.4:	17.7	
..	20.3	20.2	20.2	17.5	
..	20.3	20.3	20.3	..	
	20.0	20.0	20.0	..	
19.9	20.4	20.3	20.2	17.7	Mean log NH

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1924phae.proj.1128P

β - z = 164

	β		γ		δ		ε		k	
χ 1350 3, μ -11.94										
√ Cap, HD 193432										
4.84, A0	0	5.6	38	11.0	53	14.0	60		2.9	11
	10	6.1	42	7.0	34	8.8	37			
	20	4.0	27	5.3	26	7.0	30			
	30	2.9	20	4.3	20	5.9	25			
	40	2.2	15	4.0	19	4.9	21			
	50	1.9	13	3.0	14	4.1	17			
	60	1.4	10	2.8	13	3.4	15			
	70	1.1	7	2.2	11	2.9	12			
	80	0.8	6	2.0	10	2.7	12			
	90	0.3	2	1.8	9	2.1	9			
	100	..	..	1.4	7	1.9	8			
				1.1	5	1.4	6			
				0.9	4	1.2	5			
				0.7	3	0.8	3			
				0.3	1	0.2	1			

		γ		δ		k		ε	
C16.76, μ -23.20									
+7° 1337, A0p	0	3.2	21	3.9	23	2.4	12	..	..
4.50	10	1.8	12	2.0	12			-	..
β - z = 119	20	1.2	8	1.4	9			2.1	11
	30	0.9	6	1.0	6			1.4	7
	40	0.4	3	0.8	5			1.2	6
		0.2	1	0.6	4			1.0	5

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1924phae.proj.112sP

β	γ	δ	ε	k	
18.8	19.3	19.4	..	17.7	
20.2	20.1	20.2			
19.8	20.0	20.1			
19.7	19.9	20.0			
19.9	20.0	20.1		17.7	Mean log NH

γ	δ	ε	k
18.3	18.4	..	17.8
19.1	19.1	19 3	
(18.5)	(18.7)	(18.8)	

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1924phae.proj.112:SP

μ Vel 1821, X12380
AGC 12035

		γ		δ	
4.65	B0 0	4.2	20	5.4	23
β-ε = 164	20	1.4	7	2.0	9
	40	0.6	3	1.0	4

X4502, μ Vel 1851

	γ		δ		ε		k	
n Velorum 0	6.3	33	5.8	28	7.4	32	3.6	15
20	3.0	16	3.5	17	3.9	17	1.9	8
40	1.9	10	2.2	10	2.9	12	1.1	5
60	1.4	7	1.6	8	2.0	49	0.8	3
80	1.0	5	1.0	5	1.4	6		
100	03	2	0.5	2	1.1	5		

X4502

ν Velorum 0	2.2	12	3.8	18	4.5	20	..	..
20	1.5	8	1.5	7	2.9	12	3.4	14
40	1.1	6	1.1	5	~~1.9~~ 2.3	10	2.4	10
60	0.6	3	0.8	4	1.8	8	2.0	8
80					1.2	5	1.4	6

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1924phae.proj.112sP

log NH γ	δ
18.2	18.4
18.2	18.5
18.3	18.6
18.2	18.5 Mean log NH

β	γ	δ	ε	k
—	18.7	18.6	18.7	18.0
	19.5	19.5	19.5	18.8
	19.4	19.4	19.6	18.8
	19.3	19.3	19.4	—
	19.4	19.4	19.5	18.8
	17.8	18.2	18.2	
	19.0	18.9	19.5	
	18.8	18.8	19.4	
			19.3	
	18.9	18.8	19.4	

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Electra		β		γ		δ		ε		ζ	
B5	0	2.5	23	3.2	21	4.2	25	5.5	29	4.3	21
C18679	10	1.0	9	1.7	11	2.1	12	~~3.6~~	13	2.3	11
	20	0.5	5	1.0	7	1.2	7	2.5	9	1.3	6
	30	0.2	2	0.7	5	0.8	5	1.7	6	0.9	4
	40	..	..	0.3	2	0.5	3	1.2	5	0.6	3
	50			..		0.2	1	0.9	3	0.3	2
	60					..		0.5		..	
								..			

---

												h
η CMa	0	3.2	14	3.0	9	3.0	8	4.5	11	4.7	10	3.48
cB5	10	1.4	6	1.2	4	1.6	4	2.2	6	3.5	8	1.43
β-ε=255	20	0.7	3	~~0.4~~	1	0.8	2	1.1	4		..	0.7 2
	30	0.3	1	-	-	0.3	1	0.7	~~2~~		..	- -
	40	-	..	-	-	0.1	..	0.3	..			
	50	-	..	-	-	-						
	60											
	70											

~~HD~~ 93911, B5	0	~~3.0~~		2.3	11	2.5	11	3.0	11
X14939	10	~~1.5~~		0.8	4	1.0	4	1.5	6
β-ε=164	20	~~0.7~~		0.2	1	0.3	1	0.7	3

~~ABC~~ 11917		1.5	10	3.2	15	3.2	14	4.2	16
X12380 cB5		0.6	4	0.2	6	1.4	6	2.2	8
β-ε=164		..		0.7	3	1.0	4	1.4	5
				0.4	2	0.8	3	1.0	4
								0.5	2

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log NH

β	γ	δ	ε	ζ	
18.4	18.3	18.5	18.6	18.3	
18.7	18.9	19.0	19.0	18.9	
18.6	18.8	18.8	19.0	18.7	
..	..	..	..	..	
18.65	18.85	18.9	19.0	18.8	Mean γδ = 18.9

					k
18.0	17.5	17.4	17.7	17.6	17.4
18.3	18.0	18.0	18.3	18.5	17.7
18.0	-	-	18.3	-	17.7

Mean γδ = 18.0

18.15	18.0	18.0	18.3	18.5	17.7
-	17.7	17.7	17.7		
	17.9	17.9	18.3		
			18.1		
	17.8	17.8	18.0		Mean γδ = 17.8
17.6	18.0	18.0	18.0		
17.9	18.4	18.4	18.5		
-	18.1	18.3	18.6		
	18.0	18.3	18.6		
	18.2	18.3	18.6		Mean γδ = 18.25

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1924hae.proj.1128P

		β		γ		δ		ε		k		ζ	
q^2 Cnc ✓		8.0	75	10.0	65	8.0	47	8.0	42	3.0	15	7.0	33
A3, 5.56		2.5	23	4.2	27	3.8	23	5.6	30	1.9	9	4.8	23
e16495		1.6	15	2.4	16	2.4	14	3.9	21	1.1	5	3.3	16
β-ε = 119		1.1	10	1.6	10	1.6	9	2.4	13	0.9	4	2.4	12
		0.8	7	1.2	8	1.2	7	1.4	7	0.7	3	1.7	8
		0.6	6	0.6	4	0.7	4	1.1	6	0.5	2	1.2	6
		0.2	2	0.4	3	0.4	2	0.8	4	0.3	1	0.9	4
HD 93737 A2p		2.2	15	2.5	12	2.2	9	4.0	15	2.8	10	2.4	8
X14939 ✓		0.7	5	0.7	3	1.0	4	1.6	6	0.7	3	1.4	5
β ε = 164		0.3	2	0.3	1	0.6	3	0.9	4	0.5	2	1.0	3
		..		..		0.3	1	0.7	3	0.3	1	0.7	2
								0.4	2	..		0.4	1
✓													
ε Canis Maj		-		2.6	14	3.0	14	3.6	15				
O, β-ε = 147	0	-		1.1	6	1.3	6	1.7	7				
	10	-		0.8	4	0.9	4	1.1	5				
	20	-		-		0.5	2	0.8	3				
	30	-		-		-		0.5	2				
✓													
29 Canis Maj													
Be	0	-		3.7	20	2.7	13	3.0	13				
β-ε = 147	10	-		1.2	6	1.5	7	1.6	7				
	20	-		0.7	4	1.1	5	0.9	4				
	30	-		..		0.7	3	0.7	3				
✓													
λ Orionis	0	-		2.4	16	3.6	21	3.3	17				
β-ε = 119	10	-		0.7	5	1.2	7	1.3	7				
	20	-		0.4	3	0.7	4	0.8	4				
	30	-		..		0.4	2	0.6	2				

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β	γ	δ	ε	k	J	
19.8	19.6	19.0	18.8	18.0	18.7	
19.5	19.6	19.5	19.8	18.7	19.5	
19.5	19.6	19.5	19.8	18.6	19.6	
19.4	19.4	19.3	19.7	18.5	19.6	
19.3	19.4	19.3	19.3	18.6	19.4	
19.4	19.5	19.4	19.65	18.6	19.5	Mean $\beta\delta$ = 19.45

18.0	17.8	17.5	18.0	17.6	17.4	
18.2	17.7	17.9	18.3	17.7	18.2	
17.8	--	18.0	18.3	17.8	18.0	
18.0	17.7	17.95	18.3	17.75	18.1	Mean $\beta\delta$ = 17.8

-	18.0	18.0	18.0
	18.4	18.4	18.4
	18.4	18.4	18.6
	18.4	18.4	18.5

Mean $\beta\delta$ = 18.4

-	18.3	17.9	17.9
-	18.4	18.4	18.4
	18.4	18.5	18.4
	~~18~~	18.4	18.4
	18.4	18.4	18.4
-	18.1	18.3	18.1
	18.2	18.4	18.4
	18.1	18.2	18.3
	18.1	18.3	18.3

Mean $\beta\delta$ = 18.4

Mean $\beta\delta$ = 18.2

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		β		γ		δ		ε		κ		ζ	
X13926.3													
β-ε=164	0	11.0	75	9.0	43	10.5	45	10.5	40	5.0?	18	8.0?	28
HR 6059	10	4.1	28	3.6	17 ✓	6.0	26	6.4	25	2.0	7	~~3.0~~ 4.6	16
	20	2.6	18	2.5	12 ✓	3.4	15 ✓	4.5	17 ✓	1.2	4 ✓	~~2.9~~ 3.0	11 ✓
	30	1.9	13 ✓	1.8	9 ✓	2.2	9 ✓	3.2	12 ✓	0.8	3 ✓	2.4	8 ✓
	40	1.4	10 ✓	1.5	7 ✓	1.6	7 ✓	2.4	9 ✓	0.3	1	1.9	7
	50	0.8	5	1.2	6	1.2	5	1.7	6			1.4	5
	60	0.4	3	0.8	4	0.7	3	1.1	4			0.7	2
				0.8	2	0.4	2	0.6	2				

AGC 11900	0	-	-	-	-	-	-	-		2.0	8	-	-
X4515(147)	10	1.8	14			2.4	12	2.2	9	0.8	3	2.6	10
a Vel	20	1.1	8			1.7	8	1.7	7	0.4	2	1.8	7
	30	0.8	6			1.3	6	1.3	6	-		1.5	6
	40	0.5	4			1.1	5	1.0	4			1.2	5
	50	0.2	2			0.8	4	0.8	3			0.8	3
	60	-	-			0.5	2	0.5	2			0.5	2
								0.3	1				

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β	γ	δ	ε	k	J	
(19.8)	18.9	18.9	18.8	18.2	18.6	
19.7	19.3	19.6	19.6	18.4	19.2	
19.7	19.3	19.5	19.6	18.3	19.2	
19.7	19.3	19.3	19.6	18.4	19.2	
19.6	19.3	19.3	19.5		19.3	
19.7	19.3	19.4	19.6	18.4	19.2	$\gamma\delta = 19.35$

-	-	-	-	17.4	-	
19.1	-	19.0	18.7	17.7	18.8	
18.9	-	18.9	18.8	17.8	18.8	
18.8	-	18.8	18.8		18.8	
18.8	-	18.9	18.8		18.9	
18.6		18.8	18.7		18.7	
18.8		18.8	18.8	17.5	18.8	$\gamma\delta = 18.8$

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FSH data for K line, from HB 859. Half widths in A.U.

Star		dm → 4	17	31	42	52	60	Depth	
Class K2	α Ser	24.0	16.4	12.0	9.7	7.2	5.7	80	
	K0ph	32.0	15.8	11.6	9.0	7.0	5.7	85	
		56.0	32.2	23.6	18.7	14.2	11.4	165	
	Mean	28.0	16.1	11.8	9.4	7.1	5.7	82	
Class K5	α Hya	19.4	14.2	9.7	6.4	4.2	3.0	74	
Class M0	β And	23.7	19.4	14.5	11.5	9.0	7.1	83	
	α Lyn	20.0	13.6	8.3	5.6	3.8	2.8	79	
	λ Dra	24.0	15.4	10.4	7.9	6.1	4.8	82	
	υ Boo	22.2	16.0	11.0	8.3	6.0	3.9	76	✓
	δ Oph	22.0	15.0	9.7	6.8	5.0	3.9	81	
	13 Sge	21.0	15.5	11.6	9.4	7.6	6.4	..	
		132.9	94.9	65.5	49.4	37.5	28.9	401	
	Mean	22.2	15.8	10.9	8.2	6.2	4.8	80	
Class M1	υ Vir	27.2	18.0	10.0	6.8	4.8	3.2	77	
Class cM1	α Sco	16.3	10.0	5.0	..	..	..	40	✓
Class cM2	α Ori	24.0	17.0	10.9	7.2	4.6	2.8	71	✓
Class M2	β Peg	22.3	15.6	10.6	7.9	6.1	5.0	89	
Class M3	η Gem	25.5	12.5	7.2	5.1	4.3	3.7	81	
	μ Gem	19.0	11.0	6.7	5.0	3.8	2.6	76	
		44.5	21.5	13.9	10.1	8.1	6.3	157	
	Mean	22.2	10.8	7.0	5.0	4.0	3.2	78	✓
Class M5	Boss 3827	23.7	17.0	12.0	8.8	6.2	4.4	75	
	α Her	22.6	14.5	8.4	5.2	4.0	3.2	79	
		46.3	31.5	20.4	14.0	10.2	7.6	154	
	Mean	23.2	15.8	10.2	7.0	5.1	3.8	77	
Class M7e	o Cet	26.0	13.0	7.6	5.5	4.1	3.2	81	

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Contour data arranged by spectral classes

Half Width in Angstroms at following values of r

Star	Class	Line	4	17	31	42	52	60	67	depth
ζ CMa	O	Hγ	~~3.8~~ 3.9	2.2	1.0	-	-	-	-	
Oq		Hδ	4.6	2.3	1.6	0.2	-	-	-	
		Hε	5.3	2.6	1.6	0.8	-	-	-	
λ Ori	O	Hγ	3.5	1.3	-	-	-	-	-	
Oqe		Hδ	4.7	2.0	0.8	-	-	-	-	
		Hε	4.1	1.8	1.1	0.3	-	-	-	
29 CMa	O	Hγ	5.4	2.0	1.1	0.6	-	-	-	
Oqe		Hδ	~~4.6~~	2.6	1.2	-	-	-	-	
		Hε	4.2	2.1	-	-	-	-	-	
θ Mus	O	Hγ	2.8	-						
		Hδ	4.0							
		Hε	3.4							
		K	3.4							

Mean half breadth

~~Hγ~~	3.9	2.2	1.0	~~Hδ~~	4.6	2.3	1.6	Hε	5.3	2.6	1.6
~~Hδ~~	3.5	1.3			4.7	2.0	0.8		4.1	1.8	1.1
~~Hε~~	5.4	2.0	1.1		4.6	2.6	1.2		4.2	2.1	
	12.8	5.5	2.1		13.9	6.9	3.6		13.6	6.5	2.7
	4.3	1.8	1.0		4.6	2.3	1.2		4.5	2.2	~~0.9~~ 1.4

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Values of log NH, individual stars

17.56	17.75	17.40
17.70	17.76	17.80
17.82	17.78	17.80
17.45	17.30	..
17.66	17.67	17.00
17.60	17.60	17.60
17.85	17.67	17.60
17.69	17.88	17.61
17.60	17.70	..
17.29		
17.58		
17.41		
17.41		

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Star	Class	Line	4	17	31	42	52	60	67	Depth
3 Cas	B2	Hδ	10.2	2.7	1.3	–	–	–	–	✓
		Hε	16.2	6.7	3.2	1.2	–	–	–	
		Hγ	14.0	6.0	–	–	–	–	–	

α Per	B3	Hγ	12.5	7.4	5.6	?
			~~27.6~~	~~11.1~~	~~8.4~~	
		Hδ	9.9	3.8	0.6	
			~~24.0~~	~~9.4~~	~~1.6~~	
		Hε	12.9	4.2	1.2	
			~~30.8~~	~~10.0~~	~~2.8~~	
		Hζ				

α Eri	B5	Hε	13.8	6.9	3.8	1.8	✓
			~~38.8~~	~~16.4~~	~~9.0~~	~~4.3~~	

Electra	B5 ✓	Hγ	11.4	6.6	3.4		
		Hδ	14.3	7.0	4.1	2.8	1.3
		Hε	18.0	9.2	5.8	3.7	1.5 ✓
		Hζ	16.0	8.8	3.6	2.4	0.4

λ Cas	B5	Hγ	16.6	8.9	5.9	3.0	✓
		Hδ	16.5	8.0	5.5	3.4	
		Hε	18.4	9.8	5.8	3.4	1.6

ι Aql	B5	Hγ	19.0	6.1	1.3		
		Hδ	15.3	7.7	2.2		
		Hε	18.9	7.0	3.6	1.6	✓
		K	0.4				

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Class B5

	Hγ					Hδ					Hε				
	4	17	31	42	52	4	17	31	42	52	4	17	31	42	52
	11.4	6.6	3.4			14.3	7.0	~~4.1~~	2.8	1.3	18.0	9.2	5.8	3.7	1.5
	16.6	8.9	5.9	3.0		16.5	8.0	5.5	3.4		18.4	9.8	5.8	3.4	1.6
	19.0	6.1	1.3			15.3	7.7	2.2			13.9	7.0	3.6	1.6	
	19.7	9.0	6.7	4.2		14.2	6.2	4.0	3.3		19.3	9.0	6.6	5.4	4.3
	23.6	10.4	5.2	3.4		19.7	9.1	5.3	3.0		21.2	12.2	6.8	4.2	2.6
	90.3	41.0	22.5	10.6		80.0	38.0	21.1	12.5		90.7	47.2	28.6	18.3	10.0
Mean	18.1	8.2	4.5	3.5		16.0	7.6	4.2	3.1	1.3	18.2	9.4	5.7	3.7	2.5
log NH	18.89	18.89 ~~18.96~~	18.68			18.78	18.80	18.64			18.90	18.99	18.72		

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1924phae.proj.11283P

Star	Class	Line	4	17	31	42	52	60	67	Depth
$21^h 5, +27°.9$	B5	Hγ	19.7	9.0	6.7	4.2	-	-	-	
		Hδ	14.2	6.2	4.0	3.3	2.5	-	-	✓
		Hε	19.3	9.0	6.6	5.4	4.3	3.4	2.2	
HD93683	B5	Hγ	23.6	10.4	5.2	3.4	1.6			✓
		Hδ	19.7	9.1	5.3	3.0				
		Hε	21.2	12.2	6.8	4.2	2.6			
η CMa	cB5	Hγ	5.8	1.9	0.2	—	-			✓
		Hδ	6.2	2.8	1.2	0.3	-			
		Hε	8.8	3.6	2.0	0.8	-			
		K	5.8	2.6	-	-	-			
53 Cas	cB5	Hγ	11.4	4.2	1.3					✓
		Hδ	9.4	5.6	2.6					
		Hε	8.2	4.2	2.3					
AGC 11786	cB5	Hγ	13.2	4.2	1.0					✓
		Hδ	10.1	5.4	2.4					
		Hε	11.4	4.3	1.8	0.4				
AGC 11917	cB5	Hγ	10.8	3.8	1.8	0.6				
		Hδ	9.1	4.2	2.0					✓
		Hε	14.3	7.0	3.3	1.4				
AGC 93911	cB5	Hγ	7.0	2.7						✓
		Hδ	6.8	2.4						
		Hε	9.2	3.9						

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Class cB5

	Hδ				Hδ				Hε			
	4	17	31	42	4	17	31	42	4	17	31	42
?	5.8	1.9	0.2		6.2	2.8	1.2	0.3	8.8	3.6	2.0	0.8
	11.4	4.2	1.3		9.4	5.6	2.6		8.2	4.2	2.3	
	13.2	4.2	1.0		10.1	5.4	2.4		11.4	4.3	1.8	0.4
	10.8	3.8	1.8	0.6	9.1	4.2	2.0		14.3	7.0	3.3	1.4
	7.0	2.9			6.8	2.4			9.2	3.9		
	14.6	5.9	1.2		10.7	5.5	1.0		14.1	5.8	3.0	1.7
	62.8	22.9	5.5	0.6	52.3	25.9	9.2	0.3	66.0	28.8	12.4	4.3
Means	10.5	3.8	~~0.9~~ 1.1	0.6	8.7	4.3	1.8	0.3	11.0	4.8	2.5	1.1
log NH	18.40	18.21	17.5		18.23	18.30	17.95		18.44	18.40	18.20	
log NH for ηCMa	17.90	17.80	..		17.97	17.96			18.24	18.15	18.00	

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Star	Class	Line	4	17	31	42	52	60	67	Depth
ε Cep	cB5	Hγ	14.6	5.9	1.2	–	–	–	–	
		Hδ	10.7	5.5	1.0	–	–		–	
		Hε	14.1	5.8	3.0	0.7	–	–	–	✓
α Car	B3	Hγ	11.3	5.8	3.2	1.7	0.5			
		Hδ	12.6	6.6	4.0	2.9	1.8			✓
		Hε	13.6	7.8	5.4	3.8	3.0	2.0		
		4026	4.6	2.5	1.0					
ν Pav	B9	Hγ	17.0	9.8	6.0	4.5	3.0	2.0		
		Hδ	16.1	9.5	6.2	4.4	3.3	2.6		✓
		Hε	15.6	10.4	8.0	6.6	5.0	4.0		
m Car	B9	Hγ	25.1	14.2	9.8	7.5	6.8	4.5		
		Hδ	26.0	15.0	9.9	7.9	6.9	4.8		✓
		Hε	30.0	18.0	12.6	9.8	7.6	6.4		
σ² Cnc	A3	Hγ	37.8	17.5	8.8	6.0	4.2	3.0		
		Hδ	27.2	15.6	8.3	6.2	4.4	2.6		
		Hε	24.8	13.9	9.2	6.4	2.1	1.2		
		K	7.6	4.0	2.4	2.1	1.4	0.9		✓
α PsA	A3	Hε	27.5	18.5	13.0	9.5	7.3	6.7	4.5	
		K	6.7	4.0	2.5	1.8	1.5	1.3	1.2	✓

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Means for Class B3

	Hγ					Hδ					Hε				
	4	17	31	42	52	4	17	31	42	52	4	17	31	42	52
a Car	11.3	5.8	3.2	1.7	0.5	12.6	6.6	4.0	2.9	1.8	13.6	7.8	5.4	3.8	3.0
α Pav	12.5	7.4	5.6			9.9	3.8	0.-			12.9	4.2	1.2		
	23.8	13.2	8.8			22.5	10.4	4.6			26.5	12.0	6.6		
Mean	11.9	6.6	4.4			11.2	5.2	2.3			13.2	6.0	3.3		

log NH

Means for Class Bq

	17.0	9.8	6.0	4.5	3.0	2.0	16.1	9.5	6.2	4.4	3.3	2.6	15.6	10.4	8.0	6.6	5.0	4.0
	25.1	14.2	9.8	7.5	5.8	4.5	26.0	15.0	9.9	7.9	5.9	4.8	30.0	18.0	12.6	9.8	7.6	6.4
	42.1	24.0	15.8	12.0	8.8	6.5	42.1	24.5	16.1	12.3	9.2	7.4	45.6	28.4	20.6	16.4	12.6	10.4
Mean	21.0	12.0	7.9	6.0	4.4	3.3	21.0	12.2	8.0	6.2	4.6	3.7	22.8	14.2	10.3	8.2	6.3	5.2

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Star	Class	Line	4	17	31	42	52	60	67	Depth
Alcor	A5	Hγ	34.8	14.4	7.9	2.8				
		Hδ	36.8	14.0	7.8	4.7	2.6	1.0	0.3	
		Hε	38.2	17.1	10.7	7.4	5.9	3.4	2.8	
		K	10.6	6.7	5.0	2.3	0.7			
χ 13926.3	A5	Hγ	27.8	14.0	8.6	6.8	5.0	3.6	2.0	
		Hδ	39.8	19.3	10.9	7.8	5.8	4.3	2.9	
		Hε	33.1	19.5	12.7	8.3	5.8	4.8	3.4	
		K	11.7	5.8	3.4	1.2				
α Aql	A5	Hε	17.0	10.2	7.5	5.7	4.4	3.4	2.5	
		K	8.5	5.5	3.8	3.0	2.5	2.0	1.5	
β Pav	A5	Hδ	27.8	13.1	7.8	5.0	3.2	2.2	1.2	
		Hε	21.4	13.6	9.2	6.8	5.1	3.8	2.8	
		K	9.2	6.0	4.3	3.5	2.6	2.0	1.4	
α Vel Cas	A5	Hγ	38.6	14.9	8.8	6.2	3.4			
		Hδ	33.4	14.8	8.8	6.0	3.8	2.0		
		Hε	41.0	20.1	12.7	8.2	5.8	4.4	3.4	
		K	12.2	6.8	3.8	1.7	0.4			
α Car	A7	Hε	18.9	11.1	7.2	5.0	4.4	3.7	2.9	92
		K	9.0	5.1	3.8	3.4	2.9	2.6	2.1	92

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Class A5

Hζ				Hη				Hε				K			
34.8	14.4	7.9	2.8	36.8	14.0	7.8	4.7	38.2	17.1	10.7	7.4	10.6	6.7	5.0	2.3
27.8	14.0	8.6	6.8	39.8	19.3	10.9	7.8	33.1	19.5	12.7	8.3	11.7	5.8	3.4	1.2
~~27.8~~	~~13.1~~	~~7.8~~	~~5.0~~	27.8	13.1	7.8	5.0	21.4	13.6	9.2	6.8	9.2	6.0	4.3	3.5
38.6	14.9	8.8	6.2	39.4	14.8	8.8	6.0	41.0	20.1	12.7	8.2	12.2	6.8	3.8	1.7
												8.5	5.5	3.8	3.0
101.2	43.3	25.3	15.8	137.8	61.2	35.3	23.5	133.7	70.3	45.3	30.7	52.2	30.8	20.3	11.7
Mean 33.7	14.4	8.4	5.3	34.4	15.3	8.8	5.9	33.4	17.6	11.3	7.7	10.4	6.2	4.1	2.3

Hε		K
~~52~~	60	52
5.9	3.4	0.7
5.8	3.4	..
5.1	2.8	2.5
5.8	4.4	2.6
4.4	2.9	0.4
27 0	16 9	2.9
5.4	3.4	9.1
		1.8

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Supergiants of Class A

Star	Class	Line	4	17	31	42	52	60
β Ori	cB8	Hε	8.0	3.0	1.9	1.6	1.1	0.3
		K	2.4	0.7				
α Cyg	cA2	Hε	7.0	3.8	2.6	2.0	1.3	0.8
		K	4.4	2.0	0.8			
σ Cyg	cA0	Hγ	6.4	2.4	0.3			
		~~Hγ~~	~~12.8~~	~~4.9~~	~~0.6~~			
		Hδ	11.3	3.8	1.0	0.4		
		~~Hδ~~	~~22.6~~	~~7.6~~	~~2.1~~	~~0.8~~		
		Hε	~~25~~ 13.0	6.0	3.4	2.6	0.9	
		K	2.2	0.7				
HD 93737	cA2	Hγ	6.0	2.2	0.2			
		Hδ	8.2	3.4	1.0			
		Hε	10.8	6.0	2.8	1.4	0.3	
		K	5.8	2.0	1.0			
α Vel	cA0	Hδ	6.3	4.0	2.9	2.2	0.9	0.6
		Hε	4.8	3.4	2.4	1.8	1.6	1.1	0.8
		K	2.0	0.6				

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Stars with abnormally strong hydrogen

Star	Class	line	4	17	31	42	52	60	67
X13371.4	A2	Hγ	43	21.7	13.2	9.6	7.0	5.2	3.6
		Hδ	39.4	23.8	14.5	10.4	7.9	5.9	4.2
			~~33.2~~	~~19.2~~	~~12.8~~	~~9.8~~	~~7.2~~	~~5.7~~	~~4.2~~
		Hε	26.8	17.6	13.9	11.1	8.3	6.5	5.2
			~~45.9~~	~~23.3~~	~~15.3~~	~~10.4~~	~~7.3~~	~~5.2~~	~~2.4~~
		K	4.2	1.8					
X13413.4	A2	Hγ	33.2	19.2	12.8	9.8	7.2	5.7	4.2
		Hδ	31.6	20.2	14.0	10.8	7.9	6.2	4.2
		Hε	38.8	21.3	15.7	13.0	9.7	7.4	5.6
		K	11.1	3.2	0.4				
ATC 467	A2	Hγ	45.9	23.3	15.3	10.4	7.3	5.2	2.4
		Hδ	39.0	23.4	15.6	10.4	7.8	4.6	2.0
		Hε	41.7	23.2	14.9	11.0	7.5	5.4	4.0
		K	5.8	3.4					

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Means.

	Hγ				Hδ				Hε				K			
	43.0	21.7	13.2	9.6	39.4	23.8	14.5	10.4	26.8	17.6	13.9	11.1	4.2	1.8		
	33.2	19.2	12.8	9.8	31.6	20.2	14.0	10.8	~~7.9~~ 38.8	~~6~~ 21.3	15.7	13.0	11.1	3.2	0.4	
	45.9	23.3	15.3	10.4	39.0	23.4	15.6	10.4	41.7	23.2	14.9	11.0	5.8	3.4		
	122.1	64.2	41.3	29.8	110.0	67.4	44.1	31.6	107.5	62.1	44.6	35.1	21.1	8.4	—	
Mean	40.7	20.4	13.8	9.9	36.7	22.5	14.7	10.5	35.8	20.7	14.8	11.7	7.0	2.8		

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Star	Class	Line	4	17	31	42	52	60	67	Depth
β TrA	F0	Hδ	19.3	11.9	8.2	5.7	4.3	3.0		
		Hε	18.0	10.8	6.7	5.3	4.0	3.2	2.8	
		K	10.0	6.7	5.0	4.0	3.4	2.9	2.4	
		4227	2.9							
α Hyi	F0	Hγ	21.5	12.0	7.5	4.8	3.2	2.1		
		Hε	22.0	15.4	10.3	7.8	6.0	4.8	3.8	
		K	11.9	6.4	5.0	4.2	3.6	3.1	2.6	
θ Sco	F0	Hε	15.1	8.5	6.8	6.0	5.2	4.4	3.6	
			~~16.~~	~~10.~~	~~7.~~	~~6.~~	~~6.~~	~~5.~~		
		K	12.7	8.0	6.2	5.4	4.4	4.2	3.4	
			~~14.~~	~~9.~~	~~7.~~	~~5.~~	~~5.~~	~~4.~~	~~3.~~	
b Vel	F0	Hε	14.	5.	3.	2.	2.			
		K	17.	8.	5.	4.	3.			
L Car	F0	Hγ	12.5	5.5	3.2	2.0	1.2			
		Hδ	14.1	7.1	4.2	3.1	2.4	1.5		
		Hε	16.4	8.6	6.4	5.4	4.4	3.6		

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Means.	Hγ				Hδ				Hε				K			
ν Hyi	21.5	12.0	7.5	4.8					22.0	15.4	10.3	7.8	11.9	6.4	5.0	4.2
β Tri A					19.3	11.9	8.2	5.7	18.0	10.8	6.7	5.3	10.0	6.7	5.0	4.0
θ Sco									15.1	8.5	6.8	6.0	12.7	8.0	6.2	5.4
ι Car	12.5	5.5	3.2	2.0	14.1	7.1	4.2	3.1	16.4	8.6	6.4	5.4				
	34.0	17.5	10.7	6.8	33.4	19.0	12.4	8.8	71.5	43.3	30.2	24.5	34.6	21.1	16.2	13.6
Mean	17.0	8.8	5.4	3.4	16.7	9.5	6.2	4.4	17.9	10.8	7.6	6.1	11.5	7.0	5.7	4.5

Hε		K	
52	60	2.9	2.4
4.0	3.2	3.1	2.6
6.0	4.8	4.2	3.4
5.2	4.4	10 2	8 4
4.4	3.6	34	28
19 6	16 0		
49	40		

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Star	Class	Line	4	17	31	42	52	60	67	Depth
η Sco	F2	Hγ	13.8	6.5	3.5	2.2	1.2			
		Hδ	13.9	7.3	4.2	2.6	1.3			
		Hε	28.0	16.6	7.8	5.8	4.8	4.0		
		K	17.5	8.6	6.8	6.3	5.3	4.8		
ι_1 Sco	cF2	Hγ								
		Hδ								
		Hε								
		K								
π Sgr	cF2	Hδ	19.0	13.0	7.8	5.5	1.3			
		Hε	11.5	5.8	3.4	2.9	2.6	1.7	1.1	
		K	7.2	4.6	3.6	3.2	3.1	2.0	1.6	

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Star	Class	Line	4	17	31	42	52	60	67	Depth
α CMi	dF5	Hε	~~10.6~~	~~5.1~~	~~3.9~~	~~3.5~~	~~2.8~~	~~1.9~~	~~1.3~~	
			~~10.0~~	~~7.6~~	~~6.1~~	~~5.2~~	~~4.4~~	~~3.8~~	~~3.4~~	
		K	17.2	11.4	8.5	6.8	5.6	5.4	4.2	
			14.4	10.6	7.8	6.5	5.7	5.2	4.7	
		4227	3.9	2.6	0.6					
γ Lep	F8	Hε	12.3	9.6	7.3	5.9	5.0	3.9	3.2	
		K	12.3	9.7	7.2	5.8	4.8	3.9	3.1	
		4227	6.5	2.1	1.0	0.1				
H.D.152293	F5	Hγ	12.8	5.6	2.2	0.2				
		Hδ	13.7	6.1	2.6	1.2				
		Hε	29.0	17.3	10.6	7.6	7.0	5.7	4.9	
		K	26.1	18.1	11.4	8.2	6.0	4.1		
HD97534	cF5	Hε	21.8	9.6	4.9	4.0	3.8	3.2		
		K	10.9	5.4	3.9	3.1	2.8	2.3		
ι_1 Sco	cF5	Hγ	9.6	6.3	4.2	3.2	2.4	1.2		
		Hδ	11.1	6.4	4.4	3.0	1.4	0.6		
		Hε	19.0	10.4	7.6	6.0	4.9	4.0	3.0	
		K	18.0	11.8	8.6	6.7	5.0	3.8	2.8	
ε Aur	cF5	Hε	11.3	4.8	3.3	2.6	2.1	1.8	1.1	79+
		K	8.7	5.6	4.0	3.4	2.5	2.0	1.6	77
β Vel	cF5	Hγ	7.1	3.8	2.2	1.6				44
		Hδ	8.7	5.2	3.5	2.1	0.7			60
		Hε	15.8	7.1	4.7	4.0	3.2	2.6	2.2	84
		K	16.6	8.7	5.4	3.9	3.1	2.4	2.1	84

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HD 183028	ε	23.8	11.2	7.1	5.5	4.0	3.2	2.3	82
	K	20.0	9.9	6.0	4.3	3.0	2.2	1.4	82;
HD 152293	γ	10.5	4.7	2.1					44
F5	δ	12.4	5.9	2.4	0.9				48
	ε	27.0	16.1	9.6	7.3	6.1	5.2	4.2	85
	K	23.8	16.2	10.4	7.6	5.7	4.8	..	..?
δ Vol F5	γ	6.6	3.7	2.5	1.7	0.7			56
	δ	5.8	3.6	2.4	2.0	1.2	0.6		67
	4227	5.1	3.1	2.3	1.5	0.6			67

Means	Hγ				Hδ				Hε				K				4227		
F5	12.8	5.6	2.2	0.2	13.7	6.1	2.6	1.2	29.0	17.3	10.6	7.6	26.1	18.1	11.4	8.2			
	10.5	4.7	2.1		12.4	5.9	2.4	0.9	27.0	16.1	9.6	7.3	23.8	16.2	10.4	7.6			
	23.3	9.3	4.3	0.2	26.1	12.0	5.0	2.1	56.0	33.4	20.2	14.9	49.9	34.3	21.8	15.8			
Mean	11.6	4.6	2.2	0.2	13.0	6.0	2.5	1.0	28.0	16.7	10.1	7.4	25.0	17.2	10.9	7.9	3.9	2.6	0.6
Mean (both)									25.9	14.0	8.6	6.4	22.5	13.6	8.4	6.1			
cF5									21.8	9.6	4.9	4.0	10.9	5.4	3.9	3.1			
	9.6	6.3	4.2	3.2	11.1	6.4	4.4	3.0	19.0	10.4	7.6	6.0	18.0	11.8	8.6	6.7			
									11.3	4.8	3.3	2.6	8.7	5.6	4.0	3.4			
	7.1	3.8	2.2	1.6	8.7	5.2	3.5	2.1	15.8	7.1	4.7	4.0	16.6	8.7	5.4	3.9			
	6.6	3.7	2.5	1.7	5.8	3.6	2.4	2.0									5.1	3.1	2.3
	23.3	13.8	8.9	6.5	25.6	15.2	10.3	7.1	67.9	31.9	20.5	16.6	54.2	31.5	21.9	17.1			
Means	7.8	4.6	2.9	2.2	8.5	5.1	3.4	2.4	~~16.9~~ 17.0	8.0	5.1	4.1	13.6	7.9	5.5	4.3			

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Star	Class	Line	4	17	31	42	52	60	67	Depth
	K5									
α Cen B	~~G9~~	Hγ	2.5	0.8						29
		Hδ	4.8	2.6	1.3					29
		4227	7.2	3.8	2.9	2.2	1.7	1.0		69
σ Pup	K5	Hγ	4.5	3.2	2.5	2.0	1.5	0.5		63
		Hδ	5.5	3.5	2.6	1.8	1.1	0.4		63
		4227	4.8	3.1	2.5	1.9	1.7	1.5		84

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Means

	Hγ		Hδ			4227			
	2.5	0.8	4.8	2.6	1.3	7.2	3.8	2.9	2.2
	4.5	3.2	5.5	3.5	2.6	4.8	3.1	2.5	1.9
	7.0	4.0	10.3	6.1	3.9	12.0	6.9	5.4	4.1
Means	3.5	2.0	5.2	3.0	2.0	6.0	3.4	2.7	2.0

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Star	Class	Line	4	17	31	42	52	60	67	Depth
α For	F8	Hε	13.	7.3	6.3	5.0	3.9	3.1	2.4	
		K	20.5	11.7	7.2	5.6	4.5	3.8	3.2	
		4227	4.5	2.1						
δ CMa	cF8	Hε	13.5	10.4	8.5	7.5	6.6	5.7	4.8	
		K	22.0	16.5	12.6	10.2	8.8	7.2	6.7	
		4227	2.1	1.7	1.1	0.6				
ρ Pup	cF8	Hγ	12.8	7.8	4.5	3.2	2.3	1.8		
		Hδ	11.0	6.4	4.2	2.9	2.0	1.3		
		Hε	20.4	11.6	8.4	6.4	5.0	4.0		
		K	13.5	7.8	6.1	5.5	4.6	4.0		
χ Car	cF8	Hε	33.8	21.7	14.0	10.9	9.0	7.3	6.2	
		K	..	22.8	20.0	17.0	15.0	13.3	11.6	

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Laso F8

H					K					4227			
12.3	9.6	7.3	5.9	5.0	12.3	9.7	7.2	5.8	4.8	6.5	2.1	1.0	0.1
13.	7.3	6.3	5.0	3.9	20.5	11.7	7.2	5.6	4.5	4.5	2.1		

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1924phae.proj.112pp

Star	Class	Line	4	17	31	42	52	60	67	Depth
α Cen A	G0	Hε	15.3	9.6	7.1	5.7	4.7	3.8		
			16.8	10.4	7.2	5.0	3.4	2.4		94
		K	13.5	8.9	6.8	5.5	4.4	3.8		94
			17.0	10.9	7.6	5.9	4.6	3.6		
α Aur	G0	Hε								
		K								
β Hyi		Hε								
		4227								

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Star	Class	Line	4	17	31	42	52	60	67	Depth	
μ Vel	G5	Hγ	4.5	2.5	2.0	1.5	0.8			60	
		Hδ	4.4	2.4	1.3	0.9	0.4			60	✓
		4227	4.8	3.1	2.5	2.1	1.5				
β Crv	G5	Hε	11.6	8.9	7.5	6.4	5.5	4.7	3.8		
		4227	3.9	1.9	1.3	0.9	0.5	0.2			✓
		4215	2.6	1.5	1.1	0.8	0.4				
α Ret	G5	Hε	12.0	9.7	7.4	4.9	2.4				✓
		4227	..	3.1	1.7	1.0	0.4				
C16676.1	G5	Hε	33.4	15.0	10.2	8.2	6.9	5.8	4.5	90	✓
		K	24.4	17.0	13.3	10.8	9.1	7.6	6.4	90	
ε CMi	G5	Hε	27.4	12.3	8.2	5.3	3.3			58	✓
		K	21.8	13.3	8.0	4.7				51	
C 9643.1	G5	Hε	18.5	12.5	8.8	7.3	5.7	4.5		81	✓
		K	26.0	15.4	11.3	9.6	8.0	5.8	4.8	87	
HD85622	G5	Hε	27.8	19.0	11.8	8.4	6.4	5.3	4.1	83	✓
		K	..	14.6	10.3	8.4	7.0	6.1	5.2	86	
HD16417	G5	Hε	18.1	11.1	8.0	6.3	4.9	4.0	3.0	74	✓
		K	16.5	11.8	7.8	5.3	3.8	2.4		77	
3 Cap	CG5	Hε	32.3	14.6	10.5	8.7	6.6	4.7	3.8	88	✓
		K	26.8	17.2	12.0	9.2	7.6	6.4	5.8	88	

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Differences arise from classification

Means

Hε				K				4227			
11.6	8.9	7.5	6.4	~~26~~				3.9	1.9	1.3	0.9
12.0	9.7	7.4	4.9						3.1	1.7	1.0	0.4
18.5	12.5	8.8	7.3	26.0	15.4	11.3	9.6				
18.1	11.1	8.0	6.3	16.5	11.8	7.8	5.3				
60 2.	42.2	31.7	24.9	42.5	27.2	19.1	14.9				
15.0	10.6	7.9	6.2	21.2	13.6	9.6	7.4				

33.4	15.0	10.2	8.2	24.4	17.0	13.3	10.8	6.9	5.8	9.1	7.6
27.4	12.3	8.2	5.3	21.8	13.3	8.0	4.7	3.3	.	..	..
27.8	19.0	11.8	8.4	..	14.6	10.3	8.4	6.4	5.3	7.0	6.1
88.6	46.3	30.2	21.9	46.2	44.9	31.6	23.9	6.6	5.6	8.0	6.8
Mean 29.5	15.4	10.1	7.3	~~15.4~~ 23.1	~~14.~~ 15.0	10.5	8.0				

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Star	Class	Line	4	17	31	42	52	60	67	depth	
γ Sgr	K0	Hε	33.5	14.5	9.1	7.8	6.3	5.4	4.2		✓
		K	25.0	17.5	12.0	9.3	7.0				
−14°5257		Hε	24.0	12.	8.	6.	5.	4.	3.5		
		K	22.	16.5	11.	9.	7.	6.	5		
HD 212953	K0	Hε	{23.3 / 23.0}	10.7 / 11.5	6.6 / 8.0	5.3 / 6.5	4.5 / 5.5	4.3 / 5.0		81	86 ✓
		K	{20.5}	16.0 / 13.2	12.5 / 10.5	11.0 / 9.3	9.0 / 8.4	8.0 / 7.6		87	
HD 138688	K0	Hε	34.0	19.5	12.6	9.0	6.7	5.1	5.6	79	✓
		K	..	16.9	12.2	9.6	7.6	6.1	5.0	82	
ε Leo	K0	Hγ	4.3	2.5	1.5	1.0				51	
		Hε	13.7	10.4	8.7	7.6	5.9	4.4	2.8	no	✓
		4227	6.9	4.4	2.9	2.5	2.1	1.7		92	✓
H.D. 190056	K0	Hε	26.8	15.8	10.7	8.8	7.0	6.0	4.9	90:	✓
		K	26.0	16.9	13.2	11.4	10.0	9.4	8.5	90:	✓
HD 173741		Hε	23.4	13.4	9.4	7.4	5.9	5.0	4.1		✓
		K	23.5	16.2	12.2	9.6	8.0	6.6	5.9		

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Means

	He						K					
	33.5	14.5	9.1	7.8	6.3	5.4	25.0	17.5	12.0	9.3	7.0	~~8.4~~
	23.2	11.1	7.2	5.8	5.0	4.8	20.5	14.6	11.5	10.2	8.7	~~8~~
	34.0	19.5	12.6	9.0	6.7	5.1	..	16.9	12.2	9.6	7.6	6.1
	26.8	15.8	10.7	8.8	7.0	6.0	26.0	16.9	13.2	11.4	10.0	9.4
	23.4	13.4	9.4	7.4	5.9	5.0	23.5	16.2	12.2	9.6	8.0	6.6
	140.9	74.3	49.0	38.8	30.9	26.3	95.0	82.1	61.1	50.1	41.3	22.1
Means	28.2	12.9	9.8	7.8	6.2	5.3	23.8	16.4	12.2	10.0	8.3	~~4.4~~ 7.4

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Star	Class	Line	4	17	31	42	52	60	67	Depth
HD. 139290	K2	He	27.7	15.3	9.6	7.1	5.4	4.4	3.8	84
		K	33.3	23.4	15.1	11.0	8.5	6.9	5.5	84?
H. D. 139063	K2	He	19.4	9.2	7.1	6.4	5.2	3.5	2.4	72
		K	20.2	14.5	11.9	9.7	7.5	6.1	4.7	77
β Ara	K2	He	36.1	22.3	14.8	11.0	9.0	7.5	6.5	87
		K	34.0	23.6	17.4	13.3	10.4	8.1	7.1	84

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Classification

Means

	He						K					
27.7	15.3	9.6	7.1	5.4	4.4	3.8	33.3	23.4	15.1	11.0	8.5	6.9 5.5
19.4	9.2	7.1	6.4	5.2	3.5	2.4	20.2	14.5	11.9	9.7	7.5	6.1 4.7
36.1	22.3	14.8	11.0	9.0	7.5	6.5	34.0	23.6	17.4	13.3	10.4	8.1 7.1
83.2	46.8	31.5	24.5	19.6	15.4	12.7	87.5	61.5	44.4	34.0	26.4	21.1 17.3
Mean 27.7	15.6	10.5	8.2	6.5	5.1	4.2	29.2	20.5	14.8	11.3	8.8	7.0 5.8

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1924phae.proj.1123P

Depths of {Ca+ 4227 ; FSH, HB 859

Line	K2	K5	M0	M1	M2	M3	M5	M7e
He+H	80	78	85	73	(78)	79	75	70
	83		78	(60)	93	75	74	
			82					
			84					
			80					
			88					
	163	78	497	73	93	154	149	70
	82	78	83	73	93	77	74	(70)
				83				
K	80	74	83	77	(71)	81	75	81
	85		79	(40)	89	76	79	
			82					
			76					
			81					
	165	74	401	77	89	157	154	81
	82	74	80	83		78	77	(81)
4227	55	48	71	61	67	52	70	55
	47		70	(46)		71		
			73					
			71					
			72					
			72					
	102	48	429	61	67	123	70	55
	51	48	72	61	67	62	70	(55)

all M 750/68

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	Depth of 4227 in %				
	1 pr.	2 pr	log NH (elsewhere) HC 334	Width ~~Dep~~ A.U.	
A5	..	11	..	1 pr.	2 pr.
F0	22				
F2	..	24			
F5	24	57			
F8	34				
G0	27	62	16.5		
G5	39	73	17.7	1.2	0.4
K0	51	78	18.1	1.4	0.7
K2	58		18.4	1.7	..
K5	68		18.8	2.2	
M	68		19.1	2.9	

This shows (1) The depth of the observed line is directly governed by the resolving power

(2) the Unsold contour is not followed, the departure being greatest for K and M stars. This is another way of expressing Milne's result.

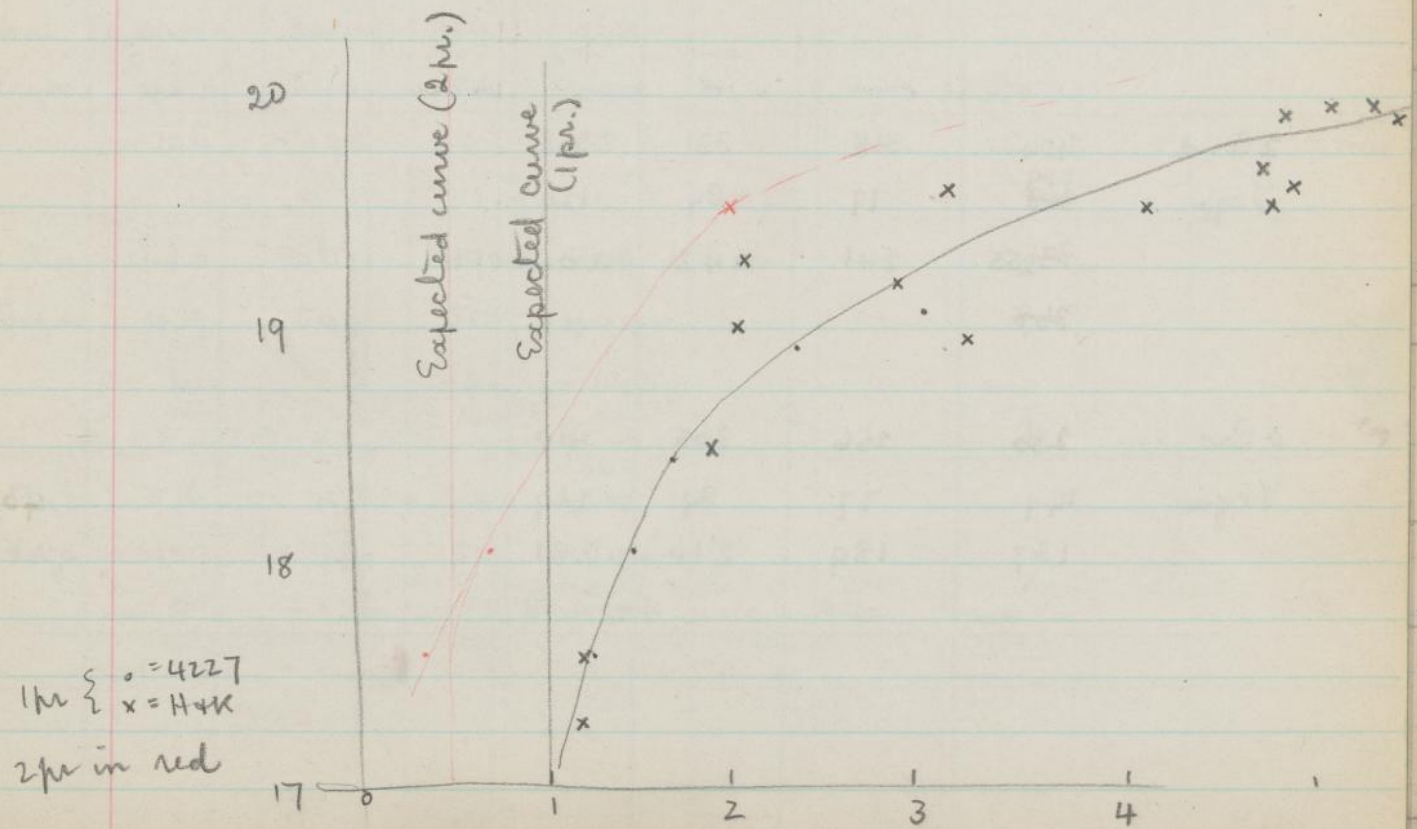
Predictions from atmospheric stratification

Supergiants should have shallower lines for atoms above their maximum, if P gradient important.

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	Depth of H and K in %			Width in Å	
	1μ H ~~2μ~~	K	log NH	1μ	2μ
A0		19	17.3	1.2	
A2			17.7	1.2	
A5		38	18.5	1.9	
		51			
F0		58	18.9	3.2	
F2	88	87	* 19.3 super?	~~2.0~~	
F5	81	78	19.0	2.0	
F8	79	76	19.2	2.6	
G0	74	75	94 19.5	4.5	2.0
G5	78	73	19.6	4.6	
K0	81	78	19.5	4.0	
K2	87	88	19.6	3.0	
K5	79	73	19.8	5.6	
M0	83	80	19.9	5.5	
M1	83	83	19.9	5.1	
M2-3	87	78	19.8	4.7	
M5	74	77	19.6	4.6	



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1924thae.proj.11283P

From Bk 28

These temperature are not at all precise

C 19086 Temperature for μμ c stars against Vega as standard. ([m+m])

	β	γ	δ	ε	β-γ	γ-δ	δ-ε	γ-ε Adopted
	RA	Dec	Start	Stop	Mean	Z.D.	Sec Z.D.	
Star δ Cep	173	140	182	229	39	30	7	~~69~~ 76 ✓
					0.01			
Vega	149	77	89	129	4900	4300		4100 4200
	RA 18 33.6	Dec +38.7	Start 20 30	Stop 20 36	Mean 20 33	34	1.2062	
Diff	24	63	93	100				
	RA	Dec	Start	Stop	Mean	~~Alt~~ +19 Z.D.	Z.D.	
	22 25.4	+57.9	21 01	21 31	21 16		1.0376	
							0.1486	

HD 224151 Bo	432	336	362	394		22	6	28 6500
Vega	149	77	89	129		6300		~~6600~~ ~~6500~~ above 15000
	293	259	273	265		34	1.2062	
	RA	Dec	Start	Stop	Mean	15	1.0353	
							0.1709	

p.58 HD 217476 Gop	322	346	404	[524]	96	046	80	126
Vega	149	77	89	129	(300)	3250	..	3200 C1
	173	269	315	[395]		34	1.2062	below 3000
	RA	Dec	Start	Stop	Mean	Z.D.	1.0403	
	22 55.9	+56.4	23 12	23 57	23 34	~~56~~ 16	0.1659	

o And	224	140	152	173	-2	-10		
Vega	149	77	89	129				hotter
Diff	75	73	63	44				12500?? C
						34	1.2062	
	R.A.	Dec.	Start	Stop	mean		1.0038	
	22 57.3	+41.8	21 35	22 05	22 20	5	0.2024	

2 And	404	318	331	368				
Vega	~~149~~ ~~318~~	77	89	129		34	1.2062	
							1.0038	
	~~331~~ 255	241	242	239		5	0.2024	
	~~368~~							

p.63 p Cas Fsp	286	266	305	410	52	27		134
Vega	149	77	89	129	4300	4300		4350
	137	189	216	281		34	1.2062	
	RA	Dec.	Start	Stop	Mean		1.0353	
	23 49.4	56.9	22 12	22 57	22 34	15	0.1709	

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1924phae.proj.1128P

C 19102

	β RA	γ Dec	δ Start	ε Stop	Mean	β-γ 2.D.	γ-δ Sec 2.D.	δ-ε	ε-ζ
						61	33	42	75
Vega	80 RA 18 33.6	8 Dec +38.7	34 Start 19 23	50 Stop 19 29	mean 19 26	+ 04	+ 03	+ 05	+ 08
η Aql	332	321	380	438		65	36	47	83
Diff	21 252 ~~273~~ 19 47.4	28 313 ~~341~~ +0.7	34 346 Start ~~360~~ 19 57	41 388 Stop ~~429~~ 20.27	mean 20 42	11 44	1.0187 1.3901 −0.3714			3900

δ Cep	276	240	276	332					
Vega	80	8	34	50					
Diff	40 196 136 RA 22 25.4	52 232 180 Dec. +57.9	63 232 199 Start 20.52	78 282 194 Stop 21 22	mean 20 37	11 23	1.0187 1.0864 −.0677			5000

C 19[illegible]29

η Aql	382	403	362	286					
Vega	421 R.A. 18 33.6	499 Dec + 38.7	472 Start 19 24	446 Stop 19 36	mean 19 27					3700
Diff	− 39 15.3 R.A. 54 19 47.4	− 96 210 Dec 187 + 0 45	− 110 27 Start − 187 19 52 30	− 160 30 Stop − 146 20 22 30	mean 20 37 30	11 44	1.0187 1.3902 − .3715			

C 19136

ba Comp to 41 Cyg	263	349	314	263					
Vega	457	544	516	494					
	− 194 2 R.A. −196 18 33.6	− 195 3 Dec. −198 + 38.7	− 202 4 Start −206 19 55	− 231 5 Stop −235 20 1	mean 20 28	20 26	1.0642 1.1126 − 0.0484			8500?

α Aql	523	566	490	349	44	48			
Vega	457	544	516	494		3104			
	66 2 RA 64 22 0.6	22 2 Dec 20 − 0.8	− 26 3 Start −29 22 15.30	− 145 3 Stop −148 22 43 30	mean 22 28 30	20 44	1.0642 1.3902 −0.3260			3300 very poor fit

η Aql	376	408	349	263 ~~338~~					
Vega	457	544	516	494					
	− 81 RA 19 47.4	− 136 Dec + 0 45	− 187 Start 20 22	−231 ~~−156~~ Stop 20 52	mean 20 37	20 44	1.0642 1.3902 −0.3260			3050

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1924phae.proj.1128P

C 19136

	β	γ	δ	ε		
No. 6 41 Cyg FS	408	465	444	376		
Vega	457	544	516	494		
Diff	−49	−79	−72	−118		20 1.0642
	Ra 20 25.5	Dec +30.0	Start 21 39 30	Stopped 22 9 30	mean 22 24 30	26 1.1126 −.0484
β Del FS	376	465	408	338		
Vega	457	544	516	494		
Diff	−81	−79	−108	−156		20 1.0642 1.1326
	Ra 20 32.9	Dec +14.2	Start 21 2	Stop 21 32	mean 21 17	28 −.0684

C 19141

Cool ν Cep	503	..	..	476		
Vega	~~503~~ 309	355	343	~~476~~ 326		
	Ra 18 33.6	Dec +38.7	Start 23 10	Stop 23 15	mean 23 12	53 1.6616 1.0946
Diff	194			150		
	Ra 21 42.6	Dec +60.7	Start 23 35 30	Stop 0 5 30	mean 23 20 30	24 +0.5670
4 Lac	436			476		
Vega	309	355	343	326		53 1.6616
Diff	127			150		32 1.1792
	Ra 22 20.4	Dec +49.0	Start 0 33	Stop 1 3	mean 1 18	+0.4824

C 19140

FSp 35 Cyg	284	320	288	247		
Vega	386	470	470	436		
	Ra 18 33.6	Dec +38.7	Start 20 7 30	Stop 20 18 30	mean 20 10 30	
Diff	−102	−150	−182	−189		20 1.0642 1.0306 3900
	Ra 20 15	Dec +34.7	Start 21 5 30	Stop 21 35 30	mean 21 20 30	14 +.0336
Cool q Cep	436			470		
Vega	386			436		
	150			34		20 1.0642 3600
	Ra 21 35	Dec +61.6	Start 22 34	Stop 23 4	mean 22 19	1.0785 22 −.0143 low weight
Cool σ Cyg	364	448	436	370		
Vega	386	470	470	436		20 1.0642 8000
	−22	−22	−34	−66		1.0403
	R.A 21 14	Dec +39.0	Start 21 49	Stop 22 23	mean 22 33	16 +.0239

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1924phae.proj.1128P

C 19158	β	γ	δ	ε		
ηAql	370	376	343	286		
Vega	516	586	579	546		
	Ra 18 33	Dec +38.7	start 22 24	stop 22 30	mean 22 27	
Diff	−146	−210	−236	−260		23 1.0837 3100
	Ra 36	Dec 49	63	69	mean	
	−1 82	−2 59	start −299	stop −327		55 1.7434
	19 47	+0.7	22 51 30	23 21 30	22 36 30	−.6597
α UMi	559	593	559	505		
Vega	516	586	579	546		
Diff	43	7	−20	−41		23 1.0837
	Ra	Dec	start	stop	mean	1.4142
	1 22.6	+88.8	23 26 30	23 31 30	23 28 30	45 −0.3305
X 4515						
b Vel	142	65	86	155		
Agc 11900	116	1	20	77		
Diff	26	64	66	78	no correction	
Book 29						
δ Cep	342	393	368	349		
Vega	415	502	484	451		
	−73	−109	−116	−102		
C 19087						
16	283	222	247	272		
β Ori	262	214	228	268		
Diff	21	8	19	4		
	Ra	Dec	start	stop	mean	
	5 9.7	−8.3	2 31	2 41	2 36	
53 Cas	340	291	353	347		
16	283	222	247	272		
Diff	57	69	106	75		
	Ra.	Dec	start	stop	mean	
	1 55.6	+63 54	0 01	0 46	0 24	
53 Cas	340	291	353	347		
β Ori	262	214	228	268		
	Ra 59.7	1924 −8.3	start 2 31	stop 2 41	mean 2 36	
	58	77	125	79		
	R.A. 1 55.6	Dec +63 54	Start 0 01	stop 0 46	mean 0 24	

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	β	γ	δ	ε	
Pi 51	276	230	252	287	
16	283	222	247	272	
Diff	−7	8	5	15	mean
	Ra 3 21.0	Dec +59.6	start 0 51	stop —	
Pi 54	344	291	317	356	
16	283	222	247	272	
Diff	61	69	70	84	mean
	Ra 3 21.9	Dec +58.5	start 1 17	stop 1 37	1 27
ε Aur	222	198	215	256	
16	283	222	247	272	
Diff	−61	−24	−32	−16	mean
	Ra 4 55	Dec +43.7	start 1 40	stop 2 00	2 20
β Cam	279	268	309	375	
16	283	222	247	272	
Diff	−4	46	62	103	mean
	Ra 4 54.5	Dec. +60.3	start 2 02	stop 2 22	2 12
C 19108					
η Aql	518	554	506	441	
Vega	594	677	648	626	mean
	Ra 18 33.6	Dec +38.7	start 18 59	stop 19.5	18 32
Diff	−76	−23	58	195	3 1.0014
	Ra 19 47.4	Dec 0 44.5	start 19 36	stop 20 6	mean 20 21 — 42 −0.3442
C 19104					
η Aql	219	178	228	237	
Vega	56	−5	9	37	mean
	Ra 18 33.6	Dec +38.7	start 21 36 15	stop 21 42 15	21 39 15
Diff	163	183	219	200	35 1.2208
	Ra 19 47.4	Dec 0° 44.5	start 20 56 45	stop 21 26 45	mean 20 41 45 — 43 −0.1465
C 19103					
π Sgr	439	502	444	372	
Vega	366	401	397	382	mean
	Ra 18 33.6	Dec +38.7	start 19 9 —	stop 19 15	19 12
	73	109	47	−10	7 1.0075
	Ra 19 9.8	Dec — 21.2	start 20 31 15	stop 20 51 15	mean 20 41 15 — 66 −1.4511

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	β	γ	δ	ε		
μ Sgr	190	235	195	145		
Vega	366	401	397	382		
Diff	−276	−266	−202	−237		7 1.0075
	Ra	Dec	start	Stop	mean	2.2812
	18 7.8	−21.5	19 52 40	20 22 40	20 37 40	64 −1.2737
C 19118 Vega	432	490	467	455		
	Ra 18 33.6	Dec +38.7	start 19 46 30	stop 19 52 30	mean	
η Aql	466	503	457	388	19 49 30	
	17	23	27	34		
Diff	34	13	−10	−133		16 1.0403
	Ra 17	Dec −10	−37 start	−167 Stop	mean	1.3673
	19 47 4	+0 44.9	20 16 30	20 46 30	20 31 30	43 −0.3270
X 4064					39	30 84 114
x Cas	48	4	44	156	4900	4300 4600
B8−A0	297	214	224	252		no correction
Diff	−249	−210	−180	−96		
	39 4800		30 4400	84		
ER Cas	252	208	238	292	39	20 26
B8−A0	297	214	224	252	4900	5100 5000
Diff	−45	−6	14	40		no correction
C 19133						
η Aql	469	529	449	389		
	17	23	27	34		
Vega	466	564	538	514		
	Ra 18 33.6	Dec +38.7	start 19 40 30	stop 19 45 30	mean	
Diff	3	−35	−89	−125	19 42 30	14 1.0306
	Ra −14	Dec −58	start −116	stop −159	mean	1.3673
	19 47.4	0 45	20 13	20 43	20 28	43 0.−3367
Book 30						
C 19127						
η Aql	311	318	266	182		
	Ra 19 47.4	Dec 0 44.9	start 20 11	stop 20 41	mean 20 26	
Vega	442 17	502 23	488 27	456 34		14 1.0306
	Ra 18 33.6 425	Dec +38.7 479	19 start 41 461	19 stop 47 422	mean 19 44	1.3673
Diff	−131	−184	−222	−274		43 −0.3367
	−148	−207	−249	−308		
S Sgr	212	271	224	182:		
Vega	442	502	488	456		14 1.0306
						1.2062
	−230	−231	−264	−274:		34 −.1756
	Ra 19 51.5	Dec +16 22	start 21.26	stop 21 58	mean 21 42	

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Cl 9137	β	γ	δ	ε		
ξ Cyg	277 Ra 21 13	352 Dec +43.5	209 Start 23 19 30	70 Stop 23 49 30	mean 23 34 30	
Vega	422	492	492	486		
Diff	-145 Ra	-140 Dec	-283 Start 22 53	-416 Stop 22 59	mean 22 56	14 1.0306 25 1.1034 −0.0728
5 Lac	209	300	225	114		
Vega	422	492	492	486		
Diff	-213 Ra 22 25.4	-192 Dec +47 11	-267 Start 23 58	-372 Stop 24 28	mean 24 43	14 1.0306 24 1.0946 −0640
HD 210221	174	215	215	215		
Vega	422	492	492	486		
Diff	-298 Ra 22 4	-277 Dec +52.8	-277 Start 0 40	-271 Stop 1 20	mean 0 30	14 1.0306 19 1.0576 −.0270
Cl 9160						
η Aql	465 Ra 19 47	513 Dec +0.7	458 Start 21 7	412 Stop 21 37	mean 21 22	
Vega	520	612	604	569		
	-055 Ra 18 33	-099 Dec +38.7	-146 Start 20 32	-157 Stop 20 38	mean 20 35	23 1.0863 47 1.4663 −0.3800
Cl 9161						
HD 214470 Fop	430 Ra 22 33	467? Dec +73.1	413 Start 0 13	352 Stop 0 43	mean 0 28	
Vega	329	389	377	353		
Diff	101 Ra 18 33	78 Dec +38.7	36 Start 22 52	-1 Stop 22 58	mean 22 55	47 1.4663 34 1.2062 +.2601
9161.7 (μ Lyr 1985)	320		298	220		
Vega	329	389	377	353		
Diff	-009		-79	-133		47 1.4663

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C 19152	β	γ	δ	ε		
Polaris	396	436	403	374		
	Ra 122.6	Dec +88.8	start 22 56	stop 23 7	mean 22 44	
Vega	425	486	478	465		
Diff	−29	−50	−75	−91		53 1.6616
	Ra	Dec	start	stop	mean	1.3673
	18 33.4	+38.7	23 22	23 28	23 25	43 ~~1.2943~~
C 15534						
no alt. corr.						
ζ Aur						
μ@2001 Ao						
μ@2002 γ Aur						
Ao						
e 19179						
η Aql 3	404	424	367	297		
	Ra 19 47	Dec +0.8	start 21 40	stop 22 10	mean 22 25	
Vega	438	523	511	481		25 1.1034
Diff	−34	−99	−144	−184		44 1.3902
	Ra	Dec	start	stop	mean	−0.2868
	18 33	+38.7	20 43 30	20 49 30	20 46 30	
η Aql 4	357	381	336	258		
Vega	438	523	511	481		25 1.1034
Diff	−81	−142	−175	−223		44 1.3902
						−0.2868
HD 224151	413	418	381	297		
	438					
Vega	~~418~~	523	511	481		
	−25					
Diff	~~381~~	−105	−130	−184		25 1.1034
	Ra	Dec	Start	Stop	mean	23 1.0864
	23 50	+56.9	22.27	23 5	22 16	−0.0170
22 And	357	438	404	352		
Vega	438	523	511	481		25 1.1034
Diff	−81	−85	−117	−129		8 1.0098
	Ra	Dec	start	stop	mean	0.9936
	0 5	+45 5	23 10	23 43	23 26	

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C1g179 Cont	β	γ	δ	ε		
q Cas	320	395	367	308		
Vega	438	523	511	481		
Diff	-118	-128	-144	-173	mean	25 1.1034
	Ra	Dec	Start	Stop	°	18 1.0515
	1 13.8	+57 7	23 50	0 20	~~12~~ 35	∓.0519

C1g183						
η Aql 2	313	323	313	265		
	Ra	Dec	Start	Stop	mean	
	19 47	+0.8	22 12 30	22 44		
Vega	451	533	516	470	22 6 37	
Diff	-138	-210	-203	-205	mean	29 1.1434
	Ra	Dec	Start	Stop		44 1.3902
	18 34	+38.7	21 1	21 7	21 4	-.2468

η Aql 1	284	295	295	236		
Vega	451	533	516	470		
Diff	-167	-238	-221	-234	mean	29 1.1434
	Ra	Dec	Start	Stop		44 1.3902
	1947	+0.8	2142	22 12	22 27	-0.2468

Book 32

C1g144						
J Del	352	399	391	343		
	Ra	Dec	Start	Stop	mean	
Vega	484	~~5~~62	~~5~~52	510		23 1.0864
						22 1.0785
	-132	-~~1~~53	-161	-167		+.0079
	Ra	Dec	Start	Stop	mean	
	18 33 6	+38.7	19 58 30	20 4 30	20 31 30	

35 Cyg	382	418	382	321		
Vega	484	552	552	510		23 1.0864
						1.0098
Diff	-102	-134	-170	-189		8 +.0766
	Ra	Dec	Start	Stop	mean	
	20 15	+34.7	20 30	21.0	20 15	

β Del	426	472	436	382		
Vega	484	552	552	510		
Diff	-58	-80	-116	-128		23 1.0864
	Ra	Dec	Start	Stop	mean	1.0785
	20 33	+14.2	21 5	2135	21 20	22 .0079

C1g145 q Cep	433	484	484	438		
	Ra	Dec	Start	Stop	mean	
	21 35	+61.6	22 55	23 25		
Vega	432	507	496	459	22 40	37 1.2521
						1.0642
	+001	-23	-12	-021		20 +0.1879
	Ra	Dec	Start	Stop	mean	
	18 33 6	+38.7	21 40 30	21 46 30	21 43 30	

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	β	γ	δ	ε	β-γ	γ-δ	δ-ε	γ-ε
C19146								
4 Lac	465	554	544	500				
	Ra 22 20.4	Dec +49.0	start 0 48 30	stop 1 18 30	mean 0 33 30			
Vega	432	507	496	459				
	33	47	48	41		55	1.7434	
	Ra 18 33.6	Dec +38.7	start 23 35	stop 23 41	mean 23 38	26	1.1126 +0.6308	
C19153								
HD127476	270	~~370~~	..	144	56	..	..	106
	Ra 22 56	Dec +56.4	start 8.21	stop 0.51	mean 23.54			
Vega	~~344~~	400	400	380				
	− 74	−130		−236		64	2.2812	
	Ra	Dec	start	stop	mean		1.0515	
			23 47	23 53	23 50	18	+1.2297	
ρ Cas	222	288	254	190	..	24	44	78
Vega	344	400	400	380				
Diff	−122	−112	−146	−190		64	2.2812	
	Ra	Dec	start	stop	mean		1.0515	
	23 49	+57.0	0 55 30	1 25 30	0 40 30	18	1.2297	
C19187					68	−3	+9	+6
η Aql 1	407	428	417	377				
	Ra 19 47	Dec +0.8	start 21 40	stop 22 10	mean 22 25			
Vega	433	522	508	477				
	−26	−94	−91	−100		29	1.1434	
	Ra	Dec	start	stop	mean			
	18 34	+38.7	21 6 30	21 12 30	21 9 30	44	1.3902 −0.2468	
η Aql 2	348	367	357	317	70	−4	+9	+5
Vega	433	522	508	477				
	−85	−155	−151	−160		29	1.1434	
	Ra	Dec	start	stop	mean			
	19 47	+0.8	22 10 30	22 40 30	22 25 30	44	1.3902 −0.2468	
ξ Cyg	440	396	282	229	133	100	22	
Vega	433	522	508	477				very cool
	+7	−126	−226	−248		29	1.1434	
	Ra	Dec	start	stop	mean		1.0576	
	21 1	+43.5	22 59	23 37	22 48	19	+0.0858	
5 Lac	329	294	265	254	124	25	−21	
Vega	433	522	508	477				
	−104	−228	−243	−223		29	1.1434	
	Ra	Dec	start	stop	mean 23 57	17	1.0457	
	22 25	+47.2	23 42	0 12	12 27		+0.0977	

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1924phae.proj.1122P

Plates of supergiants of Class B0 – B5

				plates		
*	53 Cas	cB5	1		19180	19087
✓	Pi 22	cB1	2		19184	19334
x	10 Per	cB2	2		19184	19335 x
*	67 Oph	cB5	?			
✓	HD 187879	cB2	2		19160	19159
	ε Cap	cB5	2		19166	19175
✓ *	q Cep	cB2	2		19140	19145
✓	HD 213087	cB0	2		19151	19159
	0 And	cB5	1		19086	
✓	HD 234157	cB0	3		19161	19175 19179

✓ HD 187879 cB2 C 19160

Direct comparison with γ Ori (B2)
H and 4026 equally strong
Other He lines weaker in HD 187879
K lines sharp, as in ε Ori but no more
O lines barely seen
Line at 3966? also in ε Ori
Do not find the H lines very narrow.
No emission

✓ q Cephei cB2 C 19140 C 19145

Direct comparison with γ Ori (B2)
H weaker, sharper, in q Cep
He equal, but 4009 wkr in q Cep
4481 stronger in q Cep
O stronger in q Cep, strong & sharp
4267 " " " "
4495 about equal
2 lines bet. 4116 and 4144, red of Si + lines

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3995 stronger than B0, B2.
Shp fine line at 3966
The H lines are very fine & sharp
There is no emission, but what looks like it
between 4471 and 4481.
K line strong

Evident from sp. and sep that q Cep is at low T

Pi 22 cB1 · C19334
✓ Lines very sharp.
The spectrum is poor but I should think the
star was nearer A, or else He unusually wk
K line strong
Find other plates

HD 213087 cB0 C19159
✓ Direct comparison with ε Orionis
Undoubtedly an O star; 4086 brt to red
4542, 4200 seen.
He wk, 4471 scarcely seen; 4026 str.
K line seen, but not str.
Continuous background looks like low T

C19160
Similar; the sp. is less good.
It also suggests low T

HD 224151 cB0 ε 19175
✓ ε Orionis comparison
4086 bright. Pickering not seen
K line strong
4089, –, 97 stronger than in ε Ori

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1924phae.proj.112sp

HD 224151 continued

4116 as in ε Ori

He generally weaker than in ε Ori

C 19179 confirms but is less good as a sp.

Bright 4686 does not show

C 19086 also a good plate; br 4686 seen

Supergiants from Class B8 to A5

✓	HD 8065	cA2	C 19180	C 19189	
✓	Br 283	cA2	C 19180	19189	
✓	ι Per	cA2	C 19184	19225	
	Br 386	cA3	19335		
✓	Pi 51	cB9	19087	19225	
✓	Pi 54	c A0	19087	19226	~~+90~~
	Pulk 529	cA2	—		
✓	β Ori	cB8	19084	19097	
✓	α Cyg	cA2	19072, 19078		
✓	σ Cyg	cA0	19140	19145	
✓	ν Cep	cA2	19141	19146	
✓	4 Lac	cB8	19141	19146	
✓	μ Sgr	cB8	19103		

---

4 Lacertae C 19141

Compared direct with β Ori

H, Ca+, Si, stronger in 4 Lac

He slightly weaker

Apparently cool.

Confirmed by C 19146

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1924phae.proj.1103P

μ Sgr C 19103
✓ Very similar to 4 Lacertae. Ca+ even stronger
H, and Si + stronger than in β Orionis

Pi 51 C 1908 #7
✓ H = β Ori exc Hε wh is stronger + just resolved
from H. K stronger than in β Ori
He much weaker than β Ori, but 4026, 4116,
4144, 4387, 4471, 4922? seen
4128, 31 much stronger than in β Ori
4481 rather stronger
T evidently low
Confirmed by 1922½

Pi 54 C 1908 #7
Compared with Vega.
H much weaker
K line abt. as strong, wide, stronger than in β Ori
✓ 4026 present; 4471 present, faint ✓
Si + " , stronger than in Vega
4471 present
4481 stronger than in Vega
Evidently many faint lines that cannot
be traced with this dispersion

σ Cygni Compared with Vega.
✓ H much weaker
K line stronger, sharp
4026 present on C 1914 5, 4471 fthly present
Si + much str. than in Vega
4481 str. than in Vega
Lines ν the ; 4922 but edge

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1924phae.proj.1124P

HD 8065

C 19180
Direct comp. with α Cygni
H about equal.
K " "
metallic lines weaker in HD 8065
Poor plate
C 19189
Similar result. The metallic lines are without doubt much weaker; H172,77 cannot be seen at all.
Si+ equal in the ~~two~~ stars
He absent

Br 283

C 19180
Very similar to HD 8065; metallic lines weak.

ι Per

C 19184
Very closely like α Cygni
Look up other plates.

γ Cephei

closely resembles α Cygni C 19146
Metallic lines seen.

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Central Intensities of lines in spectra of Cepheid Vars. an

η Aquilae

	line	C19108 Phase	C19104	C19118	C19133
Fe	4	09	09	..	..
	6	17	29	..	..
	42	21	26	36	21
	57	19	21	20	28
	58	10	14	20	13
	59	23	25	36	21
	64	36	28	28	35
	65	30	28	28	35
	66	23	22	16	40
	72	23	21	21	10
	73	19	15	21	10
	75	30	34	26	23
	84	38	43	20	12
	86	24	26	26	22
	89	13	11	26	10
	95 b	28	29	23	23
		337	343	347	303
		24	24	25	22
Fe +	20	00	10	..	..
	24	..	10	..	..
	27a	..	14	..	..
	28	..	10	..	..
	31	10	18	39	24
	32	00	00	..	24
	33	10	18	28	..
	46	11	07	23	21
	48	21	22	23	34
	53	19	31	31	31
	58a	10	14	20	13
	68	32	31	31	31
	69	41	37	39	40
	76	35	31	26	26
		18.9	21.9	26.6	24.4

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Mars and other stars.

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		C1q108	C1q108	C1q118	C1q133
η Aquilae 2			x		
Ti +	29	..	18	..	..
	37	16	13	28	..
	38	16	19	36	..
	54	37	36	44	42
	92	09	09	14	..
	95a	28	29	23	23
Sr	25	10	05	..	..
Sr +	63	19	22	16	23
	83	40	43	39	36
Ca	36	16	19	28	..
	39	16	16	36	..
	62	31	37	22	35
Mn	90	32	29	43	27
H	7	22	52	41	34
	49	51	53	48	~~84~~ 59
	80	53	61	52	47
	99	92	89	93	96
Cr+	27	..	14	..	..
Sc+	45	16	15	23	21
K			89	94	95

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		C1q108	C1q104	C1q118	C1q133
η Aquilae 3					
Y +	3	13	19	..	..
	5	17	16	..	16
	8	04	12	..	..
	11	05	04	..	..
	13	11	20	..	..
AC	100	30	40	40	40
	102	29	44	35	45

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	C1q098	C1q108	C1q104	C1q118	C1q071	C1q082	C1q086	1q102
δ Cephei 1	1.97	1.56	0.66	4.20	1.21?	0.47	1.36	2.96
Fe 4		08	14	06	08	17	06	
6		13	05	19	14	40	13	
42		16	22	09	30		.0	
57		10	10	14	23		18	
58		10	10	14	18		08	
59		10	10	14	18		08	
64		19	27	26	28		26	
65		19	27	26	21		14	
66		15	20	26	18		08	
72		14	27	14	16		14	
73		10	20	07	14		06	
75		18	20	25	30		20	
84	38	31	15	32	11		28	
86	38	31	27	28	18		28	
89	..	09	07	13	03		13	
95b	21	22	28	21	26		29	
		23.4	27.0	26.9	28.4		23.0	
		17 (19)	19 (23)	19 (21)	20 (25)	..	17 (21)	28/23
Fe+ 20		18	10 08	29	14		..	
24		..	10 ..	..	20		..	
27a		08	14 ..	23	28		..	
28		13	10 ..	23	14		..	
31		18	18 ..	33	23		..	
32		08	00 ..	00	07		..	
33		10	18 ..	33	20		..	
46		11	07 22	00	09		10	
48		10	22 22	00	09		06	
53		34	31 21	48	31		21	
58a		10	14 10	14	18		08	
68		19	31 24	30	24		25	
69		33	37 21	35	27		31	
76		21	31 40	20	26		25	
		13.8	16.0	14.7	14.4		12.6	

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		C1q098	C1q096	C1q108	C1q104	C1q118	C1q071	C1q082	C1q086	19102
δ Cephei 2				~~13~~	~~18~~					
Ti +	29			13	~~18~~ ..	23	20		..	
	37			..	~~13~~ 18	20	27		..	
	38			..	~~19~~ 18	20	28		..	
	54			45	~~36~~ 40	47	32		38	
	92			17	~~09~~ 05	13	11		18	
	95a	21		22	~~29~~ 28	21	26	31	29	
Sn	25			13	~~05~~ ..	23	22		..	
Sr +	63			10	~~22~~ 20	14	21		08	18
	83	56		42	~~43~~ 39	48	42		45	44
Ca	36			21	19 18	20	31		..	(?)
	39			16	16 28	20	26		..	
	62			23	37 32	20	28		26	
Mn	90	34		27	~~29~~ 29	18	26		34	
H	7	40	38	37	52 42	30	34	48	44	
	49	43	..	31	53 48	37	~~37~~ 41	56	41	
	80	44	38	39	61 53	38	37	61	45	
	99	77	44	78	89 80	58	82	79	78	
Cr +	27	..		08	..	23	28		..	
Sc +	45	..		16	22	16	20		10	
K		78 v	..	80 v	84	59	85 v	80 v	80 v	71

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δ Cephei 3

		C1q098	C1q108	C1q104	C1q118	C1q071	C1q084	C1q086
Y+	3		08	26	11	14	14	15
	5		09	18	18	08	28	04
	8		05	15	14	10		08
	11		14	10	07	11		20
	13		10	21	20	16		10
Al	100	37	38	23	39	29	24	39
	102	48	48	25	33	10	18	44

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3 Gem 1

		C18704	C18795
Fe	4	06	09
	6	18	11
	42	26	14
	57	29	22
	58	25	20
	59	27	22
	64	34	14
	65	33	34
	66	24	23
	72	22	22
	73	20	24
	75	25	22
	84	16	17
	86	26	35
	89	15	30
	95b	29	28
		351	327
		25	23
Fe+	20	17	08
	24	10	00
	27a	28	16
	28	22	15
	31	28	22
	32	03	04
	33	26	16
	46	26	04
	48	23	16
	53	36	33
	58a	25	20
	68	34	33
	69	37	39
	76	30	24
		26.8	21.1

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		C18704	C18795
3 Gem 2			
Ti+	29	28	12
	37	32	28
	38	32	15
	54	49	27
	92	15	11
	95a	29	28
Sr	25	16	04
Sr+	63	26	21
	83	40	37
Ca	36	32	18
	39	23	18
	62	36	31
Mn	90	34	28
H	7	38	29
	49	51	33
	80	42	26
	99	94	69
Cr+	27	28	16
Sc+	45	24	14
K		96	65

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3 Gem 3	C18704	
Y + 3	06	08
5	15	14
8	12	12
11	12	14
13	18	14
Al 100	35	34
102	39	34

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General C.V.1

		ERCar 1 X4064
Fe	4	..
	6	18
	42	28
	57	02
	58	17
	59	17
	64	32
	65	32
	66	28
	72	23
	73	23
	75	31
	84	23
	86	31
	89	13
	95b	36
		336
		24
Fe+	20	18
	24	15
	27a	26
	28	18
	31	26
	32	09
	33	23
	46	23
	48	28
	53	34
	58a	17
	68	36
	69	43
	76	31
		25.0

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1924phae.proj.112SP

					7	5	10	7
	β Cam (26)	χ Car	19086	ρ Pup	η Car	δ Cep	3 Gem	ER Car
Fe	~~367~~	38	44	38	24	18	24	24
Fe+	27	37	44	43	19	20	25	25
log N H Fe	0.96	1.06	1.00	0.88	1.25	0.90	0.96	0.96
log N H Fe+								
Diff								

MRD to finish the tabulations
look up the spectral classes
take the means

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1924phae.proj.1128P

		SUCas	ERCas
General C.V.		C1906	X4064
Ti +	29		21.
	37		26
	38		30
	54		42
	92		21
	95a		36
Sr	25		19
Sr+	63		28
	83		46
Ca	36		25
	39		23
	62		39
Mn	90		43
H	7	21	51
	49	~~30~~	54
	80	~~18~~	57
	99	–	69
Cr+	27		26
Sc+	45		30
Ca + K		–	..

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ER Car

General C.V.3 X4064

Y+	3	..
	5	21
	8	10
	11	12
	13	21
Ae	100	..
	102	..

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Results from X4733 rejected. See Bk 29

c stars	ε Aur C19087	βCam C19087	χ Car X4733 4064	π Sgr C19103	ι_1 Sco X14968	ι_2 Sco	22 and C19082	HD217476 C19086	β Cas C19086
Fe 4	04	10	{26 11	02	11			10	08
6	10	18	{46 18	14	17			31	26
42	09	25	{.. 40	14	..			51	44
57	20	18	{.. 44	20	..			49	44
58	20	27	{.. 22	20	..			32	36
59	06	24	{.. 30	15	0.			50	25
64	12	36	{.. 39	20	08			58	46
65	18	31	{.. 46	20	04			46	42
66	30	39	{.. 34	20	19			40	37
72	07	10	{71 36	18	18			40	42
73	..	30	{73 33	10	33			37	39.
75	..	25	{77 46	21	23			18	20
84	12	22	{61 46	13	10			48	44
86	22	30	{58 42	21	23			58	48
89	14	19	38	04	17			31	34
95 b	08	31	39	16	36			55	35
		36.7	53.5					61.3	53.6
20	10	10	.. 26	..	00			19	28
24	10	10	.. 21	..	04			24	31
27a	11	18	.. 29	..	02			22	41
28	27	14	.. 26	..	02			31	32
31	20	18	.. 29	..	..			40	36
32	27	21	.. 11	..	..			1036	18
33	10	25	.. 40	..	..			36	40
46	..	21	.. 32	18	..			31	23
48	09	19	.. 38	34	..			32	33
53	..	40	.. 40	20	..			66	59
58a	20	27	.. 22	20	..			32	36
68	18	45	85,50	23	11			62	57
69	13	27	86,57	23	16			64	66
76	..	30	80,55	14	11			61	59
		27.3	36.9					43.4	42.7

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		ε Aur	β Cam	χ Car	π Sgr	ι_1 Sco	ι_2 Sco	22 And	HD217476	p Cas
c stars	2	C19087	C19087	X4133 H064	C19103	X14968		C19082	C19086	C19086
Ti +	29	27	14	{.. 32	..	10			44	46
	31	25	24	{.. 42	13	..			31	34
	38	25	24	{.. 51	13	..			48	23
	54	33	48	{.. 54	20	..			51	50
	92	18	12	{06 35	00	10			23	..
	95a	08	31	{39 40	16	36			55	35
Sr	25	20	14	{.. 17	..	04			10	10
Sr +	63	12	36	{.. 41	10	16			40	44
	83	17	22	{78 63	30	22 08			56	~~56~~ 61
Ca	36	10	21	{.. 40	13	..			31	27
	39	30	28	{.. 37	13	..			50	30
	62	~~06~~ 18	29	{.. 44	27	26			51	48
Mn	90	21	37	{53 55	27	12			36	44
H	7	32	43	{73 36	54	46 46		44	48	42
	49	39	48	{.. 56	61	53		48	62	56
	80	43	46	{72 47	65	62		51	56	44
	99	75	71	{~ 94:	86	76 79		79	..	~
Cr +	27	11	18	{~ 29	..				36	41
Sc +	45	..	31	{.. 35	18				31	23
	K			>90	92	75 81		78	..	~

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		ε Aur	βCam	χ Car	π Sgr	ι_1 Sco	ι_2 Sco	22 Aur C19082	HD 217476 C19086	ρ Cas C15036
c stars	3	C19087	C19087	X4733	C19103					
Y+	3	08	29	28, 44	15				15	18
	5	10, 07	15	45, 23	13				26	24
	8	14	10	48, 19	..				18	19
	11		10	.., 44	..				20	18
	13	00	18	.., 23	..				25	31
Al	100	10	34	44, 50	25				-	48
	102	16	56	64, 54	19				-	70

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Identification of lines in the numbered supergiant spectra of Books 28, 29, 30, and 32

Line	Distance from mark	approx. λ	λ	Identification
1	7.2	4925:	4923 4919	Fe +5 Fe 5
2	8.3	4910		
3	9.3	4901	4900	Y+
4	10.0	4897	4891?	Fe 5
5	11.8	4881	4883	Y+
6	12.7	4872	4872,1	Fe 5
7	13.9	4861.57		Hβ
8	15.1	4848	4854	Y+
9	16.1	4840		
10	17.2	4830		
11	19.0	4814	4823	Y+
12	20.7	4799		
13	23.0	4778	4786	Y+
14	26.3	4746		
15	28.6	4726		
16	29.5	4718		
17	30.1	4703		
18	31.4	4699		
19	33.0	4685		
20	34.2	4672	4666	Fe+3
21	35.0	4666		
22	36.3	4652		
23	37.2	4644		
24	38.4	4634 -5	4629	Fe+3
25	40.1	4618	4607	Sr
26	41.6	4605		
27	42.2	4598	4592	Cr+
27a	43.7	4587	4583 4582	Fe+3 Fe+3

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Line	d	Approx. λ		λ	Ident.
28	44.4	4579		4576	Fe+4
29	48.7	4568		4563	Ti+6
30	46.1	4562		4555 4549 4523	Fe+3, Ba+ Fe+4 Fe+4
31	49.8	4532		4520 4515	Fe+3
32	51.2	4520		4509	Fe+4
33	53.4	4501		4491.41 4489.21	Fe+3
34	54.5	4492			
36	56.0	4480		4472.93 4468	Fe+3 Ti+4
36	57.7	4467		4455	Ca
37	58.2	4462		4451	Ti+2
38	59.4	4454	-10	4444	Ti+2
39	61.0	4441		4435	Ca
40	62.9	4428			
41	63.5	4422		4416.81 4415.13 4417.	Fe+2 Fe I Sc+ Ti+5
42	65.0	4410		4404.75	Fe I
43	65.9	4404		4395	Ti+2 Sc+
44	67.2	4392	-9	4383.55 4385.39	Fe I Fe+2
45	68.2	4384		4374.46	Sc+
46	69.0	4379		(4369.41)	Fe+1
47	70.4	4369			
48	71.5	4360		4351.77	Fe+2
49	73.4	(4345 4340.53	-5		
49a	74.0	4342		4337.05,	Fe ^{1}F-^{5}G' (1) Ti+3
50	75.0	4334		4325.77 4330	Fe 2 Sc+ Ti+5
51	76.6	4325		4314, 4330	Ti+5 Sc+, Sc+
52	77.9	4316		4307 {4307.91	{Ti+5 {Fe 2
53	78.8	4310		4303.18	Fe+2
54	79.4	4306		4300	Ti+5
55	80.4	4298		4296.56 4294.13 4290	Fe+1 Fe I Ti+3,5
56	81.2	4292			
57	83.0	4281		4271.76	Fe 2

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Line	d	Approx λ		λ	Ident.
58	84.7	4270		4260.49	Fe 4
58a	85.9	4262		4258.16	Fe + 1
59	86.6	4257	-7	4250.79 4250.13	Fe 2 Fe 4
60	(88.0 :)	4247			
61	88.4	4244		4235.95 4233.16	Fe 4 Fe + 2
62	89.8	4235	-8	4227.	Ca
63	91.3	4224		4215.	Sr +
64	93.2	4212		4202.03	Fe 2
65	94.1	4205		4198.31	Fe 4
66	95.9	4194		4187.813 .053	Fe 4
67	96.5	4189			
68	97.4	4183	-5	4178.87	Fe + 1
69	98.2	4177	-5	4173.48	Fe + 2
70	100.0	4166			
71	101.2	4158			
72	101.9	4156		4147.68?	Fe 2
73	102.9	4149		4143.87	Fe 3
74	103.9	4142			
75	104.9	4136		4132.06	Fe 3
76	105.4	4131		4128.74	Fe + 2
77	106.3	4127			
78	106.9	4124			
79	108.5	4113			
80	110.1	4102.00			Hδ
81	..				
82	112.7	4090			
83	114.1	4080	-3	4077.	Sr +
84	115.1	4075		4071.75	Fe 3
85	115.9	4072			
86	116.7	4069		4063.45	Fe 3
87	118.2	4059			

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Line	d	Approx. λ		λ	Ident.
88	119.0	4055			
89	119.8	4051		4048.82	Fe 3
90	122.6	4036	-3	4033	Mn
91	123.7	4028			
92	124.0	4026		4025	Ti+1
93	124.7	4023			
94	125.9	4017			
95	127.1	4009		4012	Ti+1
	127.7	4006		4005.25	Fe 3
96	128.9	4000			
97	130.4	3990			
98	131.6	3985			
99	134.2	3969		1.	H+Hε
100	136.3	3959 (60)		3961	Al
101	137.6	3953			
102	139.2	3944		3944	Al
103	141.1	3933.83			K

Series:

Fe			Fe+			Ti+		
	1	$1^3F - 1^5G'$		1	$2^4P - 1^4F'$		1	$1^2F - 1^4G'$
	2	$1^3F - 1^3G'$		2	$2^4P - 1^4D'$		2	$1^2D - 1^2F'$
	3	$1^3F - 2^3F'$		3	$2^4F - 1^4F'$		3	$1^2D - 1^2D'$
	4	$1^7D' - m^7D$		4	$2^4F - 1^4D'$		4	1.12
	5	2.84		5	$1^6S - 1^6P'$		5	1.16
							6	1.22

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