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KG
11366
100

10

APERTURED

ALTAIR

Single spectra

BETELGEUSE

γ Cygni

δ Canis Majoris

α Cassiopeiae

β Andromedae

α Tauri

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XG 11366 .100

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4 Φ 32

From light Altair measures

	α Aquilae measures. Aperture	m+n	n	w
	35	47	47	35
	30	46	42	
	25	45	37	
	20	44	31	
	15	42	27	
	10	41	22	
	5	40	17	
Hζ	0	39	13	70
	-5	38	16	
	-10	37	18	
	-15	35	24	
	-20	34	25	
	-25	33	25	
	-30	32	30	
	-35	31	31	
	50	75	74	
	45	73	70	
	40	72	66	
	35	71	60	
	30	70	56	
	25	69	53	
	20	68	45	
	15	66	35	
	10	65	30	
	5	64	22	
Hθ	0	63	15	105
	-5	62	22	
	-10	61	29	

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4

aperture 1

	m+n	n	w
-15	59	39	
-20	58	42	
-25	57	44	
-30	56	45	
-35	55	44	
-40	53	46	
-45	52	49	
-50	51	48	
-55	50	48	
60	115	115	
55	114	112	
50	112	107	
45	111	105	
40	110	102	
35	105	99	
30	107	92	
25	106	85	
20	104	74	
15	103	63	
10	102	50	
5	100	41	
H 0	99	35	120
-5	97	45	
-10	96	55	
-15	95	64	
-20	93	64	
-25	92	71	
-30	90	71	
-35	89	73	

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	m+n	n	w
-40	88	79	
-45	86	78	
-50	85	80	
-55	83	81	
-60	82	81	
M Φ 33			
65	120	120	
60	119	116	
55	119	113	
50	118	113	
45	118	112	
40	117	109	
35	116	106	
30	116	105	
25	115	101	
20	114	98	
15	114	92	
10	113	85	
5	112	72	
H 3 0	112	65	120
-5	111	70	
-10	110	80	
-15	110	87	
-20	109	92	
-25	109	97	
-30	108	97	
-35	105	98	
-40	107	100	
-45	106	102	
-50	108	101	

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6 Aperture 1

		m+n	n	w
	-55	105	101	
	-60	104	100	
	-65	103	101	
	-70	103	102	
	~~20~~	129	129	
	15	129	127	
	10	129	121	
	5	128	105	
K	0	128	87	50
	-5	128	99	
	-10	127	114	
	-15	127	121	
	-20	127	125	
	-25	127	127	
	50 ~~30~~	146	144	
	45 ~~25~~	146	143	
	40 ~~20~~	145	142	
	35 ~~15~~	144	141	
	30 ~~10~~	144	139	
	25 ~~5~~	143	137	
	~~20~~ 20 ~~0~~	143	134	
	15 ~~-5~~	143	128	
	10 ~~-10~~	142	120	
	5 ~~-15~~	142	104	
HE	0 ~~-20~~	141	92	93
	-5	140	100	
	-10	140	116	
	-15	140	126	
	-20	139	132	

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	m+n	n	w
-25	139	135	
-30	138	136	
-35	138	137	
-40	137	137	
45	158	158	
40	158	157	
35	158	157	
30	158	155	
25	158	154	
20	158	152	
15	158	150	
10	158	146	
5	158	136	
H δ 0	158	132	100
-5	158	137	
-10	158	145	
-15	158	150	
-20	158	152	
-25	158	154	
-30	158	155	
-35	158	153	
-40	158	156	
-45	158	155	
-50	158	157	
-55			
Uφ 34 40	160	160	
35	160	159	
30	160	—	

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8 Aperture 1

		$r_n + n$	n	w
	25	160	157	
	20		156	
	15		155	
	10		~~147~~ 152	
	5		145	
H 8	0		140	80
	-5		145	
	-10		152	
	-15		156	
	-20		158	
	-25		159	
	-30		158	
	-35		158	
	-40		160	
	50	157	157	
	45	157	156	
	40	158	155	
	35	158	156	
	30	158	156	
	25	158	153	
	20	158	155	
	15	158	153	
	10	158	152	
	5	158	145	
H β	0	159	134	90
	-5	159	140	
	-10	159	150	
	-15	159	153	
	-20	159	156	

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aperture 1
aperture 2

		m+n	n	w
	-25	159	157	
	-30	160	158	
	-35	160	159	
	-40	160	160	
aperture 2				
H Φ 35	65	88	48	
	60	88	86	
	55	87	83	
	50	86	81	
	45	85	76	
	40	84	74	
	35	83	70	
	30	81	66	
	25	80	62	
	20	79	53	
	15	78	45	
	10	77	39	
	5	76	32	
H 9	0	75	35	120
	-5	74	35	
	-10	72	38	
	-15	71	45	
	-20	70	49	
	-25	69	50	
	-30	68	52	
	-35	67	53	
	-40	65	56	
	-45	64	57	
	-50	63	59	
	-55	62	60	
	-60	61	61	

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Aperture 2

10

		int m +10	n	w
	70	110	120	
	65	109	107	
	60	109	112	
	55	108	110	
	50	107	109	
	45	107	108	
	40	106	103	
	35	105	102	
	30	105	97	
	25	104	95	
	20	103	90	
	15	102	83	
	10	102	73	
	5	101	60	
H 3	0	100	54	135
	-5	100	58	
	-10	99	73	
	-15	98	83	
	-20	98	89	
	-25	97	94	
	-30	96	91	
	-35	95	92	
	-40	95	94	
	-45	94	98	
	-50	93	96	
	-55	92	96	
	-60	92	98	
	-65	91	100	
	-70	90	100	

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		n+m	n	W
	30	130	130	
	25	130	130	
	20	130	128	
	15	130	125	
	10	129	113	
	5	129	90	
K	0	129	70	48
	-5	128	90	
	-10	128	110	
	-15	128	119	
	-20	128	121	
	-25	128	126	
	-30	128	128	
	35	137	136	
	30	137	134	
	45	137	132	
	40 35	136	131	
	35 30	136	130	
	30 25	136	127	
	25 20	135	124	
	20 15	135	118	
	15 10	135	110	
	10 5	135	99	
HΣ	5 0	134	80	
	0 -5	134	64	120
	-5 -10	134	79	
	-10 -15	133	100	
	-15 -20	133	111	
	-20 -25	133	118	

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Aperture 2

12

	n+m	n	w
25			
~~30~~	132	122	
30			
~~35~~	132	125	
35			
~~40~~	132	125	
40			
~~45~~	132	127	
45			
~~50~~	131	127	
50			
~~55~~	131	128	
55			
~~60~~	131	128	
60	131	129	
50	150	149	
45	150	149	
40	150	147	
35	149	147	
30	149	145	
25	149	142	
20	149	140	
15	149	138	
10	149	130	
5	148	118	
H δ 0	148	111	105
-5	148	120	
-10	148	131	
-15	148	136	
-20	148	140	
-25	148	142	
-30	147	144	
-35	147	144	
-40	147	145	
-45	147	145	
-50	147	145	
-55	147	147	

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		n+m	n	w
H β	36			
	40	149	149	
	35	149	147	
	30	149	146	
	25	149	144	
	20	148	142	
	15	148	141	
	10	148	136	
	5	148	126	
H γ	0	148	117	80
	-5	148	123	
	-10	148	134	
	-15	147	139	
	-20	147	142	
	-25	147	143	
	-30	147	143	
	-35	147	143	
	-40	147	145	
	-45	147	147	
H δ		no	trace	

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14 altair
Aperture 3
Eq 36
H 3

		n+m	n	w
	75	85	85	
	70	84	82	
	65	82	78	
	60	81	74	
	55	80	71	
	50	80	70	
	45	79	68	
	40	78	64	
	35	77	62	
	30	76	58	
	25	75	54	
	20	74	48	
	15	73	40	
	10	72	32	
	5	71	22	
H 3	0	70	20	145
	-5	69	26	
	-10	68	31	
	-15	67	40	
	-20	66	46	
	-25	65	48	
	-30	65	48	
	-35	64	49	
	-40	63	50	
	-45	62	52	
	-50	61	52	
	-55	59	52	
	-60	58	53	
	-65	57	55	
	-70	56	56	

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		n+m	n	w
	40	89 +10	99	
	35	89	97	
	30	88	96	
	25	88	96	
	20	88	94	
	15	87	90	
	10	87	80	
	5	87	55	
H	0	86	36	80
	-5	86	50	
	-10	85	72	
	-15	85	84	
	-20	84	89	
	-25	84	91	
	-30	84	92	
	-35	83	92	
	-40	83	93	
	70	119 -5	114	
	65	119	111	
	60	118	108	
	55	118	106	
	50	117	105	
	45	117	103	
	40	116	102	
	35	115	100	
	30	115	97	
	25	114	92	
	20	114	87	
	15	113	78	

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Aperture 3

16

			n+m	n	w
		10	113	65	
		5	112	47	
H	Σ	0	112	31	145
		-5	111	40	
		-10	111 -5	60	
		-15	105	75	
		-20	105	83	
		-25	104	87	
		-30	104	93	
		-35	103	94	
		-40	103	95	
		-45	102	97	
		-50	102	98	
		-55	101	98	
		-60	101	96	
		-65	100	96	
		-70	100	97	
		-75	99	99	
		-80	99	99	
μ	φ	37	55	123	122
			50	123	121
			45	122	120
			40	122	120
			35	122	118
			30	122	116
			25	122	112
			20	122	110
			15	121	106
			10	121	97

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	n+m	n	w
	0°	121	55°	
H δ	0	121	76	120
	-5°	121	82	
	-10	121	94	
	-15°	120	101	
	-20	120	106	
	-25°	120	110	
	-30	120	112	
	-35°	120	115°	
	-40	120	116	
	-45°	120	116	
	-50	119	116	
	-55°	119	117	
	-60	119	117	
	40	130	130	
	35°	130	128	
	30	129	125°	
	25°	129	121	
	20	129	120	
	15°	129	119	
	10	129	113	
	5°	128	100	
H δ	0	128	87	100
	-5°	128	95°	
	-10	128	107	
	-15°	127	115°	
	-20	127	119	
	-25°	127	121	
	-30	127	121	

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Aperture 3

18

		n+m	n	w
	-35	127	121	
	-40	127	123	
	-45	127	125	
	50	110	110	
	45	110	108	
	40	111	108	
	35	112	107	
	30	112	110	
	25	113	107	
	20	114	112	
	15	115	105	
	10	115	100	
	5	116	90	
H β	0	117	79	100
	-5	117	90	
	-10	118	98	
	-15	119	107	
	-20	120	112	
	-25	120	114	
	-30	121	117	
	-35	121	118	
	-40	122	120	
	-45	123	121	
	-50	123	123	
altair				
Aperture 4				
M φ 38	75	74	74	
	70	73	70	
	65	72	67	
	60	70	61	

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	n+m	n	w
55	69	60	
50	68	56	
45	67	53	
40	66	50	
35	65	47	
30	64	44	
25	63	42	
20	62	39	
15	60	30	
10	59	25	
5	58	17	
H 3 0	57	14	140+
-5	56	18	
-10	55	23	
-15	54	30	
-20	53	34	
-25	52	35	
-30	51	38	
-35	49	36	
-40	48	38	
-45	47	42	
-50	46	43	
-55	45	41	
-60	44	40	
40	87	87	
35	87	87	
30	87	86	
25	87	86	
20	87	85	

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Aperture 4

20

		n+m	n	w
	15′	86	79	
	10	86	65′	
	5′	86	43	
K	0	85′	26	60
	−5′	85′	40	
	−10	85′	57	
	−15′	85′	70	
	−20	84	77	
	−25′	84	80	
	−30	84	83	
	−35′	84	83	
	−40	84	83	
	70	104	104	
	65′	104	102	
	60	103	100	
	55′	103	98	
	50	102	95′	
	45′	102	92	
	40	101	91	
	35′	100	89	
	30	100	85′	
	25′	99	80	
	20	99	75′	
	15′	98	67	
	10	98	55′	
	5′	97	37	
H Σ	0	97	22	140
	−5′	96	30	
	−10	96	45′	

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	n+m	n	w
-15	95	60	
-20	95	69	
-25	94	75	
-30	94	80	
-35	93	81	
-40	93	82	
-45	92	85	
-50	91	85	
-55	91	87	
-60	90	87	
-65	90	88	
-70	89	87	
-75	89	89	
-80	88	88	
45	117	117	
40	117	115	
35	117	114	
30	117	111	
25	117	108	
20	117	105	
15	117	97	
10	117	89	
5	117	71	
H δ 0	117	65	90
-5	117	79	
H -10	117	90	90
-15	117	99	
-20	117	105	
-25	117	109	

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Aperture 4

22

	n+m	n	w
-30	117	112	
-35	117	114	
-40	117	115	
-45	117	116	
H δ -50	131	130	
45	131	126	
40	131	126	
35	131	124	
30	130	120	
25	130	115	
20	130	115	
15	130	113	
10	130	103	
5	130	83	
H δ 0	129	76	
-5	129	88	
-10	129	100	
-15	129	111	
-20	129	115	
-25	129	118	
-30	128	118	
-35	128	120	
-40	128	123	
-45	128	123	
H φ 32 50	85	85	
45	86	84	
40	87	84	
35	89	84	

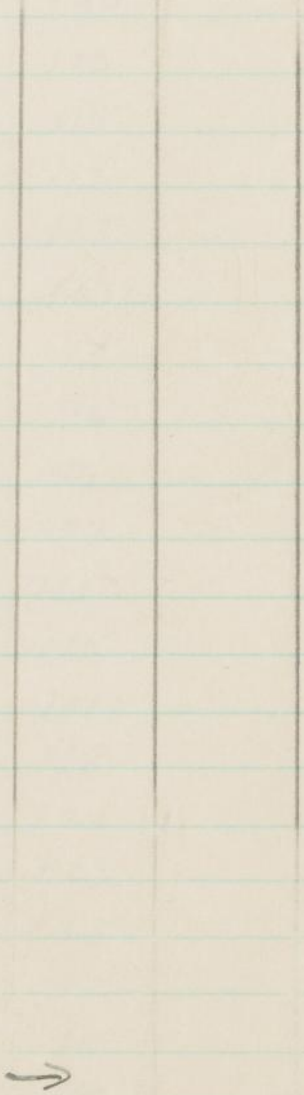
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	n+m	n	w
30	90	84	
25	91	84	
20	92	80	
15	93	78	
10	94	75	
5	95	65	
Hβ 0	96	48	
-5	97	59	
-10	98	72	
-15	99	82	
-20	100	87	
-25	101	94	
-30	102	97	
-35	103	98	
-40	104	100	
-45	105	102	
-50	106	103	

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20	309	46	253	72	215	98	179	124	1.33	150	.75
21	307	47	251	73	214	99	178	125	1.31	151	.72
22	305	48	249	74	212	100	177	126	1.29	152	.68
23	302	49	247	75	211	101	175	127	1.27	153	.65
24	299	50	245	76	210	102	173	128	1.25	154	.64
25	297	51	244	77	209	103	174	129	1.22	155	.61
26	295	52	242	78	207	104	169	130	1.20	156	.57
27	293	53	241	79	206	105	167	131	1.19	157	.53
28	290	54	240	80	205	106	165	132	1.17	158	.49
29	287	55	238	81	203	107	164	133	1.15	159	.45
30	284	56	236	82	201	108	163	134	1.13	160	.38
31	281	57	235	83	200	109	161	135	1.11	161	
32	279	58	234	84	199	110	159	136	1.08	162	
33	277	59	232	85	197	111	156	137	1.06	163	
34	274	60	231	86	196	112	155	138	1.04		
35	272	61	230	87	194	113	153	139	1.02		
36	270	62	229	88	193	114	152	140	.98		
37	268	63	228	89	192	115	150	141	.96		
38	266	64	226	90	190	116	148	142	.93		
39	264	65	225	91	189	117	147	143	.90	19	314
40	262	66	224	92	188	118	145	144	.88	18	317
41	260	67	222	93	186	119	143	145	.86	17	320
42	259	68	221	94	184	120	141	146	.82	16	324
43	257	69	219	95	182	121	139	147	.81	15	327
44	256	70	218	96	181	122	137	148	.79	14	330
45	254	71	216	97	180	123	135	149	.75		

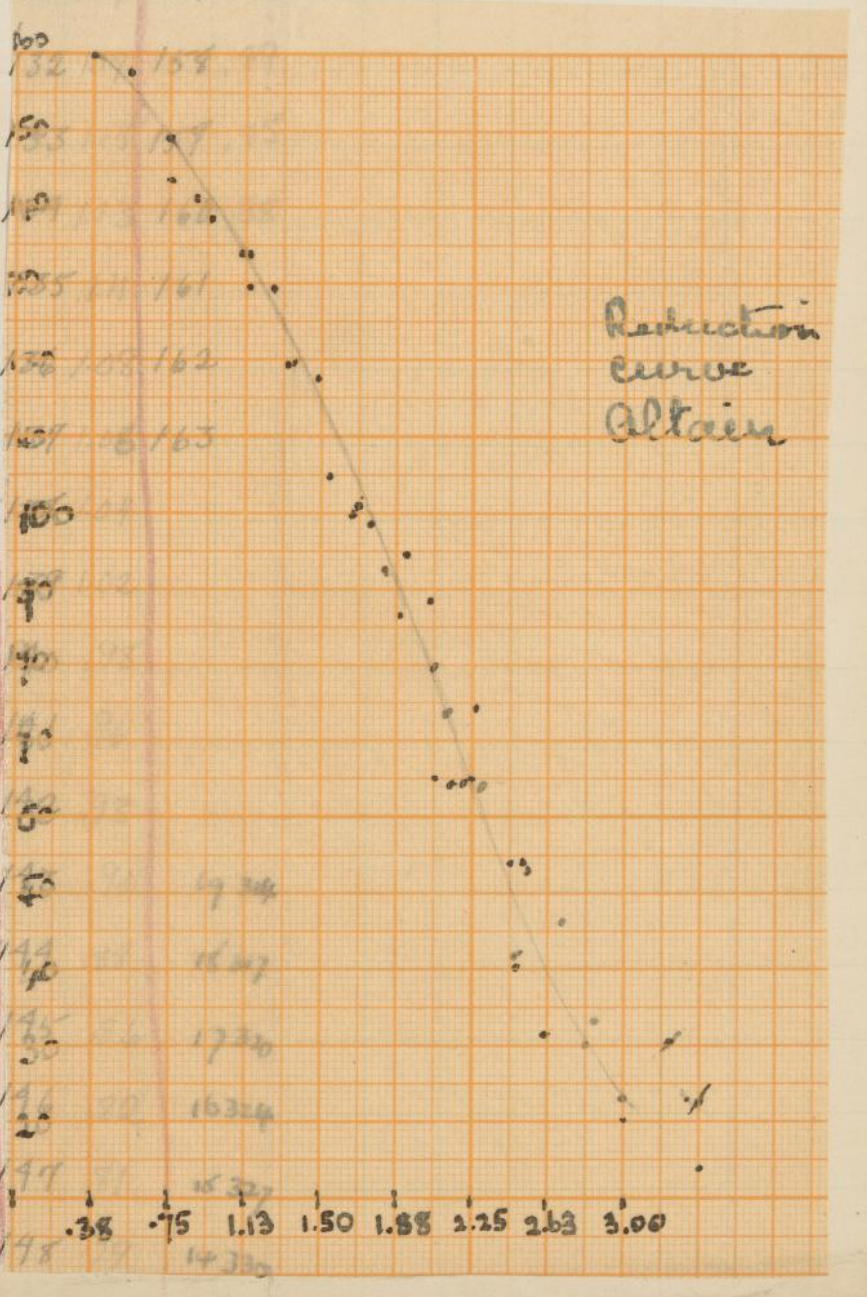
Certain reductions

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20	309	46	253	72	215	98	179	124	1.33	156	.75
21	307	47	251	73	214	99	178	125	1.31	157	.72
22	305	48	249	74	212	100	177	126	1.29	152	.68
23	302	49	247	75	211	101	175	127	1.27	153	.65
24	299	50	245	76	210	102	173	128	1.25	154	.64
25	297	51	244	77	209	103	174	129	1.22	155	.61
26	295	52	242	78	207	104	169	130	1.20	156	.57
27	293	53	241	79	206	105	167	131	1.19	157	.53
28	290	54	240	80	205	106	165	132		158	
29	287	55	238	81	203	107	164	133		157	
30	284	56	236	82	201	108	163	134		160	
31	281	57	235	83	200	109	161	135		161	
32	279	58	234	84	199	110	159	136		162	
33	277	59	232	85	197	111	156	137		163	
34	274	60	231	86	196	112	155	138			
35	272	61	230	87	194	113	153	139			
36	270	62	229	88	193	114	152	140			
37	268	63	228	89	192	115	150	141			
38	266	64	226	90	190	116	148	142			
39	264	65	225	91	189	117	147	143			
40	262	66	224	92	188	118	145	144			
41	260	67	222	93	186	119	143	145			
42	259	68	221	94	184	120	141	146			
43	257	69	219	95	182	121	139	147			
44	256	70	218	96	181	122	139	148			
45	254	71	216	97	180	123	135	149			

Certain reductions



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30 Altair reductions

H θ

	n1	2	3	m1	2	3
50	74	~~75~~		75		
45	70	~~75~~		73		
40	66	~~72~~		72		
35	60	~~71~~		71		
30	55			70		
25	53			69		
20	45			68		
15	35			67		
10	30			66		
5	22			65		
0	15			64		
−5	22			63		
−10	29			62		
−15	39			61		
−20	42			59		
−25	44			58		
−30	45			57		
−35	44			56		
−40	46			55		
−45	48			53		
−50	48			52		
−55	48			51		
				50		

(75) - 24
(70) - 20
(65) - 17
(60) - 07
(55) - 00

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1	Δm	2	Δm	3	Δm	4	Δm	mean	Res	Σh^2	μ
212-211	01										
218-214	04										
224-215	09										
231-216	15										
238-218	20										
241-219	22										
254-221	33										
272-224	48										
284-225	59										
305-226	79										
327-228	99										
305-229	76										
287-230	57										
264-232	32	no tracing									
259-234	25										
256-235	21										
254-236	18										
256-238	18										
253-241	12										
247-242	05										
249-244	05										
249-245	04										
				no tracing							
						no tracing					

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Hc	n1	2	3	4	m+n1	2	3	4	
35	47				47				25
30	42				46				25
25	37				45				26
20	31				44				28
15	27				42				29
10	22				41				30
5	17				40				32
0	13				39				33
-5	16				38				31
-10	18				37				31
-15	24				35				29
-20	25				34				29
-25	28				33				29
-30	30				32				28
-35	31				31				28

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1	Δm	2	Δm	3	Δm	4	Δm	Mean Res	Σp²	u
251-251	00									
254-253	06									
268-254	14									
281-256	25									
293-259	34									
305-260	45									
320-262	58									
334-264	70									
314-266	58									
317-268	49									
299-272	27									
297-274	23									
290-277	13									
284-279	05									
281-281	00									

no tracing

no tracing

no tracing

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HD		n1	2	3	4	m+n1	2	3	4	
	65		88				88			
	60	115	86			115	88			150
	55	112	83			114	87			155
	50	107	81			112	86			164
	45	105	76			111	85			167
	40	102	74			110	84			173
	35	99	70			108	83			178
	30	92	66			107	81			188
	25	85	62			106	80			197
	20	74	53			104	79			212
	15	63	45			103	78			228
	10	50	39			102	77			245
	5	41	32			100	76			260
	0	35	35			99	75			272
	-5	45	35			97	74			252
	-10	55	38			96	72			238
	-15	64	45			95	71			226
	-20	66	49			93	70			224
	-25	71	50			92	69			216
	-30	71	52			90	68			216
	-35	73	53			89	67			214
	-40	79	56			88	65			206
	-45	78	57			86	64			207
	-50	80	59			85	63			205
	-55	81	60			83	62			203
	-60	81	60			82	61			203

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1	Δm	2	Δm	3	Δm	4	Δm	mean	Res	Σh²	μ
		193-193	00					00			
150-150	00	196-193	03					02	2, 1		2
155-152	03	200-194	06					04	1, 2		2
164-155	09	203-196	07					08	1, 1		1
167-156	11	210-197	13					12	1, 1		1
173-159	14	212-199	13					14	0, 1		1
178-163	15	218-200	18					16	1, 2		2
188-164	24	224-203	21					22	2, 1		2
197-165	32	229-205	24					28	4, 4		4
212-169	43	241-206	35					39	4, 4		4
228-171	57	254-207	47					52	5, 5		5
245-173	72	264-209	55					64	8, 9		8
260-177	83	279-210	69					76	7, 7		7
272-178	94	272-211	68	no tracing		no tracing		81	13, 13		13
254-180	74	272-212	60					67	7, 7		7
238-181	57	266-215	51					54	3, 3		3
226-182	44	254-216	38					41	3, 3		3
224-186	38	247-218	29					34	4, 6		4
216-188	28	245-219	26					27	1, 1		1
216-190	26	+242-221	21					24	2, 3		2
214-192	22	241-222	19					20	2, 1		2
206-193	13	236-225	11					12	1, 1		1
207-196	11	235-226	09					10	1, 1		1
205-197	08	232-228	04					06	2, 2		2
203-200	03	231-229	02					02	1, 0		1
203-201	02	231-230	01					02	0, 1		1

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H 3

	n_1	2	3	4	$m+n_1$	2	3	4	
		120	85 82	(75) (70) 74 70		120	84	(75) (70) 74 70	
65	120	117	78	67	120	119	82	67	141
60	116	112	74	61	119	119	81	61	148
55	113	110	71	60	119	118	80	69	153
50	113	109	70	56	118	117	80	64	153
45	112	108	68	53	118	117	79	67	155
40	109	103	64	50	117	116	78	66	161
35	106	102	62	47	116	115	77	65	165
30	105	97	58	44	116	115	76	64	167
25	101	95	54	42	115	114	75	63	175
20	98	90	48	37	114	113	74	62	179
15	92	83	40	30	114	112	73	60	188
10	85	73	32	27	113	112	72	59	197
5	92	60	22	17	112	111	71	54	215
0	65	54	20	14	112	110	70	57	225
-5	70	58	26	18	111	110	69	56	218
-10	80	73	31	23	110	109	68	~~5~~ 45	205
-15	87	83	40	30	110	108	67	~~55~~ 53	194
-20	92	89	46	34	109	108	66	~~55~~ 52	188
-25	97	94	48	35	109	107	65	~~54~~ 52	180
-30	97	91	46	38	108	106	~~65~~	~~53~~ 51	180
-35	98	92	49	36	108	105	64	~~52~~ 49	179
-40	100	94	50	38	107	105	63	~~51~~ 48	177
-45	102	98	52	42	106	104	62	~~49~~ 47	173
-50	101	96	52	43	105	~~103~~	61	~~48~~ 46	175
-55	101	96	52	41	105	102	59	~~47~~ 45	175
-60	100	98	53	40	104	~~102~~	58	~~46~~ 44	177
-65	101	100	55		103	101	57	~~45~~	175
-70	102	100	56		103	100	56	~~44~~	173

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1	Δm	2	Δm	3	Δm	4	Δm	mean	Res	Σh^2	y
		141 - 141	00	201 - 199	02	218 - 215	03	02	2, 0, 1		
141 - 141	00	147 - 143	04	207 - 201	06	222 - 216	06	04	4, 0, 2, 2	6	2
148 - 143	05	155 - 143	12	212 - 203	09	230 - 218	12	09	4, 3, 0, 3	8	3
153 - 143	10	159 - 145	14	216 - 205	11	231 - 219	12	12	2, 2, 1, 0	2	1
153 - 145	08	161 - 147	14	218 - 205	13	236 - 221	15	12	4, 2, 1, 3	8	3
155 - 145	10	163 - 147	16	221 - 206	15	241 - 222	19	15	5, 1, 0, 4	10	3
161 - 147	14	171 - 148	23	226 - 207	19	245 - 224	21	19	5, 4, 0, 2	11	3
165 - 148	17	173 - 150	23	229 - 209	20	251 - 225	26	22	5, 1, 2, 4	11	3
167 - 148	19	180 - 150	30	234 - 210	24	256 - 226	30	26	7, 4, 2, 4	20	4
175 - 150	25	182 - 152	30	240 - 211	29	259 - 228	31	29	4, 1, 0, 2	5	2
179 - 152	27	190 - 153	37	249 - 212	37	268 - 229	39	33	8, 2, 3, 4	7	3
188 - 152	36	200 - 155	45	262 - 214	48	284 - 231	53	46	10, 1, 2, 7	38	6
197 - 153	44	214 - 155	59	279 - 215	64	293 - 232	61	57	13, 2, 7, 4	50	7
215 - 155	60	231 - 156	75	305 - 216	89	320 - 234	86	78	18, 3, 11, 8	98	10
225 - 155	70	240 - 159	91	309 - 218	91	330 - 235	95	87	17, 4, 4, 8	96	9
218 - 156	62	234 - 159	75	295 - 219	76	317 - 236	81	74	12, 1, 2, 7	50	7
205 - 159	46	214 - 161	53	281 - 221	60	302 - 238	64	56	10, 3, 4, 8	47	7
194 - 159	35	200 - 163	37	262 - 222	40	284 - 241	43	39	4, 2, 1, 4	9	3
188 - 161	27	192 - 163	29	253 - 224	29	274 - 242	32	29	2, 0, 0, 3	3	2
180 - 161	19	184 - 164	20	249 - 225	24	272 - 242	30	23	4, 3, 1, 7	19	4
180 - 163	17	189 - 165	24	249 - 225	24	266 - 244	22	22	5, 2, 2, 0	8	3
179 - 163	16	188 - 164	21	247 - 226	21	270 - 247	23	20	4, 1, 1, 3	7	3
177 - 164	13	184 - 167	17	245 - 228	17	266 - 249	17	16	3, 1, 1, 1	3	2
173 - 165	08	179 - 169	10	242 - 229	13	259 - 251	08	10	3, 0, 3, 2	4	2
175 - 167	08	181 - 171	10	242 - 230	12	257 - 253	04	08	0, 2, 4, 4	9	3
175 - 167	08	181 - 173	08	242 - 232	10	260 - 254	06	08	0, 0, 2, 2	2	1
177 - 169	08	179 - 173	06	241 - 234	07	262 - 256	06	07	1, 1, 0, 1	.0	.0
175 - 171	04	177 - 175	02	238 - 235	03		—	03	1, 1, 0	.0	.0
173 - 171	02	177 - 177	00	236 - 236	00		—	01	1, 1, 1	1	1

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K

	m+n	130 130 2	(40) 99 97 96 3	87 87 4 86 86	m+n	130 2 130 130	99 99 98 3 98 98	87 87 4 86 86	
20	129	128 131	94	85	129	130	98	85	122
15	127	125 130	90	79	129	130	97	86	127
10	121	113 128	80	65	129	129	97	86	139
5	105	90 125	55	43	128	129	97	86	167
0	87	70 113	36	26	128	129	96	85	194
-5	99	90 90	50	40	127	128	96	85	178
-10	114	110	72	57	127	128	95	85	152
-15	121	119	84	70	127	128	95	85	139
-20	125	121	89	77	127	128	94	84	131
-25	127	126	91	80	127	128	94	84	127
		128	92	83			94	84	
			92	83			93	84	
			93	83			93	84	

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1	Δm	120 2 −120	Δm	178 180 3 178 / 181 − 179 / 181 − 179 / 184 − 179	Δm	194 194 4 194 / 196 196 / 196 196 / 197 − 197	Δm	00 0 mean	0, 0, 1, 2, 0 / 1, 1, 1, 0	Σh	d	0 1 μ
122 − 122	00	120 −120 / 125 −120	00 / 05		00,02 / 02,03 / 05		00,00, / 00,00, / 00	01 / 02	2, 3, 3, 2	7		3
127 − 122	05	131 −120	11	190 − 180	10	206 − 196	10	09	4, 2, 1, 1	6		2
139 − 122	17	153 −122	31	205 − 180	25	225 − 196	29	26	9, 5, 1, 3	29		5
167 − 125	42	190 −122	68	238 − 180	58	257 − 196	61	57	15, 11, 1, 4	91		10
194 ~~127~~ − 125	69 ~~53~~	218 − 122	~~96~~	270 − 181	89	295 − 197	98	88	19, 8, 1, 0	132		11
178 − 127	51	190 −125	65	245 − 181	64	262 − 197	63	61	10, 4, 3, 2	32		6
152 − 127	25	159 − 125	34	215 − 182	33	235 − 197	38	32	7, 2, 1, 6	22		5
139 − 127	12	143 −125	18	199 − 182	17	218 − 197	21	17	5, 1, 0, 4	10		3
131 − 127	04	139 − 125	14	192 − 184	08	209 − 197	12	10	6, 4, 8, 2	30		5
127 − 127	00	129 − 125	04	189 − 184	05	205 − 199	06	04	4, 0, 1, 2	5		2
	—	125 − 125	00	188 − 184	04	200 − 199	01	02	2, 2, 1	3		2
	—		—	188 − 186	02	200 − 199	01	02	0, 1	1		1
	—		—	186 − 186	00	200 − 199	01	01	1, 0	1		1

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H E	n_1	2	3	4	n_1+n_2	2	3	4
		136	(70) 114	104			114	104
			111	102			114	104
50	144	134	1083	100	146	137	113	103
45	143	132	106	98	145	137	112	103
40	142	131	103	95	145	137	112	102
35	141	130	102	92	144	136	111	101
30	139	127	100	91	144	136	110	100
25	137	124	97	89	143	136	110	100
20	134	118	92	85	143	135	109	99
15	128	110	87	80	143	135	109	99
10	120	99	78	75	143	135	108	98
5	104	80	65	67	142	135	108	98
0	92	64	47	55	142	135	107	97
-5	100	79	31	37	141	134	107	97
-10	116	100	40	22	140	134	106	96
-15	126	111	60	30	140	134	106	96
-20	132	118	75	~~30~~ 45	140	133	105	95
-25	135	122	83	60	139	133	105	95
-30	136	125	87	69	139	132	104	94
-35	137	125	93	75	138	132	104	94
-40	137	127	94	etc. 80	138	132	103	93
		127	95	81	137	132	103	93
		128	97	82		131	102	92
		128	98	85		131	102	91
		129	~~98~~	85		131	101	91
			96	87		131	101	90
			96	87			100	90
			97	88			100	89
			99	87			99	89
			99	89			99	~~88~~
				~~88~~				

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4

1	Δm	2	Δm	3	Δm	4	Δm	Mean	Res	Σh²	
		184-		165-153	-12	179-171	08				
88 - 82	06	113 - 106	07	167 - 155	12	182 - 173	09	08	2, 1, 4, 1	4	2
90 - 86	04	117 - 106	11	171 - 155	16	188 - 173	15	12	8, 1, 4, 3	22	5
93 - 86	07	119 - 106	13	173 - 156	17	189 - 175	14	13	6, 0, 4, 1	13	4
96 - 88	08	120 - 108	12	177 - 159	18	192 - 177	15	13	5, 1, 5, 2	14	4
102 - 88	14	127 - 108	19	180 - 159	21	197 - 177	20	18	4, 1, 3, 2	8	3
106 - 90	16	133 - 108	25	188 - 161	27	205 - 178	27	24	8, 1, 3, 3	21	5
113 - 90	23	145 - 111	34	194 - 161	33	211 - 178	33	31	8, 3, 2, 2	20	4
125 - 90	35	159 - 111	48	207 - 163	44	222 - 179	43	42	7, 6, 2, 1	22	5
141 - 93	48	178 - 111	67	225 - 163	62	238 - 179	59	59	11, 8, 3, 0	48	7
169 - 93	76	205 - 111	94	251 - 164	87	268 - 180	88	86	10, 8, 1, 2	42	6
188 - 96	92	226 - 113	113	281 - 164	117	305 - 180	125	112	20, 1, 4, 13	146	12
177 - 98	79	206 - 113	93	262 - 165	97	284 - 181	103	93	14, 0, 4, 10	78	9
148 - 98	50	177 - 113	64	231 - 165	66	~~284~~ - 181	103	63	13, 1, 3, 10	70	8
129 - 98	31	156 - 115	41	211 - 167	44	254 - 182	49	41	10, 0, 3, 8	48	7
117 - 102	15	145 - 115	30	200 - 167	33	231 - 182	37	29	14, 1, 4, 8	69	8
111 - 102	09	137 - 117	20	194 - 169	25	219 - 184	27	20	11, 0, 5, 7	49	7
108 - 104	04	131 - 117	14	186 - 169	17	211 - 184	21	14	10, 0, 3, 7	40	6
106 - 104	02	131 - 117	14	184 - 171	13	205 - 186	17	12	10, 2, 1, 5	32	6
106 - 106	00	127 - 117	10	182 - 171	11	205 - 186	15	09	9, 1, 2, 6	30	5
		127 - 119	08	180 - 173	07	201 - 188	09	08	0, 1, 1	1	1
		125 - 119	06	179 - 173	06	197 - 189	09	07	1, 1, 2	1	1
		125 - 119	06	179 - 175	04	197 - 189	05	05	1, 1, 0	1	1
		122 - 119	03	181 - 175	06	194 - 190	05	05	2, 1, 0	1	1
				181 - 177	04	194 - 190	04	04	0, 0,	0	0
				180 - 177	03	193 - 192	02	02	1, 0	1	1
				178 - 178	00	194 - 192	00	00	0, 0	0	0
				178 - 178	00	192 - 193	00	00	0, 0	0	0
						193 -					

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H δ	n_1	2	123	4	$m+n_1$	2	123	4	
		149	121			150	123		
45	158	149	120	117	158	150	122	117	49
40	157	147	120	115	158	150	122	117	53
35	157	147	118	114	158	149	122	117	53
30	155	145	116	111		149	122	117	61
25	154	142	112	108		149	122	117	64
20	152	140	110	105		149	122	117	68
15	150	138	106	97		149	121	117	75
10	146	130	97	89		149	121	117	82
5	136	118	85	71		148	121	117	10
0	132	111	76	65		148	121	117	117
-5	137	120	82	79		148	121	117	10
-10	145	131	94	90		148	121	117	8
-15	150	136	101	99		148	120	117	75
-20	152	140	106	105		148	120	117	68
-25	154	142	110	109		148	120	117	64
-30	155	144	112	112		147	120	117	61
-35	155	144	115	114		147	120	117	6
-40	156	145	116	115		147	120	117	5
-45	155	145	116	116		147	120	117	61
-50	157	145	116			147	119		53
		147	117			147	119		
			117				119		

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1	Δm	2 − 75	Δm	137③ − 135 / 139 − 135	Δm	4	Δm	Mean	Res	Σh²	h
			00		02						
49 − 49	00	75 − 75	00	141 − 137	04	147 − 147	00	07	1, 1, 3, 1	2	1
53 − 49	04	81 − 75	06	141 − 137	04	150 − 147	03	04	0, 2, 0, 1	1	1
53 − 49	04	81 − 75	06	145 − 137	08	152 − 147	05	06	2, 0, 2, 1	2	1
61 − 49	12	86 − 75	11	148 − 137	11	156 − 147	09	11	1, 0, 0, 2	1	1
64 − 49	15	93 − 75	18	155 − 137	18	163 − 147	16	17	2, 1, 1, 1	1	1
68 − 49	19	98 − 75	23	159 − 137	22	167 − 147	20	21	2, 2, 1, 1	2	1
75 − 49	26	104 − 75	29	165 − 139	26	180 − 147	33	28	2, 1, 2, 5	8	3
82 − 49	33	120 − 75	45	180 − 139	41	192 − 147	45	41	8, 4, 0, 4	24	5
108 − 49	59	145 − 79	68	197 − 139	58	216 − 147	69	64	5, 4, 6, 5	26	5
117 − 49	68	156 − 79	77	210 − 139	71	225 − 147	78	74	6, 3, 3, 4	18	4
106 − 49	57	141 − 79	62	201 − 139	62	206 − 147	59	60	3, 2, 2, 1	4	2
86 − 49	37	119 − 79	40	184 − 141	43	190 − 147	43	41	4, 1, 2, 2	6	2
75 − 49	26	108 − 79	29	175 − 141	34	178 − 147	31	30	4, 1, 4, 1	9	3
68 − 49	19	98 − 79	19	165 − 141	24	167 − 147	20	20	1, 1, 4, 0	5	2
64 − 49	15	93 − 79	14	159 − 141	18	161 − 147	14	15	0, 1, 3, 1	3	2
61 − 49	12	88 − 81	07	155 − 141	14	155 − 147	08	10	2, 3, 4, 2	8	3
61 − 49	12	88 − 81	07	150 − 141	09	152 − 147	05	08	4, 1, 1, 3	7	3
57 − 49	08	86 − 81	05	148 − 141	07	150 − 147	03	06	2, 1, 1, 3	4	2
61 − 49	12	86 − 81	05	148 − 141	07	148 − 147	01	06	6, 1, 1, 5	16	4
53 − 49	04	86 − 81	05	148 − 143	05		−	05	1, 0, 0	0	0
−	−	81 − 81	00	147 − 143	04		−	02	2, 2	4	2
	−		−	147 − 143	04		−	04	0	0	0

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H	δ	n_1	2	3	4 (50)130 126	$m+n_1$	2	3	4 131 131	
	40	160	149	130	126	160	149	130	131	.38
	35	159	147	128	124	160	149	130	131	.45
	30	—	146	125	120	160	149	129	130	—
	25	157	144 142	124	115		149	129	130	.53
	20	156	141	120	115		148	129	130	.57
	15	155	136	119	113		148	129	130	.61
	10	152	137	113	103		148	129	130	.68
	5	145	117	100	83		148	128	130	.86
	0	140	123	87	76		148	128	129	.98
	-5	145	134	95	88		148	128	129	.86
	-10	152		107	100		148	128	129	.68
	-15	156	139	116	111		147	127	129	.57
	-20	158	142	119	115		147	127	129	.49
	-25	159	143	121	118		147	127	128	.45
	-30	158	143	121	118		147	127	128	.49
	-35	158	143	121	120		147	127	128	.49
	-40	160	145	123	123		147	127	128	.38
			147	125	123		147	127		

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1	Δm	2	Δm	3	Δm	4	Δm	mean	Res	Σh²	u
.38 -.38	00	.75 -.75	00	1.20 -1.20	00	129 -119	10	02	2, 2, 2, 8	19	4
.45 -.38	07	.81 -.75	06	1.25 -1.20	05	133 -119	14	08	1, 2, 3, 6	12	3
-	-	.82 -.75	07	1.31 -1.22	09	141 -120	21	12	0, 5, 3, 9	38	6
.53 -.38	15	.88 -.75	13	1.39 -1.22	17	150 -120	30	19	4, 6, 2, 11	44	7
.57 -.38	19	.93 -.79	13	1.41 -1.22	19	150 -120	30	20	1, 7, 1, 10	38	6
.61 -.38	23	.96 -.79	17	1.43 -1.22	21	153 -120	33	24	1, 7, 3, 9	35	6
.68 -.38	30	1.08 -.79	29	1.53 -1.22	31	171 -120	51	35	5, 6, 4, 16	83	9
.86 -.38	48	1.06 -.79	27	1.77 -1.25	52	200 -120	80	52	4, 25, 0, 28	356	19
.98 -.38	60	1.47 -.79	68	1.94 -1.25	69	210 -122	88	71	11, 3, 2, 17	106	10
.86 -.38	48	1.35 -.79	56	1.82 -1.25	57	193 -122	71	58	10, 2, 1, 14	75	9
.68 -.38	30	1.13 -.79	34	1.64 -1.25	39	177 -122	55	40	10, 6, 1, 15	90	9
.57 -.38	19	1.02 -.81	21	1.50 -1.27	23	156 -122	34	24	5, 3, 1, 10	39	6
.49 -.38	11	.93 -.81	12	1.43 -1.27	16	150 -122	28	17	6, 5, 1, 11	46	7
.45 -.38	07	.90 -.81	09	1.39 -1.27	12	145 -125	20	12	5, 3, 0, 8	24	5
.49 -.38	11	.90 -.81	09	1.39 -1.27	12	145 -125	20	13	2, 4, 1, 7	18	4
.49 -.38	11	.90 -.81	09	1.39 -1.27	12	141 -125	16	12	1, 3, 0, 4	6	2
.38 -.38	00	.86 -.81	05	1.35 -1.27	08	135 -125	10	06	6, 1, 2, 4	14	4
		.81 -.81	00	1.31 -1.27	04	135 -125	10	05	5, 5, 5	17	4

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H B	n,	2	3	4	m+n,	2	3	4	
50	157		110	85	157		110	85	53
45	156		108	84	157		110	86	57
40	155		108	84	158		111	87	61
35	156		107	84	158		112	89	57
30	156		110	84	158		112	90	57
25	155		107	84	158		113	91	61
20	155		112	80	158		114	92	61
15	153		105	78	158		115	93	65
10	152		100	73	158		115	94	68
5	145		90	65	158		116	95	86
0	134	no trace	79	48	159	trace	117	96	113
-5	140		90	59	159		117	97	98
-10	150	no	98	72	159		118	98	75
-15	153		107	82	159		119	99	65
-20	156		112	87	159	no	120	100	57
-25	157		114	94	159		120	101	53
-30	158		117	97	160		121	102	49
-35	159		118	98	160		121	103	45
-40	160		120	100	160		122	104	38
			121	102			123	105	
			123	103			123	106	

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1	Δm	e	Δm	3	Δm	4	Δm	mean	res	Σh²	u
53 -53	00			159 -159	00	197 -197	00	00	0, 0, 0	0	0
57 -53	04			163 -159	04	199 -196	03	04	0, 0, 1	0	0
61 -49	12			163 -156	07	199 -194	05	08	4, 1, 3	9	3
57 -49	08			164 -155	09	199 -192	07	08	0, 1, 1	1	1
57 -49	08			157 -155	12	199 -190	09	10	2, 2, 1	3	2
61 -49	12			164 -153	11	199 -189	10	11	1, 0, 1	1	1
61 -49	12			155 -152	03	205 -188	17	11	1, 8, 6	34	6
65 -49	16			167 -150	17	207 -186	21	18	2, 1, 3	5	2
68 -49	19			177 -150	27	214 -184	30	25	~~6, 3, 1~~ 10, 2, 1	22	5
86 -49	37			190 -148	42	225 -182	43	41	4, 12	7	3
113 -45	68	—		206 -147	59	249 -181	68	65	3, 6, 3	18	4
98 -45	53			190 -147	53	232 -180	52	53	0, 0, 1	0	0
75 -45	30			179 -145	34	215 -179	36	33	3, 1, 3	6	2
65 -45	20			164 -143	21	201 -178	23	21	1, 0, 2	2	1
57 -45	12			155 -141	14	194 -177	17	14	2, 0, 3	4	2
53 -45	08			152 -141	11	184 -175	09	09	1, 2, 0	2	1
49 -38	11			147 -139	08	180 -173	07	09	2, 1, 2	3	2
45 -38	07			145 -139	06	179 -171	08	07	0, 1, 1	1	1
38 -38	00			141 -137	04	177 -169	08	04	4, 0, 4	11	3
				139 -135	04	173 -167	06	05	1, 1	1	1
				135 -135	00	171 -165	06	03	3, 3	9	3

no traces of spectrum cut off

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Derivation of line intensities

	Δm	μ	Intensity dl / λ A°m	dl				
H η	65	00		00				
	60	02	2	.01				
	55	04	2	.03				
	50	08	1	.07				
	45	12	1	.10				
	40	14	1	.12				
	35	16	2	.13				
	30	22	2	.18				
	25	28	4	.23				
	20	39	4	.30				
	15	52	5	.38				
	10	64	8	.45				
	5	76	7	.50				
	0	81	13	.53				
	-5	67	7	.46				
	-10	54	3	.39				
	-15	41	3	.31				
	-20	34	4	.27				
	-25	27	1	.22				
	-30	24	2	.20				
	-35	20	2	.17				
	-40	12	1	.10				
	-45	10	1	.09				
	-50	06	2	.05				
	-55	02	1	.02				
	-60	02	1	.02				
				Σdl = 5.33				

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50

H 3

	~~Δm~~	Δμ	~~Surf. Br.~~	dU	m+n 1	2	3	4
70	02	1		.02				
65	04	2		.04				
60	09	3		.08				
55	12	1		.10				
50	12	3		.10				
45	15	3		.13				
40	19	3		.16				
35	22	3		.18				
30	26	4		.14				
25	29	2		.23				
20	35	3		.28				
15	46	6		.35				
10	57	7		.41				
5	78	10		.51				
0	87	9		.55				
-5	74	7		.50				
-10	56	7		.40				
-15	39	3		.30				
-20	29	2		.23				
-25	23	4		.19				
-30	22	3		.18				
-35	20	3		.17				
-40	16	2		.14				
-45	10	2		.09				
-50	08	3		.07				
-55	08	1		.07				
-60	07	0		.06				
-65	03	0		.03				
-70	01	1		.01				
				$\Sigma dl =$ 5.72				

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+ Δm	Δm μ	∘2 Δm	Δm dl	3	Δm	4	Δm Mean	Res	Σh²	h

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— K

	Δm	u	Σ ut Δm	dl	n+m 1 2 3 4
30	01	0		.01	
25	01	1		.01	
20	02	3		.02	
15	04	2		.08	
10	26	5		.21	
5	57	10		.41	
0	88	11		.56	
-5	61	6		.43	
-10	32	5		.26	
-15	17	3		.15	
-20	10	5		.09	
-25	04	2		.04	
-30	02	2		.02	
-35	02	1		.02	
-40	01	1		.01	
				Σdl = 2.32	

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λ	Δm	μ & Δm (2)	dl (3)	Res. (4)	$\frac{\Sigma h^2}{\Delta m^2}$ μ Mean	Res	Σh^2 μ
3942	.15		.13	—	—		
3939	.22		.18	2, 3	2		
3936	.53		.39	3, 4	4		
3933	.79		.52	3, 2	2		
3930	.51		.37	1, 1	1		
3927	.07		.06	5, 5	5		
3924	.05		.05	—	—		
			Σdl = 1.70				

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H Σ

	Δm	u	Int. Δm	dl	nm 1 2 3 4
55	10			.09	
50	08	2		.07	
45	12	5		.10	
40	13	4		.11	
35	13	4		.11	
30	18	3		.15	
25	24	5		.20	
20	31	4		.25	
15	42	5		.20	
10	59	7		.42	
5	86	6		.55	
0	112	12		.64	
-5	93	9		.58	
-10	63	8		.44	
-15	41	7		.31	
-20	29	8		.23	
-25	20	7		.17	
-30	14	6		.12	
-35	12	6		.10	
-40	09	5		.08	
-45	08	1		.07	
-50	07	1		.06	
-55	05	1		.05	
-60	05	1		.05	
-65	04	0		.04	
-70	02	1		.02	
-75	00	0		.00	
-80	00	0		.00	

Σdl = 5.21

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λ	Δm	μ & Δλ	Åm dl δ	Res. Δm	4	$\frac{\Sigma h^2}{n}$ Δm	mean Res	Σh^2	n
3970	>1.5		.61		—		—		
3967	.79		.52		1, 1		1		
3964	.48		.36		13, 14		14		
3960	.25		.21		12, 13		12		
3957	.12		.10		2, 3		2		
3954	.07		.02		—		—		
3986	.20		.17		—		—		
3983	.25		.21		0, 0		0		
3980	.32		.26		2, 3		2		
3976	.43		.33		3, 4		4		
3973	.81		.53		1, 1		1		
		Σdl=	3.32						

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+ δ

	Δm	μ	Å m	dl
60				
55				
50	02	2		.07
45	01	1		.01
40	04	1		.04
35	06	1		.05
30	11	1		.10
25	17	1		.14
20	21	1		.18
15	28	3		.23
10	41	5		.31
5	64	5		.45
0	74	4		.49
-5	60	2		.42
-10	41	2		.31
-15	30	3		.24
-20	20	2		.17
-25	15	2		.13
-30	10	3		.10
-35	08	3		.07
-40	06	2		.05
-45	06	4		.05
-50	05	0		.05
-55	02	2		.02
-60	04	0		.04
			Σdl	3.67

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λ	Δm	μ	Åm	dl	res.	$\frac{\Sigma h^2}{n}$	μ
4116	.03			.03	4, 3		4
4112	.10			.10	5, 5		5
4109	.23			.20	7, 8		8
4105	.46			.25	6, 6		6
4102	.71			.48	1, 1		1
4098	.50			.37	5, 5		5
4095	.23			.19	7, 6		6
4091	.10			.10	5, 5		5
4088	.01			.01	1, 1		1
				2dl 1.83			

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Φ 36
H δ

	Δm	μ	Åm	dl	
40	02	4		.02	4
35	08	3		.07	4
30	12	6		.10	4
25	19	7		.16	4
20	20	6		.17	4
15	24	6		.20	4
10	35	9		.28	.4
5	52	19		.38	4
0	71	10		.48	4
-5	58	9		.41	4
-10	40	9		.31	4
-15	24	6		.20	
-20	17	7		.14	
-25	12	5		.10	
-30	13	4		.11	
-35	12	2		.10	
-40	06	4		.05	
-45	05	4		.05	
				Σdl = 3.33	

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λ	Δm	μ	Åm	dl	Res.	μ
4363	.06			.05	1, 1	1
4358	,11			.10	4, 4	4
4354	.16			.14	4, 4	4
4349	,21			,18	4, 4	4
4345	.39			,30	10, 9	10
4840	.81			,53	1, 1	1
.4336	39			.30	10, 9	10
4331	,24			.18	4, 4	4
4327	.16			.14	4, 4	4
4322	.07			,06	0, 0	0
4318	,01			,01	1, 1	1
			Σdl =	1.99		

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~~XX 76~~

HB

	Δw	μ	Åw	dl
75				
70				
65				
60				
55				
50	00	0	.00	
45	04	0	.04	
40	08	3	.07	
35	08	1	.07	
30	10	2	.10	
25	11	1	.10	
20	11	6	.10	
15	18	2	.15	
10	25	5	.21	
5	41	3	.31	
0	65	4	.45	
-5	53	0	.39	
-10	33	2	.26	
-15	21	1	.18	
-20	14	2	.12	
-25	09	1	.08	
-30	09	2	.08	
-35	07	1	.06	
-40	04	3	.04	
-45	05	1	.05	
-50	03	3	.03	
-55			Σdl 2.89	
-60				
-65				
-70				

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λ	Δm	μ	Åm	dl	Reo.	μ
4877	.00			.00	0, 0	0
4872	.12			.10	5, 5	5
4866	.36			.21	6, 6	6
4861	.71			.48	1, 1	1
4856	.45			.34	5, 5	5
4846	.15			.13	3, 2	2
4840	.09			.08	7, 8	8
				2dl 1.34		

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Hc	Δm	μ	Åm	dl
40				
35	00			.00
30	06			.05
25	14			.12
20	25			.21
15	34			.27
10	45			.34
5	58			.41
0	70			.48
-5	58			.41
-10	49			.36
-15	27			.22
-20	23			.26
-25	13			.11
-30	05			.05
-35	00			.00
-40			Σdl	3.29

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λ Δm μ Åm dl

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64 Ori 3

4 D

	Δm	μ	Åm	dl
70	–			
65	–			
60	–			
55	–			
50	01		.01	
45	04		.04	
40	09		.08	
35	15		.13	
30	20		.17	
25	22		.18	
20	33		.26	
15	48		.33	
10	59		.42	
5	79		.52	
0	99		.60	
-5	76		.50	
-10	54		.41	
-15	32		.25	
-20	25		.21	
-25	21		.18	
-30	18		.15	
-35	18		.15	
-40	12		.10	
-45	5		.04	
-50	5		.04	
-55	4		.04	
-60				
-65			4.81	
-70				
-75				
-80				

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λ Δm μ Åm dl

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66 ~~ap 3~~

α Aquilae — Summary of results

Line	Int App. C	Int, App MC	MC to C	Mean C/MC	C reduced in λ	Adopted *
Hε	3.29	–	–	3.29	–	~~2.3~~ 4.16
Hδ	4.81			4.81		6.71
Hγ	5.33	–	–	5.33	–	4.8 7.95
H3	5.72	–	–	5.72	–	5.3 8.60
K	2.32	~~1.88~~ 1.70	~~2.73~~	2.77	1.36	2.77 (4.20 *
Hε	5.21	3.32	6.30	5.75	1.48	6.3 ~~4.5?~~ for Hε 8.65 alone
Hδ	3.67	1.83	3.47	3.57	2.02	5.1 7.39
Hγ	3.33	1.99	3.78	~~3.58~~ 3.78	1.67	6.9 7.92
Hβ	2.89	1.34	~~2.54~~	2.72	2.15	4.3 6.46
					9.08	
					1.82	

* Provisional estimate of Hε = (H+Hε) − 2K.

*

The adopted intensities are derived by multiplying Σdl by the number of AU included in 5 scale divisions = 2.5 mm at that λ on the microphotometer traces.

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α Lyrae. Summary of Results

Line	Int. Sp. C.	Mc	Mc to C	Mean	C/Mc	C reduced	Adopted *		α Lyr / α Aql
Hι									
Hθ									
Hη	9.95	–	–	9.95	–	~~6.0~~	10.49		(1.86) ~~1.25~~
Hζ	9.87	3.70	7.12	7.9	~~2.69~~	~~6.3~~	10.18		1.39
K	–	0.34	~~0.64~~	0.64	–	~~0.64~~	0.96		~~1.58~~ (1.58)
Hε	8.01	4.52	8.61	8.31	1.77	8.30	10.25	~~7.12 for Hε~~	~~1.44~~ 1.44
Hδ	5.81	4.04	7.66	6.7	1.46	8.7	10.17		1.70
Hγ	5.02	3.37	6.42	5.72	1.48	9.70	10.26		1.64
Hβ	4.03	2.32	4.40	4.21	1.74	~~10.46~~	10.01		1.44
					9.14			Σ	10.35
					1.82			mean	1.48

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Line intensity in Å %

α Canis Majoris. Data from H.R. 28. Line int.

	φ	dm	dl	Reduced int.
	35			
	30	.12	.10	
	25	.30	.24	
	20	.56	.40	
Hβ	15	1.02	.60	
	10	.67	.46	
	5	.31	.25	
	0	.13	.11	
	-5	Σdl =	2.16	10.80
	-10			
	-15			
	-20	.28	.23	
	-25	.45	.34	
	-30	.80	.52	
Hγ	-35	1.38	.72	
	-40	.83	.53	
	-45	.43	.33	
		.27	.22	
		Σdl =	2.89	13.00
		.12	.10	
		.20	.17	
		.42	.32	
		.60	.42	
		.98	.59	
Hδ		1.45	.74	
		1.04	.62	
		.61	.43	
		.43	.33	
		.24	.20	16.48
		.12	.10	Σdl = 4.02

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	dm	
	.25	.21
	.42	.32
	.66	.46
	.86	.55
He	1.47	.74
	1.10	.64
	.70	.48
	.47	.35
	.33	.26
	.23	.19
	4.21	13.47

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70 ap. 3

δ Cassiopeiae. Data from HR 28

		dm	dl	Reduced int.
Hδ	50			
	45	.32	.25	
	40	.42	.32	
	35	.72	.48	
Hε	30	1.49	.75	
	25	.72	.48	
	20	.34	.27	
	15	.13	.11	
	10		2.16	13.30
	5	.31	.25	
	0	.45	.34	
	-5	.81	.53	
	-10	1.46	.74	
	-15	.84	.54	
Hζ	-20	.55	.40	
	-25	.32	.26	
	-30		3.06	13.77
	-35			
	-40	.34	.27	
	-45	.54	.39	
	-50	.88	.56	
Hη		1.54	.76	
		.86	.55	
		.53	.39	
		.33	.26	
			3.18	13.04

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dm	dl
.84	.54
1.37	.72
2.15	.86
1.37	.72
.84	.54
3.38	

10.81 ?

doubtful.

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Measures of line depth (m) and distance from darkness (m+n) for

line		1 prism m	1 prism m+n	1 prism w	1 prism w red	2 prisms m	2 prisms m+n	2 prisms w	2 prisms w red
1	75	12	15			11	17		
2	70	15	18			17	23		
3	65	17	21			17	27		
4	60	22	24			24	29		
5	55	20	25			21	34		
6	50	25	31			29	38		
7	45	30	34			27	39		
8	40	33	37			32	41	.6	3.0
9	35	29	38			25	43	.8	4.0
10	30	36	40			39	44		
11	25	33	40			34	46		
12	20	37	41			33	46		
13	15	31	47			29	47		
14	10	34	44			36	48		
15	5	35	44			37	48		
16	0	37	44			47	50		
17	-5	39	44			46	50		
18	-10	43	45			46	51		
19	-15	40	46			40	52		
20	-20	46	48			49	53		
21	-25	44	49			43	54		
22	-30	44	50			42	55		
23	-35	57	66			63	75		
24	-40	—	—			68	76		
25	-45	—	—			68	76		
26	-50	58	68			65	76		
27	-55	—	—			72	77		
28	-60	63	68			70	77		
29		66	69			72	78	.6	3.0
30		63	69			70	78		

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spectra of α Orionis made with 1,2,3, and 4 prisms, measured in centimeters

3 prisms m	mtn	ω	$ω_{red}$	4 prisms m	mtn	ω	$ω_{red}$
–	–	–	–	–	–		
–	–	–	–	–	–		
–	–	–	–	–	–		
–	–	–	–	–	–		
–	–	–	–	–	–		
–	–	–	–	–	–		
–	–	–	–	–	–		
–	–	–	–	–	–		
–	–	–	–	–	–		
–	–	–	–	–	–		
–	–	–	–	–	–		
–	–			–	–		
–	–			–	–		
–	–			–	–		
–	–			–	–		
–	–			–	–		
–	–			–	–		
–	–			–	–		
–	–			–	–		
–	–			–	–		
–	–			–	–		
2	21			–	–		
10	26			–	–		
15	26			–			
16	28			–	–		
11	28			–	–		
24	30			–	–		
20	31			–	–		
28	32			–	–		
21	35			–	–		
				–	–		

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74 ap. 4

α Orionis

K

		1 prism m	1 prism m+n	1 prism w	1 prism w red	2 prism m	2 prism m+n	2 prism w	2 prism w red
31	40	63	70			71	78		
32	35	62	70			71	79		
33	30	63	71			71	79		
34	25	64	71			70	79		
35	20	61	71			70	79		
36	15	66	71			64	80		
37	10	65	72			73	80		
38	5	—	—			74	80		
39	0	68	73			73	81		
40	−5	—	—			77	81		
41	−10	—	—			77	81		
42	−15	70	74			79	81		
43	−20	69	74			74	82		
44	−25	71	75			76	82		
45	−30	70	75			77	82		
46	−35	73	75			81	83		
47	−40	71	75			77	83		
48		68	76			74	83		
49		73	77			78	83	.5	
50		—	—			80	84		
51		—	—			79	84		
52		72	79			78	84		
53		71	79			81	84		
54		76	80			81	85		
55		75	80			80	85		
56		73	80			78	85		
57		70	81			75	86		
58		—	—			76	86		
59		—	—			83	86		
60		81	82			85	86		

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3 prism m	3 prism m+2	4 prism m	4 prism m+2	3 Prism wed	3 Prism wed
20	35	—	—		
21	36	—	—		
14	36	—	—		
21	36	20	24		
21	37	21	25		
15	38	15	25		
26	39	22	26		
29	39	23	27		
28	39	24	27		
34	40	—	—		
32	40	25	27		
31	40	25	28		
29	41	23	28		
33	42	25	28		
34	42	25	28		
40	43	27	29		
35	44	26	29		
31	45	25	30		
37	46	26	30		
44	47	28	31		
38	48	28	31		
38	48	27	31		
36	48	26	31		
42	49	28	31		
—	—	—	—		
37	50	26	31		
33	51	26	31		
38	52	27	31		
50	53	29	31		
53	54	31	32		

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76 ~~Aph~~ α Orionis

H	Σ	1 prism m	1 prism m+n	1 prism w	1 prism w red	2 prism m	2 prism m+n	2 prism w	2 prism w red
61	70	—	—			84	86		
62	65	79	83			88	87		
63	60	80	83			85	87		
64	55	—	—			84	87		
65	50	79	84			82	86		
66	45	—	—			85	86	.4	
67	40	79	84			82	86	.8	
68	35	79	84			83	86		
69	30	—	—			84	86		
70	25	—	—			—	—		
71	20	77	84			—	—		
72	15	—	—			—	—		
73	10	81	85			—	—		
74	5	—	—			—	—		
75	0	80	85			—	—		
76	-5	78	86			—	—		
77	-10	80	86			—	—		
78	-15	80	86			—	—		
79	-20	75	87			—	—		
80	-25	84	87			—	—		
81	-30	—	—			—	—		
82	-35	—	—			—	—		
83	-40	79	87			—	—		
84	-45	—	—			—	—		
85	-50	—	—			—	—		
86	-55	78	87			—	—		
87	-60	—	—			—	—		
88	-65	—	—			—	—		
89	-70	—	—			—	—		
90	-75	—	—			—	—		
	-80								

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3 prism				4 prism			
m	m+n	w	w_{red}	m	m+n	w	w_{red}
50	54			31	32		
47	55			30	32		
51	56			31	32		
48	56			31	32		
44	57			30	32		
52	58			31	32		
48	58			30	33		
46	58			31	33		
51	58			—	—		
51	58			—	—		
49	58			32	33		
53	58			—	—		
48	57			32	33		
49	57			—	—		
46	57			31	33		
42	56			30	34		
47	56			33	34		
46	56			33	34		
36	57			29	34		
49	56			33	34		
54	56			—	—		
44	56			31	34		
41	56			31	34		
46	56			—	—		
46	56			—	—		
38	56			—	—		
39	56			—	—		
42	56			—	—		
47	56			—	—		
44	56			—	—		

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78 ~~Ap 4~~ α Orionis

		1 prism				2 prism			
~~H δ~~		m	m+n	w	w_{red}	m	m+n	w	w_{red}
91	45	78	87			—	—		
92	40	—	—						
93	35	—	—			—	—		
94	30	80	87			—	—		
95	25	81	87			—	—		
96	20	—	—			—	—		
97	15	—	—			—	—		
98	10	—	—			—	—		
99	5	—	—			—	—		
100	0	—	—			—	—		
101	−5	—	—			—	—		
102	−10	86	87			—	—		
103	−15	~~8~~	—			—	—		
104	−20	85	87			—	—		
105	−25	85	88			—	—		
106	−30	—	—			—	—		
107	−35	81	88			—	—		
108	−40	—	—			—	—		
109		80	88			87	88		
110		—	—			—	—		
111		—	—			—	—		
112		—	—			—	—		
113		—	—			—	—		
114		79	88			—	—		
115		79	88			85	82		
116		—	—			—	—		
117		—	—			—	—		
118		—	—			—	—		
119		—	—			—	—		
120		—	—			—	—		

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3 prism				4 prism			
m	m+n	w	w_{red}	m	m+n	w	w_{red}
41	56			—	—		
41	56			—	—		
44	56			—	—		
43	56			—	—		
43	56			—	—		
50	56			—	—		
46	56			—	—		
47	55			—	—		
49	55			—	—		
46	55			—	—		
51	55			—	—		
53	55			—	—		
52	55			—	—		
51	55			—	—		
51	55			—	—		
44	55			—	—		
41	55			31	34		
41	54			32	34		
39	54			31	34		
42	54			—	—		
42	53			32	34		
42	53			—	—		
38	53			—	—		
37	53			30	34		
36	53			31	34		
38	53			32	34		
41	53			33	34		
44	52			33	34		
45	52			—	—		
42	52			—	—		

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80 ~~ep. 4~~ α Orionis

Hg		1 prism m	1 prism m+n	1 prism w	1 prism w_{red}	2 prism m	2 prism m+n	2 prism w	2 prism w_{red}	
121	60	81	88			87	92			
122	45	—	—			87	92			
123	40					—	—			
124	35	82	88			—	—			
125	30	—	—							
126	25	—	—			78	82			
127	20	—	—			80	82			
128	15	83	88			~~79~~	~~82~~			
129	10	—	—			79	82	5		2.5
130	5	—	—			—	—			
131	0	81	88			77	82			
132	-5	—	—			80	82			
133	-10	—	—			—	—			
134	-15	—	—			—	—			
135	-20	75	88			71	82			
136	-25	75	88			71	82			
137	-30	—	—			—	—			
138	-35	—	—			76	82			
139	-40	—	—			—	—			
140	-45	—	—			77	82			
141		—	—			—	—			
142		—	—			76	82			
143		—	—			68	82	7		3.5
144		—	—			—	—			
145		—	—			—	—			
146		—	—			—	—			
147		—	—			75	82			
148		—	—			70	82			
149		—	—			79	82			
150		—	—			71	82			

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3 param

m	m+n	W	W_{100}
39	52		
40	52		
42	51		
39	51		
38	51		
42	50		
47	50		
40	50		
41	50		
49	50		
33	49		
40	49		
43	49		
45	49		
25	49		
35	49		
34	49		
33	49		
34	49		
31	49		
39	49		
32	48		
16	48		
29	48		
29	48		
27	48		
24	48		
20	48		
30	48		
33	47		

4 param

m	m+n	W	W_{100}
31	34		
32	34		
—	—		
31	34		
—	—		
33	35		
—	—		
31	35		
—	—		
—	—		
31	35		
33	35		
—	—		
—	—		
29	35		
28	35		
—	—		
30	35		
33	35		
31	35		
—	—		
31	35		
22	35		
31	35		
—	—		
—	—		
29	35		
29	35		
32	35		
33	35		

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82 ~~ABM~~ ~~WBM~~ WBM32

α Orionis

HB	m	m+n	w	w_{red}	m	m+n	w	w_{red}
151	50	—	—		—	—		
152	45	—	—		—	—		
153	40	—	—		77	82		
154	35	—	—		78	82		
155	30	—	—		77	82		
156	25	—	—		—	—		
157	20	—	—		70	82	7	3.5
158	15	—	—		71	81	6.5	3.2
159	10	—	—		—	—		
160	5	—	—		76	81		
161	0	—	—		68	81	7	3.5
162	-5	—	—		77	81		
163	-10	—	—		69	81		
164	-15	—	—		69	80		
165	-20	—	—		58	80		
166	-25	—	—		63	80		
167	-30	—	—		63	80		
168	-35	—	—		72	80		
169	-40	—	—		74	80		
170	-45	—	—		74	80		
171	-50	—	—		61	80	7	3.5
172		—	—		57	79		
173		—	—		58	79		
174		—	—		↓	↓		
175		—	—		—	—		
176		—	—		67	79		
177		—	—		—	—		
178		—	—		67	79		
179		—	—		—	—		
180		—	—		63	79	7	3.5

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3 prism				4 prism			
m	m+n	w	$w_{red.}$	m	m+n	w	w_{red}
32	47			31	35		
34	47			—	—		
31	47			32	35		
38	49			33	35		
37	49			31	35		
25	48			32	34		
21	48	13	4.3	26	34		
24	48	8.5	2.8	26	34		
39	47			33	34		
38	47			33	34		
19	46	13	4.3	24	34		
38	45			31	34		
18	44			27	34		
16	44			28	34		
6	43			19	34		
11	42			24	34		
12	42			—	—		
21	42			30	34		
21	42			30	34		
28	41			31	34		
9	40	13	4.3	24	34		
30	40			—	—		
7	39			—	—		
19	39			—	—		
16	38			—	—		
15	38			—	—		
17	38			—	—		
15	38			—	—		
17	37			—	—		
10	36	15	5.0	—	—		

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1924phae.proj.11017

84 α Orionis

	1 prism				2 prism			
	m	m±n	w	w_red	m	m±n	w	w_red
181	—	—						
182	—	—			52	78		
183	—	—			66	78	5	
184	—	—			64	78		
185	—	—			68	78		
186	44	60			41	78		
187	—	—			71	78		
188	51	63	5	5.0	53	77	6	3.0
189	—	—			—	—		
190	61	67			68	77		
191	—	—			—	—		
192	—	—			—	—		
193	—	—			—	—		
194	—	—			—	—		
195	58	68			65	77		
196	—	—			67	76		
197	56	68	4	4.0	56	76		
198	63	68			63	76		
199	—	—			67	76		
200	44	68	4.5	4.5	41	76		
201	—	—			57	75		
202	—	—			73	75		
203	—	—			73	75		
204	63	68			66	75		
205	50	68	4	4.0	48	74	6	3.0
206	—	—			—	—		
207	61	67			63	73		
208	55	67			52	72		
209	—	—			—	—		
210	43	66			37	71		
211	—	—			48	70		

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3 prism				4 prism			
m	m+n	w	Wvd.	m	m+n	w	Wvd
19	35			~~22~~	~~32~~		
15	34	11		—	—		
13	33			—	—		
7	32			20	32		
2	31			13	33		
19	31			30	33		
6	30	13	4.5	16	34	14	3.6
21	29			30	34		
16	29			30	34		
28	29			32	34		
26	28			33	34		
25	28			32	34		
19	28			30	34		
13	28			28	34		
20	27			31	34		
6	26			20	35	12	3.0
—	—			22	35		
—	—			26	35		
—	—			11	35	7.5	1.9
—	—			18	35	(18 over 20)	(4.5)
—	—			31	30		
—	—			30	34		
—	—			26	34		
—	—			12	34	10	2.5
—	—			29	34		
—	—			26	33		
—	—			17	33		
—	—			18	32		
—	—			14	32		
—	—			16	31		

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δ Orionis

	1 prism				2 prism			
	m	m+n	w	w adj	m	m+n	w	w adj
212	—	—			—	—		
213	39	65			31	69		
174	—	—			—	—		
215	—	—			—	—		
216	55	65			51	68		
217	33	64			27	67		
218	—	—			58	66		
219	53	64			60	65		
220	40	63	7	7.0	—	—		
221	48	62			—	—		
222	43	61			—	—		
223	45	61			—	—		
224	49	61			—	—		
225	47	60			—	—		
226	39	60			—	—		
227	21	60			—	—		
228	35	59			—	—		
229	50	58			—	—		
230	38	58			—	—		
231	44	57			—	—		
232	46	56			—	—		
233	30	55			26	61		
234	46	55			31	60		
235	48	55			37	49		
236	38	54			22	48		
237	30	53	6.0	6.0	15	46	6.0	3.0
238	34	53			20	44		
239	36	52			22	43		
240	40	51			25	42		
241	35	51	4.0	4.0	19	41		
242	23	50	6.0	6.0	9	40	9.0	4.5

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3 Prism

m	m+n	W	W red
—	—		
—	—		
—	—		
5	13		
−1	13		
4	13		
—	—		
1	13	28	9.0
3	13		
1	13		
1	13		
2	13		
3	13		
1	11		
−1	10		
0	8		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		

4 Prism

m	m+n	W	W red
10	31		
22	31		
—	—		
19	31		
7	31		
19	30		
19	30		
11	29	22 (over 220a)	5.5
16	28		
9	27		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
—	—		
16	25		
7	24	8.5	2.1
4	24	14.5	3.6
6	23		
8	22		
10	21		
8	21		
3	20	16.0	4.0

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α Orionis

	1 Prism				2 Prism			
	m	m+n	w	w red	m	m+n	w	w red
243	41	50			23	39		
244	46	50	4.0		29	89	4.0	2.0
245	40	49			25	37		
246	37	48	2.5		20	37	4.5	2.2
247	18	48	6.0		6	36	10	5.0
248	31	46	3.0		14	34	5.5	2.7
249	37	45	3.0		18	33	4.0	2.0
250	27	45	4.0		7	33	6.5	3.2
251	33	44			14	31		
252	32	43			14	30		
253	22	41			6	28		
254	32	40			16	27		
255	16	38			3	26		
256	18	38			7	25		
257	—	—			18	24		
258	24	36			8	23		
259	—	—			6	22		
260	—	—			15	22		
261	33	34			15	21		
262	25	33			10	19		
263	25	32			9	19		
264	22	31			10	17		
265	22	31			9	16		
266	17	29			—	—		
267	18	25			—	—		
268	12	23			—	—		
269	13	21			—	—		
270	0	19			—	—		
271	0	9			—	—		

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3 Prism
minimum

4 Prism
minimum

9	19		
10	19	9.5	2.4
11	19		
6	18	9.0	2.2
2	17	24	6.0
4	16	14.5	3.6
6	15	8.5	2.1
3	14	13.5	3.4
9	14		
4	13		
1	12		
6	11		

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Measures of C6045 α Cassiopeiae in attempt to analyze the weaker lines

l	m	n	m-n	Δm from H.R 28	
4861	L1	4.8	5.9	.25	.24
4444		6.8	7.5	.31	
4340		✓ 5.7	7.1	.42	.35
4227		✓ 2.3	6.8	.83	.94
4215		✓ 3.5	6.7	.71	.69
4101		? 4.1	6.1	.56	.42
3970		✓ 0.0	3.3	2.5	
3933		✓ 0.0	2.0	2.5	

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α Cassiopeiae c 6045

	Line		m	m+n	log n	mag m+n	Δm	w	dl	dw	
1	3930	Cat	0	19	-	126					31
2	3953	Fe	13	24	-	100		5			32
3	3970	Cat	0	33	-	80					33
4			27	41	92	67	.25		.21		34
5			27	42	92	65	.27		.22		35
6			34	43	79	63	.16		.14		36
7			33	46	80	58	.22		.18		37
8			37	47	74	56	.18		.15		38
9			35	50	77	50	.27		.22		39
10			48	52	54	46	.08		.07		40
11	4005	Fe	30	53	86	44	.42		.32		41
12			45	53	60	40	.20		.17		42
13			48	56	54	38	.16		.14		43
14			46	57	58	35	.23		.19		44
15			50	58	50	33	.17		.14		45
16			48	59	54	30	.24		.20		46
17			45	60	60	28	.22		.18		47
18	4028	Ti+	39	61	70	26	.44		.33		48
19	4031	Mn	36	61	75	26	.49		.36		49
20	4041	Fe Mn	50	61	50	26	.24		.20		50
21	4046	Fe+	19	61	126	26	1.00	7	.60		51
22	4050	(Fe)	52	61	46	26	.20		.17		52
23	4055	Fe+	44	61	61	26	.35		.27		53
24	4057.9	Fe	41	61	67	26	.41		.31		54
25	4064	Fe	25	62	98	24	.74	5	.49		55
26	4067	Fe+ Fe	44	62	61	24	.37	4	.29		56
27	4069		38	62	72	24	.48	5	.36		57
28	4072	Fe	30	62	86	24	.62	9	.44		58
29	4076	Fe	54	62	42	24	.18		.15		59
30	4077	Sr+	51	62	48	24	.24		.20		60

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α Cassiopeae ε 6045

	line		n	m+n	log n	Mag m+n	Δm	dl
31	4079	Fe	37	61	74	26	.48	.36
32			54	61	42	26	.16	.14
33	4092	Fe,V	49	61	52	26	.26	.21
34	4101	H,Fe	41	61	67	26	.41	.31
35	4112	[illegible]	49	61	52	26	.26	.21
36	4113	Fe	49	62	52	24	.28	.23
37	4119	Fe	44	62	61	24	.37	.29
38	4123	Fe	47	62	56	24	.32	.26
39	4126		52	62	46	24	.22	.18
40	4128	Fe,V	49	62	52	24	.28	.23
41	4129		48	62	54	24	.30	.24
42	4132	Fe	41	63	67	21	.46	.35
43	4134	Fe,Fe	44	63	61	21	.40	.31
44	4140	Fe	51	63	48	21	.27	.22
45	4144	Fe	26	63	95	21	.74	.49
46	~~4148?~~	?	49	64	52	19	.33	.26
47	4150	Fe	39	64	70	19	.51	.37
48	4152	Fe	39	64	70	19	.51	.37
49	4154	Fe	42	64	65	19	.46	.34
50	4156	Fe	37	64	74	19	.55	.40
51	~~4162~~	?	48	64	54	19	.35	.28
52	4165	Fe	47	64	56	19	.37	.29
53	4167	Mg	42	65	65	16	.49	.36
54	4172	Ti+ Fe	34	65	79	16	.63	.44
55	4178	Fe,Sr+	39	65	70	16	.54	.39
56	4179	Fe+	42	65	65	16	.49	.36
57	4182	Fe	44	65	61	16	.45	.34
58	4187	Fe	49	64	52	14	.38	.29
59	4192	Fe	37	66	74	14	.60	.42
60	—		42	66	65	14	.51	.37

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α Cassiopeiae — C 6045

	Line		n	m+n	log n	Mag m+n	Δ m	dl	
61	4202	Fe	43	66	63	14	.49	.36	91
62	4205	-	47	66	56	14	.42	.32	92
63	4210	Fe	53	67	44	11	.33	.26	93
64	4215	Sr+	35	67	77	11	.66	.46	94
65	4221	Fe	~~66~~	67	16	11	.05	.04	95
66	4227	Ca	22	67	107	11	.96	.59	96
67	4234	Fe+Fe	57	68	35	09	.26	.21	97
68	4236	Fe	56	68	38	09	.29	.23	98
69	4244	Fe	64	68	19	09	.10	.09	99
70	4247	Fe	66	68	14	09	.05	.04	100
71	4249	-	61	69	26	06	.20	.17	101
72	4251	Fe	56	69	38	06	.32	.26	102
73	4255	Fe	57	69	35	06	.29	.23	103
74	4260	Fe+	54	69	42	06	.36	.28	104
75	4264	Fe	68	70	09	04	.05	.04	105
76	4272	Fe+	46	70	58	04	.54	.39	106
77	4275	Cr	56	70	38	04	.34	.27	107
78	4280	-	61	71	26	00	.26	.21	108
79	4283	Fe Ca	60	71	28	00	.28	.23	109
80	4290	Cr Ti+	53	71	44	00	.44	.33	110
81	4292	Ti?	63	72	21	-04*	.25	.21	111
82	4300	Ti Ti+	44	72	61	-04*	.65	.45	112
83	4303	Fe+	53	72	44	-04*	.48	.36	113
84	4308	Fe+Ti+Ca	42	72	65	-04*	.69	.47	114
85	4315	Fe+Ti	62	73	24	-08*	.32	.26	115
86	4321	Ti+	69	73	06	-08*	.14	.12	116
87	4326	Fe+ Fe	49	73	52	-08*	.60	.42	117
88	4331	Ti+, V	65	70	16	04	.12	.10	118
89	4333	V	67	70	11	04	.07	.06	119
90	4340	H	56	70	3[illegible]	0[illegible]	.34	.27	120

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α Cassiopeiae ε 6045-

	Line		n	m+n	log n	Mag n+m	Δm	dl
91	4345	Ti+	66	70	14	04	.10	.09
92	4348	Fe	66	70	14	04	.10	.09
93	4352	Mg Fe+	59	70	30	04	.26	.21
94	4355	Ca	66	70	14	04	.10	.09
95	4360	Cr	64	71	19	.00	.19	.16
96	4363	Cr	69	71	06	00	.06	.05
97	4367	Fe+ Ti+	65	71	16	00	.16	.14
98	4375	Ti+	61	71	26	00	.26	.21
99	4379	V	68	72	09	-06	.15	.13
100	4383	Fe+ Fe	45	72	60	-06	.66	.46
101	4395	V, Ti+	64	72	19	-06	.25	.21
102			66	72	14	-06	.20	.17
103	4402	Fe	66	72	14	-06	.20	.17
104	4405	Fe+	59	72	30	-06	.36	.28
105	4408	Fe Fe	64	72	19	-06	.25	.21
106	4415	Fe+	65	75	16	-12	.28	.23
107	4423	Fe	67	73	11	-12	.23	.19
108	4435	Ca Fe	68	73	09	-12	.21	.18
109	4435	Ca Fe	66	74	14	-18	.32	.26
110	4444	Ti+	68	74	09	-18	.27	.22
111			71	74	00	-18	.18	.15
112	4453	Ca	69	75	06	-23	.29	.23
113	4462	Fe	67	75	11	-23	.34	.27
114			70	75	04	-23	.27	.22
115	4482	Fe	70	75	04	-23	.27	.22
116	4490	Fe	70	75	04	-23	.27	.22
117								
118								
119								
120								

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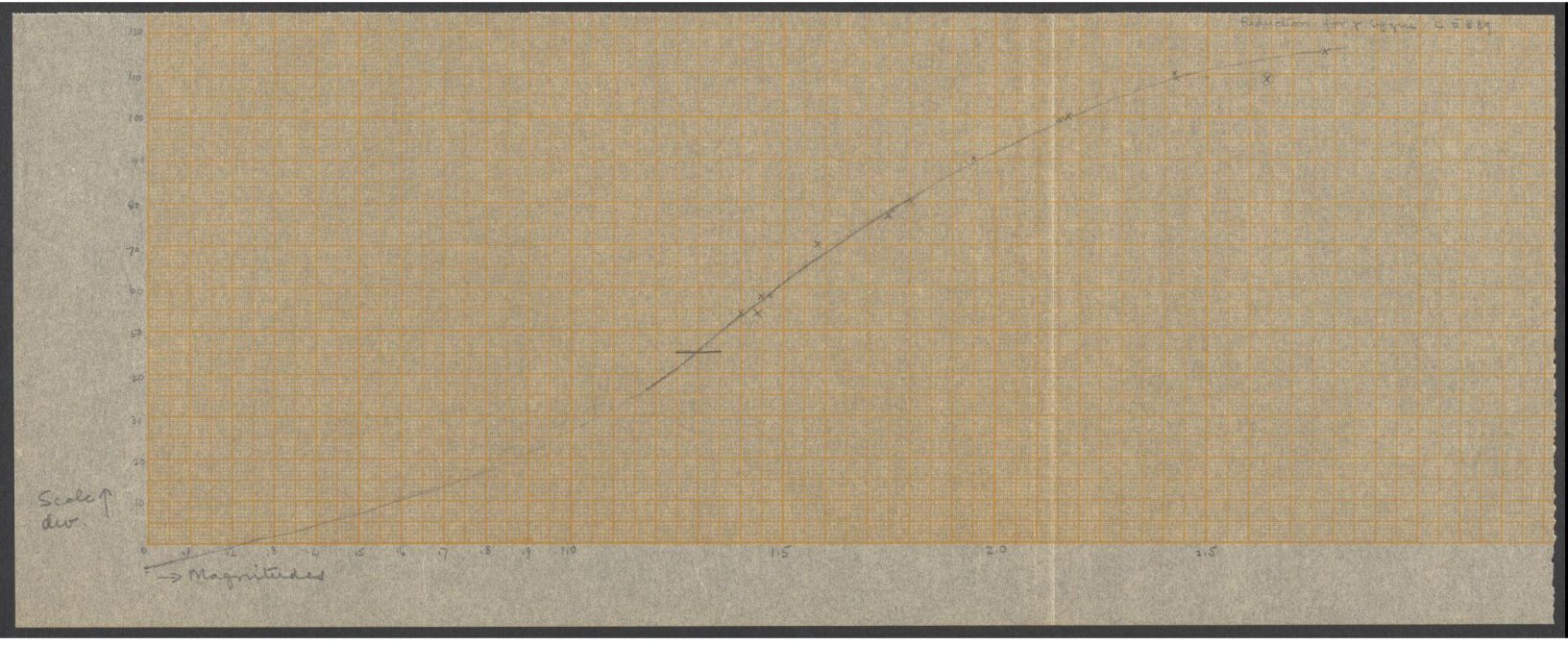
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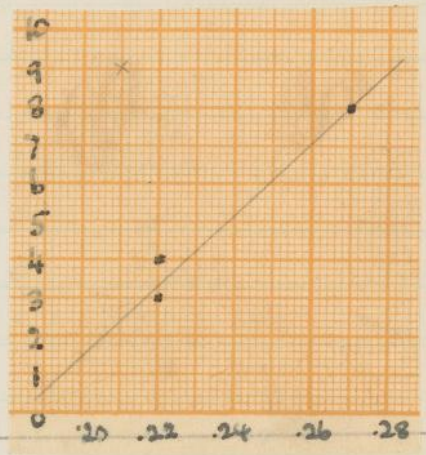


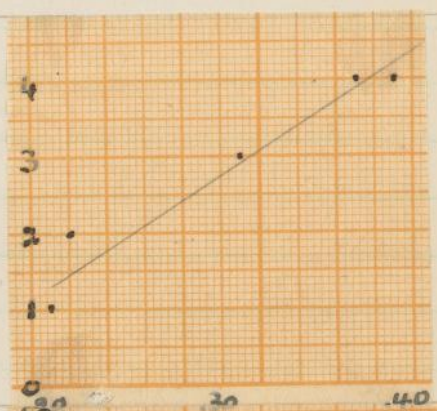
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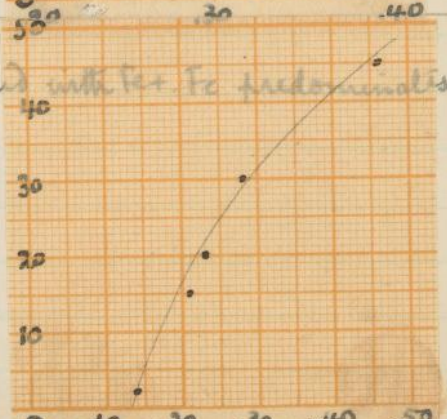
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α Cassiopeiae. Residual intensities for known

Iron	Series	E.P.	Int.	dl	
4489.74	$^5D-^7F'$	0.0	3	.22	
4482.18			4	.22	
4461.65			8	.27	
4445.43			(1)	-	
4427.31			10	?	
4375.93			9	.21	
4347.24			(1)	-	
4291.47	$^5D-^7P'$	0.0	4	-	
4258.38			2	-	
4232.72			1	-	
4216.18			8	-	blend with Sr+
4206.70			3	-	
4199.98			1		
4134.34			(1)		
4239.85	$^5F-^3F'$	0.94	2	-	
4177.60			4	.39	
4152.18			4	.37	
4139.93			2	.22	
4100.75			3	.31	
4092.51			(1)	.21	
4415.13	$^3F-^5D'$	1.54	20	.23	Blend with Fe+, Fe predominates.
4404.75			30	.28	
4383.55			45n	.46	
4367.91			2	.14	
4337.05			10	<.27	
4294.13			15	.21?	
4291.47			4	-	
4249.75			(1)	-	





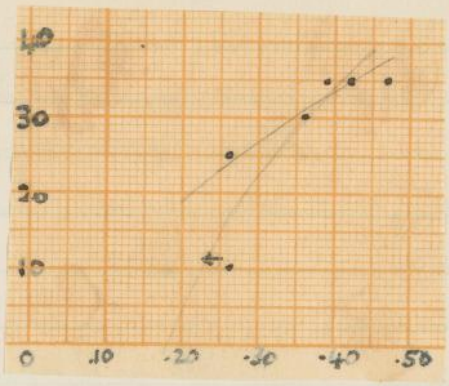


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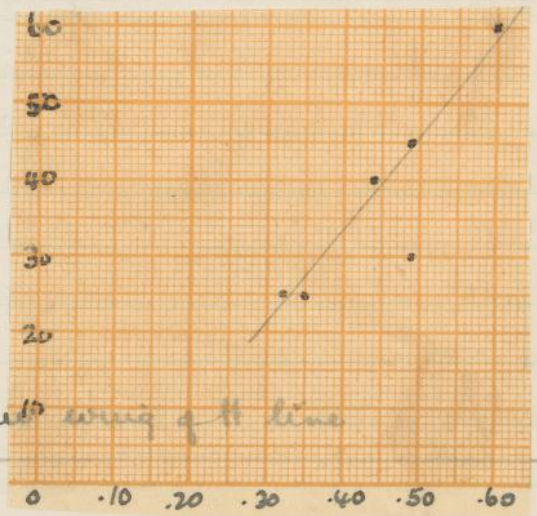
lines, 3933 up

line	Series	EP.	Int.	dl
4325.77	$1^3F-1^3G'$	1.54	35	.42
4307.91			35	.47
4271.76			35	.39
4250.79			25	.26
4202.03			30	.36
4147.68			10	.26



Blend with Mn + Unknown line.

4143.87	$1^3F-2^3F'$	1.54	30	.49
4132.06			25	.35
4071.75			40	.44
4063.60			45	.49
4045.82			bon	.60
4005.25			25	.32
3969.26			30	—



Lot wing of H line

—

4494.57	$1^5P-3^5D'$	2.14	12	(.20)
4482.26			6	.22
4469.13			10	—
4447.73			9	—
4442.35			12	—
4430.62			6	—
4408.42			6	—
4407.72			5	—

see $1^5D-1^7F'$

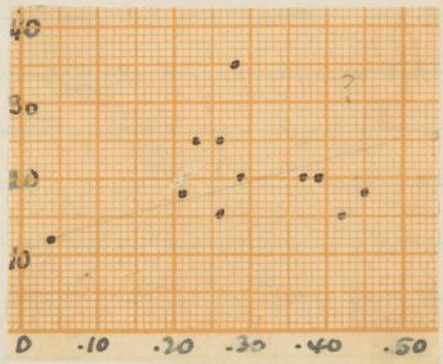
4352.74	$1^5P-1^5S'$	2.14	9	.21
4315.09			10	.26
4282.41			12	.23

Int G band. depth probably increased by this

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Iron. Line	Series	EP.	Int.	dl	
4299.25	~~1P~~ 1F'-1m³D	2.46	18	.45	In G band. Plate doubled.
4271.17			20	.39	
4260.49			35	.28	
4250.13			25	.26	
4235.95			25	.23	
4233.61			18	.21	
4222.23			12	.04	
4210.36			15	.26	
4198.31			20	.37	slope doubtful.
4191.45			15	.42	
4187.81			20	.29	
4187.05			20		
Ionized Iron					
4369.41	2⁴P-1⁴F'	2.68	..	..	
4296.56			(6)	.21?	
4258.16			..	..	
4178.87			(6)	.39	
4416.81	2⁴P-1⁴D'	2.68	(4)	.23	Blend with Fe which predominates
4385.39			..	..	
4351.77			(6)	.21	
4303.18			(4)	.36	in G band, probably doubled, in depth by Kio
4233.16			(6)	.21	
4173.48			(6)	..	
4128.74			..	..	



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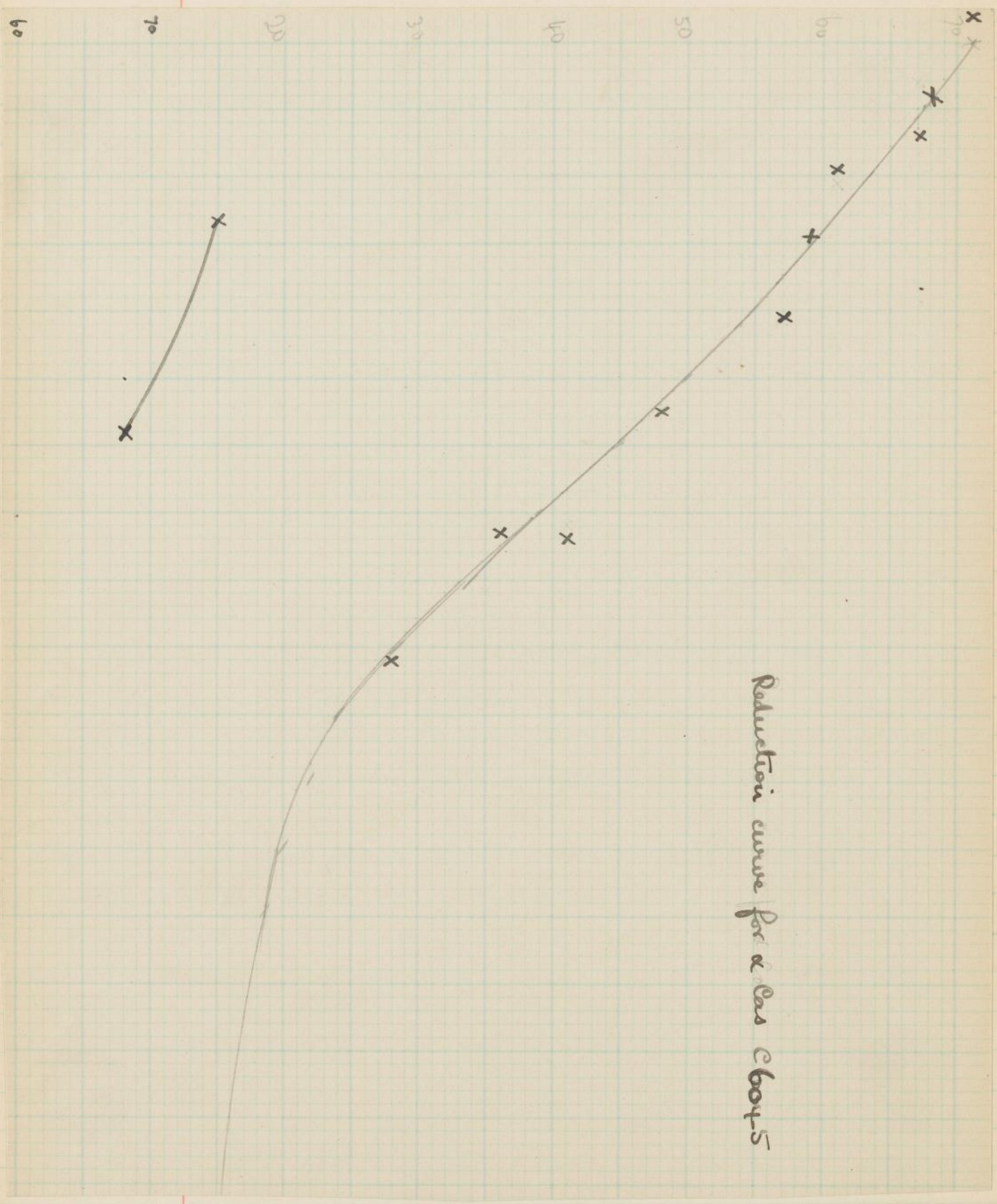
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From Fe for α Cas, it appears that Fe lines corresponding to more abundant atoms are centrally blacker. This would suggest higher effective level.

Nothing can be asserted about lines of other elements.

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Reduction table for α Cas C6045

71	0.0				
70	0.4	50	5.0	30	8.6
69	0.6	49	5.2	29	8.8
68	0.9	48	5.4	28	9.0
67	1.1	47	5.6	27	9.2
66	1.4	46	5.8	26	9.5
65	1.6	45	6.0	25	9.8
64	1.9	44	6.1	24	10.0
63	2.1	43	6.3	23	10.4
62	2.4	42	6.5	22	10.7
61	2.6	41	6.7	21	11.1
60	2.8	40	6.8	20	11.7
59	3.0	39	7.0		
58	3.3	38	7.2	75	-2.3
57	3.5	37	7.4	74	-1.8
56	3.8	36	7.5	73	-1.2
55	4.0	35	7.7	72	-0.6
54	4.2	34	7.9	71	0.0
53	4.4	33	8.0		
52	4.6	32	8.2		
51	4.8	31	8.4		
50	5.0	30	8.6		

Copy onto p. 105

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C 5889 γ Cygni 2 prisms.

	Line	Str.	Series	n	m+n	[n]	[m+n]	Δλ	dl	Chromo Nr	No.
1	3933			-6	54	*[0]	1.41	[1.41]	.73	14000	31
2	3945			~~26~~	61	[1.00]	1.50	[50]	.37	2000	32
3	3952			~~25~~	63	[0.98]	1.52	[54]	.39	600	33
4	3956			35	65	[1.16]	1.55	[39]	.30	800	34
5	3958			37	66	[1.19]	1.57	[38]	.30	800	35
6	3970			-7	70	[0]	1.63	[1.63]	.78	14000	36
7	3982			46	76	[1.31]	1.72	[41]	.32	800	37
8	3984			70	80	1.63	1.79	16	.14	650	38
9	3986			69	80	1.61	1.79	18	.15	500	39
10	3987			68	79	1.60	1.77	17	.15	600	40
11	3989			67	80	1.59	1.79	20	.17	600	41
12	3990			69	81	1.61	1.80	19	.16	600	42
13	3994			70	83	1.63	1.84	21	.18	500	43
14	3995			60	84	1.49	1.85	36	.28	550	44
15	3997			64	85	1.54	1.87	33	.24	600	45
16	4002-4			74	86	1.69	1.89	20	.17	500	46
17				74	86	1.69	1.89	20	.17		47
18	4005			59	87	1.48	1.91	43	.33	800	48
19	4012			82	91	1.82	1.99	17	.15	600	49
20	4014			82	91	1.82	1.99	17	.15	800	50
21	4018			85	93	1.87	2.03	16	.14	500	51
22	4022-3			84	95	1.85	2.07	22	.18	700	52
23	4028			73	97	1.67	2.11	44	.33	750	53
24	4030			90	98	1.97	2.14	37	.29	700	54
25	4031			68	99	1.60	2.16	56	.40	750	55
26	4033			74	99	1.69	2.16	47	.35	750	56
27	4035			82	98	1.82	2.14	32	.24	750	57
28	4036			90	98	1.97	2.14	17	.15	400	58
29	4041			84	99	1.85	2.16	31	.25	600	59
30	4046			70	98	1.63	2.14	51	.38	1000	60

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50 - 90
90 - 110
110 - 120

No.	Line	Int.	Series	m	mtn	[m]	[mtn]	Δm	dl	Chromo ht.
31	4048			90	99	1.97	2.16	19	.16	400
32	4050			89	99	1.95	2.16	21	.18	500
33	4052			90	99	1.97	2.16	19	.16	500
34	4054			80	99	1.79	2.16	39	.30	750
35	4057			93	99	2.03	2.16	13	.11	500
36	4059			93	99	2.03	2.16	13	.11	450
37				98	100	2.14	2.18	04	.04	400?
38	4064			76	100	1.72	2.18	46	.35	900
39	4067			85	100	1.87	2.18	31	.25	500
40	4072-4			85	100	1.87	2.18	31	.25	500
41	4078			54	100	1.41	2.18	77	.51	6000
42	4083			90	100	1.97	2.18	21	.18	500
43				91	101	1.99	2.21	22	.18	400
44	4085			86	101	1.89	2.21	32	.26	500
45	4087			86	101	1.89	2.21	32	.26	500
46				98	100	2.14	2.18	04	.04	
47	4092			97	100	2.11	2.18	07	.06	500
48	4093			97	100	2.11	2.18	07	.06	500
49				92	101	2.01	2.21	20	.17	
50	4098			87	101	1.91	2.21	30	.24	500
51	4101			54	100	1.41	2.18	77	.51	8000
52	4106			75	100	1.70	2.18	48	.36	450
53	4107			67	105	1.59	2.31	72 (34)	.48	450?
54	4109			90	105	1.97	2.31	32	.26	600
55	4111			99	105	2.16	2.31	15	.13	450
56	4113-15			103	105	2.25	2.31	06	.05	400
57	4119			88	106	1.93	2.34	41	.32	600
58	4123			88	107	1.93	2.37	44	.33	650
59	4128			78	107	1.76	2.37	61	.48	550
60	4132			86	108	1.89	2.40	51	.38	550

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No.	Line	Et.	Series	n	m+n	[n]	[m+n]	Δm	dl	Chr. wt.	No
61	4136			95	107	2.07	2.37	30	.24	~500	91
62	4139			99	108	2.16	2.40	24	.20	~400	92
63	4144			83	109	1.84	2.42	58	.41	~1000	93
64				103	109	2.25	2.42	17	.15		94
65	4149			96	109	2.09	2.42	33	.26	~600	95
66				102	109	2.23	2.42	19	.16		96
67	4155			94	109	2.05	2.42	37	.29	~500	97
68	4157			96	109	2.09	2.42	33	.26	~500	98
69	4162			93	110	2.03	2.46	43	.33	~650	99
70	4164			102	110	2.23	2.46	23	.19	~400	100
71	4166			105	110	2.31	2.46	15	.13	~400	101
72	4167			103	110	2.25	2.46	21	.18	~600	102
73	4172			76	110	1.72	2.46	74	.49	~1500	103
74	4177			79	110	1.77	2.46	69	.47	~1500	104
75	4182			97	110	2.11	2.46	35	.28	~600	105
76	4184			95	110	2.07	2.46	39	.30	~500	106
77	4188			91	110	1.99	2.46	47	.35	~600	107
78	4191			96	110	2.09	2.46	37	.29	~550	108
79	4196			86	110	1.89	2.46	57	.41	~500	109
80	4198			87	110	1.91	2.46	55	.40	~600	110
81	4202			93	110	2.03	2.46	43	.33	~600	111
82	4205			87	110	1.91	2.46	55	.40	~550	112
83	4209			100	110	2.18	2.46	27	.22	~550	113
84				103	110	2.25	2.46	21	.18		114
85	4215			90	109	1.97	2.42	45	.34	~6000	115
86	4219			105	110	2.31	2.46	15	.13	~400	116
87	4222			101	109	2.21	2.42	21	.18	~500	117
88	4225			91	110	1.99	2.46	47	.35	~500	118
89	4227			60	110	1.79	2.46	67	.46	~5000	119
90	4233			90	110	1.97	2.46	49	.36	~1000	120

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No.	Line.	St.	Series	w	w+w	[w]	[w+w]	Δm	dl	Chrom.
91	4236			98	111	2.14	2.50	36	.28	650
92	4239			100	111	2.18	2.50	32	.26	500
93	4243			106	111	2.34	2.50	16	.14	400
94	4243			93	111	2.03	2.50	47	.35	600
95	4247			100	110	2.18	2.50	32	.26	6000
96	4250			105	111	2.31	2.50	19	.16	700
97	4258			103	110	2.25	2.46	21	.18	400
98	4260			101	110	2.21	2.46	25	.21	600
99	4272			96	110	2.09	2.46	37	.29	800
100	4274			103	110	2.25	2.46	21	.18	500
101				107	110	2.37	2.46	09	.08	
102				108	109	2.34	2.42	08	.07	
103				106	110	2.34	2.46	12	.11	
104	4283			103	110	2.25	2.46	21	.18	700
105	4288			100	110	2.18	2.46	28	.23	600
106	4290			88	110	1.93	2.46	53	.39	1300
107	4294			101	110	2.21	2.46	25	.21	1200
108	4296			103	110	2.25	2.46	21	.18	600
109	4299			85	110	1.87	2.46	59	.42	1200
110	4300			88	110	1.93	2.46	53	.39	750
111	4306			101	110	2.21	2.46	25	.21	600
112	4308-9			100	110	2.18	2.46	28	.23	750
113	4315			91	110	1.99	2.46	47	.35	800
114				107	109	2.37	2.42	05	.05	400
115	4321			104	110	2.28	2.46	18	.15	500
116	4326			97	109	2.11	2.42	31	.25	900
117	4331			103	109	2.25	2.42	17	.15	600
118	4334			106	109	2.34	2.42	08	.07	500
119	4337			83	109	1.84	2.42	58	.41	900
120	4340			76	109	1.63	2.42	79	.52	8000

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No.	Line	St.	Series	n	m+n	[n]	[m+n]	Δm	dl	Chrom.	No
121	4344			99	109	2.16	2.42	26	.21	600	151
122				107	109	2.37	2.42	05	.05		152
123	4352			95	109	2.07	2.42	35	.28	600	153
124				106	109	2.34	2.42	08	.07		154
125	4359			101	108	2.21	2.40	19	.16	500	155
126				108	108	2.40	2.40	00?	0	350?	156
127	4367			101	108	2.21	2.40	19	.16	500	157
128	4375			101	115	2.21	2.72	51	.38	[illegible]	158
129	4384			114	116	2.65	2.80	25	.21	1600	159
130	4391			110	116	2.46	2.80	34	.27	500	160
131	4395			104	116	2.28	2.80	52	.38	2500	161
132	4400			101	116	2.21	2.80	59	.42	800	162
133	4405			112	116	2.55	2.80	25	.21	800	163
134	4408			107	116	2.37	2.80	43	.33	450	164
135	4415			104	116	2.28	2.80	52	.38	500	165
136	4416			~~108~~ ~~104~~	116	2.23	2.80	57	.41	500	166
137	4423			109	116	2.42	2.80	38	.30	500	167
138	4427			112	116	2.55	2.80	25	.21	600	168
139	4430			110	116	2.46	2.80	34	.27	450	169
140	4435			109	116	2.42	2.80	38	.30	600	170
141	4444			99	115	2.16	2.72	56	.40	1600	171
142	4450			110	116	2.46	2.80	34	.27	600	172
143	4455			108	116	2.40	2.80	40	.31	500	173
144				110	116	2.46	2.80	34	.27		174
145	4459			107	115	2.37	2.72	35	.28	450	175
146	4462			112	115	2.55	2.72	17	.15	500	176
147	4467			106	116	2.34	2.80	46	.35	1500	177
148				113	116	2.60	2.80	20	.17		178
149	4482			107	116	2.37	2.80	43	.33	500	179
150	4490			108	116	2.40	2.80	40	.31	450	180

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No.	Lwic. St.	Series	m	m+n	[m]	[m+n]	Δm	dl	
151	4495		111	116	2.50	2.80	30	.24	- 350
152	4501		111	116	2.50	2.80	30	.24	- 1600
153	4508		112	116	2.55	2.80	25	.21	- 600
154	4515		112	116	2.55	2.80	25	.21	- 600
155	4528		111	116	2.50	2.80	30	.24	
156	4534		110	116	2.46	2.80	34	.27	- 400
157			109	115	2.42	2.72	30	.24	- 1200
158			112	115	2.55	2.72	17	.15	
159	4541 4544		112	115	2.55	2.72	17	.15	- 400
160	4550		109	115	2.42	2.72	30	.24	- 1300
161	4554		107	114	2.37	2.65	28	.23	- 1200
162			112	114	2.55	2.65	10	.09	
163			113	115	2.60	2.72	12	.11	
164	4564		111	114	2.50	2.65	15	.13	1200
165	4572		~~113~~ 110	115	2.46	2.72	26	.21	1200
166	4576		113	115	2.60	2.72	12	.11	- 500
167	4581		110	114	2.46	2.65	19	.16	- 400
168	4584		107	114	2.37	2.65	28	.23	1100
169	4616		110	113	2.46	2.60	14	.12	- 400
170	4635		110	113	2.46	2.60	14	.12	- 500
171	4646		110	113	2.46	2.60	14	.12	- 600
172	4666		107	112	2.37	2.55	18	.15	- 400
173			110	113	2.46	2.60	14	.12	
174			110	114	2.46	2.65	19	.16	
175			111	114	2.50	2.65	15	.13	
176			110	114	2.46	2.65	19	.16	
177	4765		105	113	2.31	2.60	29	.23	800
178	4805		107	110	2.37	2.46	09	.08	- 400
179	4810		105	109	2.31	2.42	11	.10	
180	4824		102	109	2.23	2.42	19	.16	750

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No.	Lwie.	St. Series	n	m+n	[n]	[m+n]	Δm	dl	chw	No
181	4848		99	105	2.16	2.81	15	.13	350	210
182	4854		92	105	2.01	2.31	30	.24	350	212
183	4861		73	104	1.67	2.28	61	.43	8000	213
184	4871		94	103	2.05	2.25	20	.17	400	214
185	4876-8		97	102	2.12	2.23	11	.10	350	215
186	4883		93	101	2.03	2.21	18	.15	600	216
187	4890		92	101	2.01	2.21	20	.17	600	217
188	4900		93	99	2.03	2.16	13	.11	600	218
189	4903-4		95 90	99 97	2.07	2.16	09	.08	350	219
190	4924		↓	↓	1.96	2.12	16	.14	1000	220
191	4934		79	95	1.76	2.07	31	.25	750	221
192	?		81	95	1.81	2.07	26	.21		222
193	4946		91	94	1.98	2.05	07	.06	350	223
194			82	91	1.82	1.98	16	.14		224
195	4957		82	91	1.82	1.98	16	.14	500	225
196			86	89	1.89	1.95	16	.14		226
197			85	88	1.87	1.93	06	.05		227
198			86	88	1.89	1.93	04	.04		228
199			85	86	1.87	1.89	02	.02		229
200	4968-70?		77	85	1.72	1.87	15	.13	350	230
201			81	84	1.81	1.85	04	.04		
202			77	82	1.72	1.82	10	.09		
203			77	82	1.72	1.82	10	.09		
204			75	81	1.70	1.81	11	.10		
205			76	80	1.71	1.79	08	.07		
206			72	80	1.66	1.79	13	.11		
207	5018		58	77	1.46	1.72	26	.21	1200	
208			65	76	1.55	1.71	16	.14		
209			68	75	1.60	1.70	10	.09		
210			61	73	1.50	1.67	17	.15		

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No. Line of Series	m	m+n	[m]	[m+n]	Δm	dl	Chr
211	65	72	1.55	1.66	11	.09	
212	59	70	1.48	1.63	15	.13	
213	57	69	1.45	1.61	16	.14	
214	53	68	1.39	1.60	21	.18	
215	52	64	1.38	1.54	16	.14	
216	47	64	1.32	1.54	22	.18	
217	48	62	1.33	1.51	18	.15	
218	45	62	1.30	1.51	21	.18	
219	51	58	1.37	1.46	09	.08	
220	43	54	[1.27]	1.41	[14]	.12	
221	41	52	[1.25]	1.38	[13]	.11	
222	37	48	[1.19]	1.33	[14]	.12	
223	28	39	[1.04]	[1.22]	[18]	.15	
224	20	36	[0.88]	[1.18]	[30]	.24	
225	24	33	[0.96]	[1.13]	[17]	.15	
226	17	27	[0.80]	[1.11]	[31]	.25	
227	16	24	[0.78]	[0.95]	[17]	.15	
228	15	21	[0.75]	[0.90]	[15]	.13	
229	10	17	[0.60]	[0.80]	[20]	.17	
230	9	14	[0.57]	[0.71]	[14]	.12	

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Reduction curve for

C 5889 γ Cygni. From Plate C 18482

Present measure

Line	Δm	n	m+w	
4861	.68	73	104 ✓	8000
4444	.63	99	115 ✓	1600
4340	1.06	70	109 ✓	8000
4227	.62	80	110 ✓	5000
4215	.48	90	109 ✓	6000
4101	.77	54	100 ✓	8000
3970	1.58	−7	70 ✓	14000
3933	1.44	−6	54 ✓	14000
No. 207	.30	58	77 ✓	1200

γ Cygni. Residual Intensities for known lines

Iron	Series	E.P.	Int.	Δm	dl	Remarks
4489.74	$^1D-^7F'$	0.0	3	40	.31	Fe + $^2F-^4F'$, predominates
4482.18			4	43	.33	Fe $^1P-^3D'$, predominates
4461.65			8	* 17	.16	pure
4445.43			(1)	* –	–	not observed
4427.31			10	* 25	.21	Mg + $^2P-^4S$; Fe prob. predom.
4375.93			9	51	.38	Sc+, Unknown series, predom.
4367.24			(1)	* 05	.06	pure
4239.85	$^5F-^3F'$	0.94	2	32	.26	Zr+. Fe prob. rather pure
4177.60			4	69	.47	Fe+ $^4P-^4F'$ predominates
4152.18			4	* 19	.16	pure
4139.93			2	24	.20	pure? La+ at 4141
4100.75			3	–	–	in H line
4092.51			(1)	07	.06	Ca $^3D-^4F'$. Co+
4415.13	$^3F-^5G'$	1.54	20	52	.38	Sc+ strong
4404.75			30	* 25	.21	pure

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Iron line	Series	ε.P Int.	Int. ~~Am~~	Obs	dl	Remarks
4383.55	Cont.	1.54	45 r	*.25	.21	pure
4367.91			2	19	.16	Ti
4337.05			10	58	.41	Cr 1^5D-1^5F; Ti+ 1^2D-$1^2D'$
4294.13			15	25	.21	Ti+ 1^2D-$1^2D'$; Sc+ 1^3F-$1^3D'$
4291.47			4	–	–	not observed
4229.75			(1)	–	–	not observed
4325.77	1^3F-$1^3G'$	1.54	35	*.31	.25	pure? Sc+ 1^3F-$1^3D'$ nearby but also?
4307.91			35	.28	.23	Ca 1^3P-$1^3P'$; *Ti+ 1^4P-$1^4P'$
4271.76			35	*.37	.29	pure
4250.79			25	*.19	.16	pure
4202.03			30	.43	.33	V+ $^5P_3$-$^5D_4$
4147.68			10	*.17	.15	pure
4143.87	1^3F-$2^3F'$	1.54	30	.58	.41	pure? Double in chromo; something else prob. present
4132.06			25	.51	.43	V 1^6D-$2^6D'$
4071.75			40	*.31	.25	Fe unclas. Prob: not imp.
4063.60			45	*.46	.35	pure
4045.82			bor	*.51	.41	pure
4005.25			25	.43	.33	V+ a^3G_5-$^3G_5$
3969.26			30	–	–	in Ca+ line
4362.74	1^5P-$1^5S'$	2.19	9	.35	.28	* Cr 1^5D-1^5F; Mg 1P-5D; * Fe+ 2^4P-$1^4D'$
4315.09			10	.47	.35	*Ti+ 1^4P-$1^4D'$; Ti 1^5F-$5^5D'$
4282.41			12	*.21	.18	pure

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Ionized Iron	Series	E.P.	Int.	Δm	dl	Remarks
4369.41	~~$^4P-{}^4F'$ $^5F-{}^3F'$~~	2.68	..	* 19	.16	pure
4296.56			6	* .21	.18	pure
4258.16			..	* .21	.18	pure
4178.87			6	.69	.47	Fe * ~~$^4P-{}^4F'$~~ $^5F-{}^3F'$
4416.81	$^4P-{}^4D'$	2.68	4	.57	.41	Ti +; Sc+; Fe $^3F-{}^5G'$
4385.39			..	25	.21	Cr $^4P-{}^4D$
4351.77			6	35	.28	Cr $^5D-{}^5F$
4303.18			4	-	-	Ca $^3P-m^3P'$
4233.16			8	49	.36	Fe $^7D'-m^7D$ prob. mst imp.
4173.48			6	* -	-	pure
4128.74			..	61	.43	Y $^2D-n^2P'$; V $^6D-{}^6D'$
4666.75	$^4F-{}^4F'$	2.82	..	.18	.15	Ti $^3F-{}^3G'$; Co; ~~Fe+~~ prob. imp.
4629.33			4	* -	-	pure
4582.84			..	.19	.14	Fe+ 4583.84 ?
4555.90			6	?		
4534.17			..	.30	.24	Ti+ $^2P-{}^2D'$; Co+?
4520.24			6	* .30	.24	pure
4515.33			6	* .25	.21	pure
4491.41			4	* ..	..	pure
4489.21			4.	.40	.31	Fe $^5D-{}^7F'$
4472.93			..	* ..		pure
4620.52	$^4F-{}^4D'$	2.82	..	* .. -		pure
4583.84			8	* .28	.23	see above; prob. pure
4576.31			4	* .12	.11	pure
4549.48			4	.30	.24	Ti+ $^2H-{}^2G'$; Co+?
4541.52			..	* .17	.15	pure
4522.64			6	.30	.24	Ti $^5F-{}^5F'$; Ba+ $^1P-{}^2S$
4508.29			8	* .25	.21	pure

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Ionized Titanium lines		E.P.	Int.	Δm	dl	Remarks	
4450.49	$1^2D-1^2D'$	1.08	4	*34	.27	pure	600
4443.80			25	*56	.40	pure	1600
4395.04			25	*52	.38	pure. V not imp. $1^6D-2^6F'$	2500
4344.31	$1^2D-1^2D'$	1.08	3	26	.21	Cr	600
4337.92			10	*58	.41	Cr 1^5D-1^5F	900
4294.10			8	25	.21	Sc+	1200
4287.88			2	28	.23	pure	600
4501.27	$1^2G-1^2F'$		25	*30	.24	pure	1600
4468.49			25	*20	.17	pure	1500
4341.39			2	* –		not found	In H Line
4417.71			8	?57	.41		
4330.71	$1^4P-1^4D'$		1	*17	.15	pure	600
4320.95			1	*18	.15	Sc+ $1^3F-1^3D'$ (other member missing)	500
4314.98			5	47	.35	Ti $1^5F-5^3D'$ not imp; Fe $1^5P-1^5S'$ not imp. Sc+ $1^3F-1^3D'$ (?)	
4312.88			7		.2	pure	750
4307.89			12	*25	.21	Fe $1^3F-1^3G'$ not imp; Ca $1^3P-1^3P'$ not v. imp.	
4301.93			5				
4300.05			12	53	.39	heavy blend	1200
4290.23			8	53	.39	Cr 1^7S-1^7P very strong	1300
4708.65	$1^2P-1^4D'$		(2)	*15	.13	pure	
4589.96			3	?		Cr+?	
4563.77			15	15	.13	V+	
4533.97			20	30	.24	Fe+ $2^4F-1^4F'$; Co+, Ti $1^5F-2^5F'$	
4399.77			6	59	.42	Sc+, V $1^6D-2^6F'$	
4394.06			2	52	.38	~~Ti~~ +, but this not imp.	

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Analysis of γ Cyg spectrum

Ionized Scandium	Series	E.P.	Int.	Δm	dl	Remarks
4431.35	$^3F - ^3F'$	0.60	4	34′	.27	Fe $^5P-^5D'$ not imp?
4420.66			(1)	—*		pure
4415.55			40	52*	.38	Fe $^3F-^5G'$ (20) not imp?
4400.38			50	59*	.42	Ti+ $^2P-^4D'$ not imp
4384.80			8	25	.21	*Fe+ $^4P-^4D'$; Cr $^4P-^4D'$
4374.46			60	51*	.38	Y+ not imp.
4354.60			8	08	.07	Ca $^1D-^4F$
4325.00	$^3F-^3D'$	0.60	50	31	.25	4325.77 Fe $^3F-^3G'$ imp
4320.73			75	18*	.15	Ti+ $^4P-^4D'$ imp
4314.09			100	47*	.35	Ti+ $^4P-^4D'$; Ti $^5F-^5D'$; Fe $^5P-^5S'$
4305.71			10	25	.21	Sr+ $^2P-^2S$
4294.77			10	25	.21	Ti+ $^2D-^2D'$
Ionized Yttrium						
4422.60	$^3D-^3P'$	0.0	10	38	.30	~~Ti+~~ Sc+
4398.03			15	59	.42	Ti+ $^2P-^4D'$
4358.72			8	19	.16	Cr
4309.61			20	*28	.23	pure
4235.71			6	36	.28	Fe $^7D'-m^7D$
4199.28			3	..	..	Fe $^7D'-m^7D$
4900.11	$^3F-^3D'$	0.93	30	*13	.11	pure
4883.69			50	*18	.15	pure
4854.88			30	30	.24	~~pure (8)~~ Fe $^3H-^3I'$
4823.32			10	19	.16	Mn $^8P-^8S$
4786.57			5	*..	..	pure
Vanadium (cont.) 4406.65			80	43	.33	Fe $^3F-^5G'$
4400.59			60	59	.42	Ti+ $^2P-^4D'$; Sc+
4395.24			80	52	.38	Ti+ $^2D-^2F'$
4389.99			100	*34	.27	pure?
4384.73			125	25	.21	Heavy blend
4379.24			150	..	..	pure

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Titanium	Series	E.P.	Int	Δm	dl	Remarks
4024.57	$1^3F-2^3F'$	0.0	35	22	.18	Ti+
4008.94			35	* ..	..	pure
3998.65			100R	*33	.26	pure
3989.77			80R	*19	.16	pure? La+
3981.77			70R	[41]	.32	pure
3964.27			35	..		Cr
3962.85			35	..		Al 1^2P-1^2S
3958.21	$1^3F-2^3D'$	0.0	80	[38]	.30	
3956.28			60	[39]	.30	
3948.66			60	..		
3929.87			40	..		
3924.51			50	..		
3898.49			8	..		
Vanadium						
4460.30	$1^6D-1^6P'$	0.28	50	35	.28	} Fe $1^5D-1^7F'$
4459.77			30	35	.28	
4457.48			15	34	.27	
4444.22			20	56	.40	Ti+
4441.69			25	..		
4437.84			20	..		
4436.14			15	..		
4428.52			15	..		
4419.94			12	..		
4429.80	$1^6D-2^4F'$	0.28	15	34	.27	Fe $1^5P-3^5B'$
4426.01			15	25	.21	Ca 1^3P-2^3D
4421.58			20	..		Y+
4416.48			20	57	.44	Fe+, Ti+
4408.51			45	} 43	.33	Fe $1^5P-3^5D'$
4408.21			70	} ~~43~~		
4407.65			70	..	..	

Continued on page 190

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120 first reduction curve

N.B. June $\Delta m = \frac{4}{5}$ of red Δm col., owing to misreading of reduction scale

×6275

~~B 18483~~ δ Canis Majoris

~~δ Cygni~~ aperture 1

No.	Line	Ct	Series	n	m+n	[n]	[m+n]	Δm	Second red ~~dl~~	dl ~~Line Δm~~	Δm. γ Cyg	No
1	3933 ~~3935~~			-.1	11 0						1.41	31
2	3945 ~~3946~~			66	119	1.28 ~~2.17~~	2.02	74	164 -102=62	60 .49	50	32
3	3952 ~~3950~~			66	119	1.28	2.02	74	164-102 = 62	60 .49	54	33
4	3956 ~~3954~~			83	123	1.52	2.07	55	170-119 = 51	44 .40	39	34
5	3956			83	123	1.52	2.07	55	170-119 = 51	44 .40	38	35
6	3970 ~~3963~~			0	130		2.25	[2.25]		.87	1.63	36
7	3982 ~~3964~~			92	135	1.62	2.37	75	195 -127= 68	60 .50	41	37
8	3984 ~~3973~~			120	138	2.00	2.46	46	203-166=37	37 .35	16	38
9	3986 ~~3974~~			120	138	2.00	2.46	46	37	37 .35	18	39
10	3987 ~~3979~~			120	138	2.00	2.46	46	37	37 .35	17	40
11	3989 ~~3980~~			120	138	2.00	2.46	46	37	37 .35	20	41
12	3990 ~~3983~~			120	138	2.00	2.46	46	37	37 .35	19	42
13	3994 ~~3985~~			~~104~~	~~=~~						2.1	43
14	3995 ~~3994~~			109	142	1.83	2.56	73	213- 149 = 64	57 .49	36	44
15	3997 ~~3997~~			109	142	1.83	2.56	73	213-149 = 64	57 .49	33	45
16	4002 ~~3985~~			130	146	2.25	2.70	45	223-184 = 39	36 .34	20	46
17	~~3988~~			130	146	2.25	2.70	45	223-184=39	36 .34	20	47
18	4005 ~~3990~~			119	147	2.02	2.72	70	225-164= 61	56 .48	43	48
19	4012 ~~3993~~			140	151	2.53	2.85	32	236-208= 28	25 .26	17	49
20	4014 ~~4003~~			140	151	2.53	2.85	32	236-208=28	25 .26	17	50
21	4018 ~~4005~~			149	154	2.80	2.94	14	244-231 = 13	11 .12	16	51
22	4022 ~~4016~~			142	155	2.56	2.97	41	246-213=33	33 .29	22	52
23	4028 ~~4015~~			132	156	2.30	3.00	70	249-188=61	56 .48	44	53
24	4030 ~~4027~~									—	37	54
25	4031 ~~4025~~			119	158	2.02	3.07	1.05	255 -164 = 91	84 .62	56	55
26	4034			—	—	—	—	—		—	47	56
27	4035			—	—	—	—	—		—	32	57
28	4036 ~~4033~~			—	—	—	—	—		—	17	58
29	4041 ~~4037~~			147	158	2.37	3.07	35	285-225=30	28 .28	31	59
30	4046 ~~4044~~			146	158	2.30	3.07	37	225-223=32	30 .29	51	60

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No.	Line	Et Series	n	m+n	[n]	[m+n]	Δm	dl	true dle	Δm Cyg
31	4048 4101		145	158	2.70	3.07	37	2.55-2.20=35 ~~29~~	~~29~~ .29	19
32	4050 4122		+	−	−	−	−			21
33	4052 4128		143	158	2.60	3.07	47	255-223=32	37 .35	19
34	4054 4131		137	158	2.43	3.07	64	255-200=55	51 .45	39
35	4057 4167		−	−	−	−	−			13
36	4059 4174,3		−	−	−	−	−			13
37	4179		−	−	−	−	−			04
38	4064 4233		137	160	2.43	3.15	72	263-200=63	.49	46
39	4067 4242		148	160	2.76	3.15	39	263-224=34	.30	31
40	4072.4 4247		148	160	2.76	3.15	39	263-224=34	.30	31
41	4078 4258		118	160	1.97	3.15	1.18	263-162=101	.66	77
42	4083 4262									21
43										22
44	4085		144	160	2.62	3.15	53	263-218=45	.39	32
45	4087		144	160	2.62	3.15	53	263-218=45	.39	32
46										04
47	4092									07
48	4093		159	161	3.13	3.20 ~~16~~	07	268-259=09	.06	07
49	~~4302~~									20
50	4098 ~~4315~~		147	160	2.72	3.15	43	263-225=38	.33	30
51	4101 ~~4315~~		123	160	2.07	3.15	1.08	263-170=93	.63	77
52	4106 ~~4331~~									48
53	4107 ~~4326~~		149	159	2.80	3.12	32	259-231=28	.26	? 72
54	4109 ~~4340~~									32
55	4111 ~~4352~~									15
56	4113 ~~4355~~									06
57	4119 ~~4370~~		147	161	2.72	3.20 ~~16~~	48	268-225=43	.36	41
58	4123 ~~4395~~		144	162	~~268~~ 2.72	3.24	62	272-218=54	.44	44
59	4128 ~~4400~~		134	162	2.35	3.24	89	272-193=79	.56	61
60	4132 ~~4405~~		142	161	2.57	3.20 ~~16~~	63	268-213=55	.44	51

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no.	line	ct	series	n	m+n	[n]	[m+n]	Δm	df	no
61	4136 ~~4411~~			~~157~~	~~162~~					91
62	4139 ~~4414~~			157	162	3.03	3.24	21	.18	92
63	4144 ~~4450~~			147	161	2.72	3.20	58	.41	93
64	~~4467~~									94
65	4149 ~~4471~~			150	161	2.78	3.20	42	.32	95
66	~~4482~~									96
67	4155 ~~4489-91~~			150	163	2.78	3.28	50	.37	97
68	4157			150	163	2.78	3.28	50	.37	98
69	4162 ~~4507~~			147	161	2.72	3.20	48	.36	99
70	4164 ~~4508~~			158	161	2.78	3.20	42	.32	100
71	4166 ~~4515~~									101
72	4167 ~~4520,22~~			155	161	2.97	3.20	33	.36	102
73	4172			122	161	2.05	3.20	15	.13	103
74	4177 ~~4534~~			129	161	2.22	3.20	98	.60	104
75	4182 ~~4541~~									105
76	4184 ~~4549~~			143	160	2.60	3.15	55	.40	106
77	4188 ~~4556~~			144	161	2.62	3.20	58	.41	107
78	4191 ~~4558~~			150	161	2.78	3.20	42	.32	108
79	4196 ~~4564~~			147	161	2.72	3.20	48	.36	109
80	4198 ~~4572-76~~			143	163	2.60	3.28	68	.47	110
81	4202			141	162	2.55	3.24	69	.47	111
82	4205 ~~4574~~			141	163	2.55	3.28	73	.49	112
83	4209 ~~4580~~			150	163	2.78	3.28	50	.37	113
84	~~4619~~									114
85	4215 ~~4627~~			148	163	2.76	3.27	51	.38	115
86	4219 ~~4634~~									116
87	4222 ~~4791~~									117
88	4225 ~~4824~~									118
89	4227 ~~4836~~			140	163	2.52	3.28	76	.50 ~~.46~~	119
90	4233 ~~4845~~			144	163	2.62	3.28	66	.46	120

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no	Sing Ct Series	n	m+n	[n]	[m+n]	Δ m	dl
91	4235 ~~4861~~	148	163	2.75	3.28	53	.39
92	4239 ~~4883~~	154	164	2.93	3.31	38	.30
93	~~4900~~						
94	4243 ~~4924~~	147	164	2.74	3.31	57	.41
95	4247 ~~4924~~	158	166	2.78	3.35	57	.41
96	4250 ~~5018~~	155	165	2.97	3.35	38	.30
97	4258 ~~5042~~	156	165	3.00	3.35	35	.28
98	4260 ~~6069~~	157	165	3.03	3.35	32	.26
99	4272	149	166	2.80	3.40	60	.43
100	4274						
101							
102							
103							
104	4283	157	165	3.03	3.35	32	.26
105	4288						
106	4290	147	165	2.74	3.35	61	.43
107	4294	150	166	2.78	3.40	62	.44
108	4296	148	166	2.76	3.40	64	.45
109	4299	136	165	2.40	3.35	95	.58
110	4300	136	165	2.40	3.35	95	.58
111	4306	~~150~~	~~161~~				
112	4308-9	150	165	2.78	3.35	57	.41
113	4315	149	166	2.80	3.40	60	.43
114							
115	4321	160	166	3.15	3.40	25	.21
116	4326	157	166	3.03	3.40	37	.29
117	4331						
118	4334						
119	4337	133	166	2.33	3.40	1.07	.63
120	4340	133	166	2.33	3.40	1.07	.63

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No	Line	Et	Series	n	m+n	[n]	[m+n]	Δ m	dl	No
121	4344									151
122										152
123	4352			146	166	2.70	3.40	70	.48	153
124										154
125	4359			163	167	3.27	3.43	16	.14	155
126										156
127	4367			160	166	3.15	3.40	25	.21	157
128	4375			161	167	3.20	3.43	23	.19	158 159
129	4384			150	166	2.78	3.40	62	.44	160
130	4391									161
131	4395			153	166	2.91	3.40	49	.36	162
132	4400			153	166	2.91	3.40	49	.36	163
133	4405									164
134	4408			157	166	3.03	3.40	37	.29	165
135	4415			149	166	2.80	3.40	60	.43	166
136	4416			149	166	2.80	3.40	60	.43	167
137	4423									168
138	4427									169
139	4430			162	167	3.24	3.43	19	.16	170
140	4435			161	166	3.20	3.40	20	.17	171
141	4444			150	161	2.78	3.20	42	.33	172
142	4450			155	161	2.97	3.20	23	.19	173
143	4455			156	161	2.98	3.20	22	.18	174
144				156	161	2.98	3.20	22	.18	175
145	4459									176
146	4462			153	161	2.91	3.20	29	.23	177
147	4467			152	161	2.88	3.20	32	.26	178
148										179
149	4482			156	161	2.98	3.20	22	.18	180
150	4490			154	161	2.94	3.20	26	.21	181
151				156	161	2.98	3.20	22	.18	182

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No	Line	Et	Series	n	m+n	[n]	[m+n]	Δm	dl
151	4495			↓159	↓161				
152	4501			↓159	↓161	3.11	3.20	09	.08
153	4508			↓158	↓161	3.11	3.20	09	.08
154	4515					3.07	3.20	13	.11
155	4			↓154	↓161				
156	4528			↓155	↓160	2.94	3.20	26	.21
157	4534					2.97	3.15	18	.15
158									
159	4541-4544			156	166	2.98	3.40	42	.32
160	4550			154	161	2.94	3.20	26	.21
161	4554			152	160	2.88	3.15	27	.22
162									
163									
164	4564			154	160	2.94	3.15	21	.18
165	4572			157	160	3.03	3.15	12	.11
166	4576			158	161	3.07	3.20	13	.11
167	4581								
168	4584			153	160	2.91	3.15	24	.20
169	4616			145	158	2.65	3.07	42	.32
170	4635			156	158	2.98	3.07	09	.08
171	4646			154	157	2.94	3.04	10	.09
172	4666			151	157	2.85	3.04	19	.16
173				153	156	2.91	3.00	09	.08
174				150	154	2.78	2.93	15	.13
175				152	154	2.88	2.93	05	.05
176				149	153	2.80	2.90	10	.09
177	4765			141	149	2.55	2.80	25	.13
178	4805			143	146	2.59	2.70	11	.10
179	4810			140	146	2.52	2.70	18	.15
180	4824			134	141	2.35	2.55	20	.17
181	4848			127	134	2.17	2.35	18	.15
182	4854			113	133	1.89	2.32	43	.33

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	Line	Ht Series	n	m+n	[n]	[m+n]	Δm	dl
183	4861	113	9.2	131	1.62	2.27	65	.45
184			114	128	1.91	2.19	28	.23
185								
186			112	124	1.88	2.10	12	.11
187			111	123	1.86	2.08	22	.18
188			112	119	1.88	1.99	11	.10
189								
190			104	115	1.77	1.93	16	.14
191			82	111	1.50	1.86	36	.28
192			85	108	1.54	1.82	28	.23
193								
194			91	104	1.61	1.77	16	.14
195			95	104	1.66	1.77	11	.10
196								
197								
198								
199			93	96	1.63	1.67	04	.04
203			81	92	1.50	1.63	13	.11
201								
202			78	86	1.45	1.55	10	.09
203			78	86	1.45	1.55	10	.09
204			78	86	1.45	1.55	10	.09
205			78	86	1.45	1.55	10	.09
206								
207			51	76	1.10	1.37	[27]	.22
208								
209								
210			53	70	1.13	1.33	[20]	.17
211								
212			48	66	1.05	1.26	[23]	.19
213								

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No	Line	Ht	Series	n	m+n	[m]	[m+n]	Δm	dl
183	4861	143		92	134	1.62	2.27	05	.35
184				114	128	1.91	2.19	28	.23
185									
186				113	124	1.88	2.10	12	.11
187				111	123	1.86	2.08	22	.14
188				112	119	1.88	1.99	11	.07
189									
190				104	115	1.77	1.93	16	.14
191				82	111	1.50	1.86	36	.24
192				85	101	1.54	1.82	28	.23
193									
194				91	104	1.61	1.77	16	.14
195				95	103	1.66	1.77	11	.07
196									
197									
198									
199				93	94	1.63	1.67	04	.04
200				81	92	1.50	1.63	13	.14
201									
202				78	86	1.45	1.55	10	.11
203				78	86	1.45	1.56	10	.11
204				78	86	1.45	1.55	10	.11
205				78	86	1.45	1.55	10	.11
206									
207				67	76	1.10	1.37	[27]	.32
208									
209									
210				53	74	0.5	1.33	.7	[20]
211									
212				48	66	1.05	1.28	[23]	.19
213									

No	Line	Ht	Series	n	m+n	[m]	[m+n]	Δm	dl
				20	34	2.0	3.4	1.6	26
				2n					
				23	63			0.40	1.20
				38	57			0.34	1.16
				33	71			0.88	1.05
				21	43			0.83	1.00
				21	43			0.83	1.00
				17	37			0.73	0.93

Canis Majoris
2nd reduction

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	Line	Δf	Series	n	m+n	[n]	[m+n]	Δm	de
214				44	64	1.02	1.25	[23]	.19
215				~~34~~	~~60~~				
216				34	60	0.90	1.20	[30]	.24
217									
218				30	57	0.84	1.16	[32]	.26
219				33	49	0.88	1.08	[20]	.17
220				28	43	0.83	1.00	[17]	.15
221				28	43	0.83	1.00	[17]	.15
222				26	37	0.78	0.93	[15]	.13
223									
224									
225									
226									
227									
228									
229									
230									
231									

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δ Canis Majoris ×6275. Construction of reduction curve.

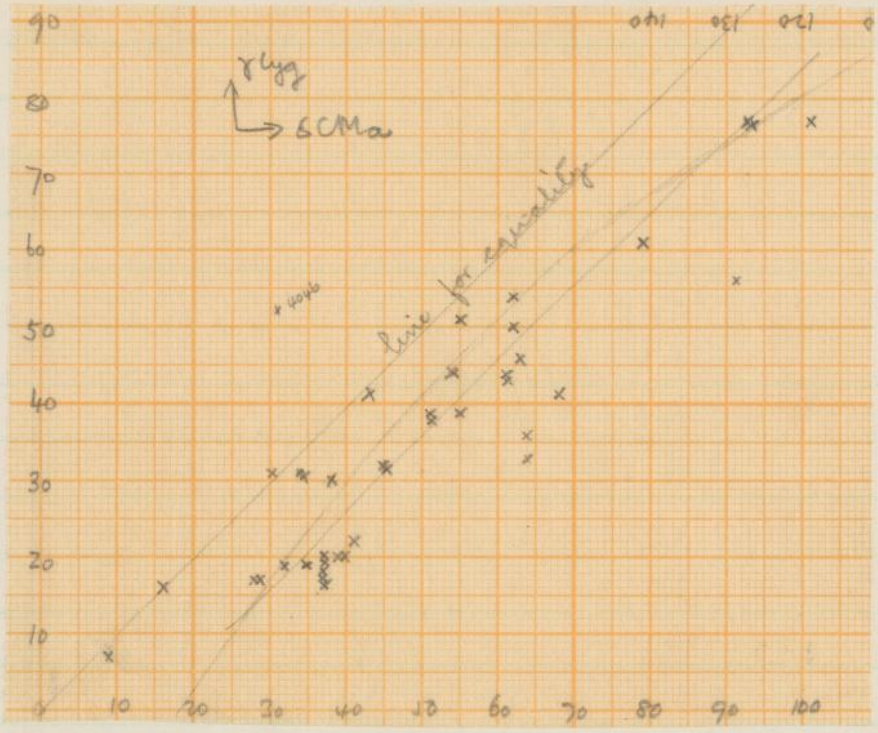
Line	Δm from HR. 28	[γ Cyg] n	[γ Cyg] m+n	δ CMa n	δ CMa m+n	
		from present measures				
4861 H	.61	73	104 ✓	92	131 ✓	8000
4340 H	1.12	70	109 ✓	133	166 ✓ ✓	8000
4227	.70	80	110 ✓	140	163 ✓ ✓	5000
4215	.51	90	109 ✓	148	163 ✓ ✓	6000
4101 H	.86	54	100 ✓	123	160 ✓ ✓	8000
3970	[2.25]	-7	70 ✓	0	130 ✓	4000
3933	[2.25]	-6	54 ✓	-1	110	4000

MC 21822 is almost half the scale of ×6275

Relative line intensities are similar to those for γ Cygni but lines are deeper. This indicated by Book 11 p. 16 which shows a mean increase of 7 hundredths of a magnitude for lines from γ Cyg to δ CMa. Present plot gives 7-14 hundredths of a magnitude for this excess. It may be real or may be plate effect; deeper lines are from MC and X plates.

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β Andromedae

~~ε Canis Majoris~~

No.	Genus	Ct	Series	n	n+m	[n]	[n+m]	Δm	dl	No
1	~~3933~~ 4005			17	50					31
2	~~3945~~			33	52					32
3	~~3952~~			33	54					33
4	~~3956~~			41	55					34
5	~~3958~~			42	58					35
6				47	59					36
7				44	60					37
8				40	60					38
9				33	61					39
10				27	61					40
11				44	62					41
12				18	64					42
13	4031 4033			10	64					43
14				56	66					44
15				44	66					45
16	4046			6	67					46
17				48	68					47
18				57	69					48
19				59	70					49
20				43	70					50
21				38	72					51
22	4064			12	74					52
23				47	75					53
24				46	75					54
25				50	75					55
26	4072			25	76					56
27	4077			19	78					57
28				55	80					58
29				59	81					59a
30				69	81					60a

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No.	Line	Et	Series	n	n+m	[n]	[n+m]	Δm	dl
31				57	82				
32				45	83				
33				52	83				
34	4161			29	83				
35				53	84				
36				57	84				
37				55	84				
38				43	85				
39				57	85				
40				44	85				
41				54	85				
42				49	85				
43				73	86				
44				58	87				
45				49	86				
46				55	86				
47				39	87				
48				42	87				
49				59	87				
50				59	87				
51	4144			15	87				
52				58	88				
53				58	88				
54				56	89				
55				53	89				
56				66	90				
57				66	90				
58				56	90				
59a				~~53~~ 52	90				
59e				53	90				
60	4172			30	90				

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No	Line	Ct	Series	n	n+m	[n]	[n+m]	Δm	dl	No.
61				56	90					91
62				53	90					92a
63				52	90					93
64				49	91					94
65				57	92					95
66a				48	91					96
67				49 70	92					97
68				63	93					98
69				70	93					99
70	4215			44	95					100
71	4227			-14	95					101
72a				58 66	96 97					102
73				75	97					103
74				80	97					104
75				60	98					105
76				43	98					106
77				65	98					107
78				95	107					108
79	4272			50	108					109
80	4275			57	108					110
81				94	110					111
82				91	110					112a
83				93	111					113
84	4290			52	113					114
85				90	114					115
86	4300			65	115					116
87				82	115					117
88	4308			56	117					118
89				94	119					119
90				106	120					120

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No.	Line	Et	Series	n	n+m	[n]	[n+m]	Δm	dℓ
91	4326			66	120				
92				110	120				
a				115	120				
93				99	120				
94	4340			90	120				
95				110	121				
96				113	121				
97	4352			98	121				
98				110	121				
99				111	123				
100				102	123				
101	4383			60	122				
102				109	123				
103				109	123				
104				111	123				
105	4408			83	123				
106				97	123				
107				104	124				
108				113	124				
109				117	124				
110				114	124				
111	4444			105	125				
112				113	125				
a				123	126				
113				120	126				
114				124	127				
115				118	127				
116				118	127				
117				119	127				
118	4482			124	128				
119				120	128				
120				117	129				

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No	Line	St	Series	n	m+n	[n]	[m+n]	Δm	dl	No
121				124	129					151
122				126	129					152
123				125	130					153
124				125 125	130 130					154 a
125 a				118	131					155 a
126				117	130					156
127				124	131					157
128				125	131					158
129				125	131					159 a
130				123 125	131 131					160
131										
132				125	131					161
133				125	132					162
134				126	132					163
135				125	132					164
136				126	133					165 a
137				129	133					166
138				127	132					167
139				129	132					168
140				128	132					169
141				127	132					170 a
142				125	131					171
143				124	132					172
144				127	132					173
145				122	131					174
146				127	131					175
147				125	131					176
148				126	130					177
149				125	129					178
150				125	129					179
				125	129					180

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No	Lini Series	Et	Series	m	m+m	[m]	[m+m]	Δm	dl
				~~1111~~					
151				124	129				
152				126	129				
153				123	129				
154				119	127				
a				122	126				
155				119	126				
a				119	126				
156				120	125				
157				118	124				
158				120	124				
159				117	122				
a				117	122				
160				114	121				
161				115	120				
162				116	120				
163				113	120				
164				105	119				
165				108	117				
a				111	117				
166				108	116				
167				106	115				
168				104	115				
a				107	114				
169				107	114				
170				106	112				
a				106	112				
171				96	110				
172				101	110				
173				100	108				
174				93	107				
175				80	100				
176				78	97				
177				88	94				
178				72	90				
179				78	88				
180				79	86				

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λ	Line	Ed	Series	n	m+n	[n]	[m+n]	Δm	dl
181				67	83				
182				64	81				
183				55	78				
184				57	74				
185				57	72				
186				41	66				
187				49	62				
188				40	55				
189				40	50				
190				26	45				

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140

ε Aurigae

	Seine	8t	series	n	m+n	[n]	[m+n]	Δm	dl	
1	8933			-1	50					32
2				2	50					33
3				24	52					34
4				44	53					35
5				44	54					36
6				40	55					37
7				49	55					38
8				46	56					39
9				45	58					40
10				52	59					41
11				55	59					42
12				52	60					43
13				51	60					44
14				49	61					45
15				51	61					46
16				47	61					47
17				3	63					48
18	3970			1	63					49
19				2	63					50
20				39	64					51
21				59	65					52
22				59	65					53
23				51	66					54
24				63	67					55
25				60	67					56
26				64	67					57
27				63	68					58
28				65	69					59
29				68	69					60
30				67	69					61
31				61	70					62

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No	Line	Int	Series	n	m+n	[m]	[m+n]	δm	dl
32				61	70				
33				66	76				
34				60	72				
35				58	62				
36				57	70				
37				60	71				
38				65	72				
39				~~59~~	72				
40				59 ~~57~~	74				
41				63 ~~67~~	74				
42				69	75				
43				~~74~~ 69	75				
44				74	75				
45				74	76				
46				66	76				
47				72	77				
48				71	78				
49				66	78				
50				74	78				
51				70	79				
52				73	79				
53				72	79				
54				66	80				
55				~~78~~	80				
56				77	80				
57				79	81				
58				74	81				
59	4101			45	81				
60				76	82				
61				78	81				
62				73	81				

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No	Line	St	Series	n	m+n	[n]	[m+n]	Δm	dl	
63				69	81					93
64				73	81					94
65				80	81					95
66				79	81					96
67				81	81					97
68				77	82					98
69				77	82					99
70				79	82					100
71				78	81					101
72				72	83					102
73				79	82					103
74	4172			61	83					104
75	4177			59	82					105
76				75	82					106
77				77	83					107
78				76	83					108
79				77	82					109
80				80	83					110
81				77	83					111
82				75	83					112
83				76	83					113
84				78	83					114
85				75	83					115
86				75	84					116
87	4215			73	84					117
88				70	84					118
89	4227			69	71					119
90	4233			57	71					120
91				67	71					121
92				67	71					122
93				61	73					123
										124

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No	Line	Et Series	n	m+n	[m]	[n+m]	Δm	dl
94			67	73				
95			68	73				
96			68	73				
97			67	74				
98			74	75				
99			72	74				
100			66	75				
101			67	75				
102			70	75				
103			70	76				
104			63	76				
105			65	76				
106			67	76				
107			62	76				
108			60	76				
109			71	76				
110			68	76				
111			54	76				
112			67	77				
113			68	77				
114			73	77				
115			67	77				
116			72	78				
117			73	78				
118			60	77				
119	4340		44	77				
120			64	78				
121			63	78				
122			74	77				
123			73	77				
124			68	78				

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No	Line	Bt	Series	n	m+n	[n]	[m+n]	Δm	dl
125				~~68~~	78				
126				68	78				
127				74	78				
128				59	77				
129				72	77				
130				58	77				
131				66	77				
132				72	77				
133				75	78				
134				73	77				
135				73	77				
136				65	77				
137				58	78				
138				72	78				
139				75	78				
140				75	78				
141				74	78				
142				74	78				
143				77	78				
144				75	78				
145				64	79				
146				72	79				
147				77	79				
148				75	79				
149				76	79				
150				75	79				
151				64	79				
152				74	79				
153				69	79				
154				72	80				
155				74	80				

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	Line 8t series	n	mtn	[n]	[mtn]	δ m	dl
156		78	80				
157		73	80				
158		78	80				
159		73	80				
160		78	80				
161		75	80				
162		74	80				
163		78	82				
164		77	81				
165		75	81				
166		78	82				
167		74	82				
168		73	82				
169		73	82				
170		78	82				
171		76	82				
172		76	83				
173		79	83				
174		73	83				
175		76	83				
176		81	83				
177		78	83				
178		76	83				
179		78	83				
180		79	83				
181		79	82				
182		79	82				
183		81	82				
184		81	82				
185		79	81				

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Line 67 Series

No	n	m+n	[n]	[m+n]	Δm	dl
186	79	81				
187	78	81				
188	78	81				
189	74	81				
190	76	80				
191	75	80				
192	74	78				
193	76	77				
194	75	76				
195	73	76				
196	73	76				
197	70	75				
198	72	75				
199	71	74				
200	66	73				
201	69	72				
202	66	71				
203	66	71				
204	67	70				
205	65	69				
206	60	68				
207	63	67				
208	57	65				
209	38	64				
210	49	63				
211	56	62				
212	55	61				
213	53	60				
214	57	59				
215	51	58				
216	53	57				

No
217
218
219
220
221
222
223
224
225
226
227
228
229
230

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No	Line	ff	Series	n	m+n	[n]	[m+n]	Δ m	de
217				51	54				
218				48	54				
219				49	53				
220				47	52				
221				43	52				
222				49	50				
223				44	49				
224				35	48				
225				39	45				
226				38	43				
227				39	42				
228				35	41				
229				35	40				
230				32	38				

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L Tauri

	Linie	Bl	Serie	n	m+n	[m]	[m+n]	Δm	dl
1	4275			24	63				
2	4272			17	63				
3	4264			54	63				
4	4260			37	64				
5	4255			28	65				
6	4251			34	65				
7	4247			51	65				
8				45	65				
9	4236			39	65				
10	4234			24	65				
11	4227			8	65				
12	4215			~~49~~ 22	64				
a	4221			49	64				
13	4210			42	64				
14				39	64				
15				34	63				
16				23	63				
17				26	63				
18				32	63				
19				41	63				
20	4187			29	63				
21	4182			29	63				
22				33	62				
23				30	62				
24	4172			16	61				
25				30	61				
26				31	61				
27				40	61				
28				33	61				
29				28	61				
30				38	61				
31				39	60				

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m	line	st	series	n	m+n	[n]	[m+n]	Δm	dl
32	4144			6	61				
33				38	60				
34				39	60				
35				28	60				
36	4132			19	59				
37				21	60				
38				37	60				
39				32	59				
40				36	59				
41				25	59				
42				37	59				
43				26	59				
44				35	59				
45				46	59				
46				33	59				
47				19	59				
48				33	58				
49				24	68				
50				38	58				
51				47	58				
52	4079			38	57				
53				34	55				
54	4077			13	55				
55	4072			10	52				
56	4067			27	50				
57	4064			7	50				
58	4057 4059			28	49				
59	4055			26	47				
60				39	47				
61				32 2	45 44				
62	4046 4048			29	44				
63	4037 4033			8	41				

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No	Line	Et	Series	n	m+n	[n]	[m+n]	Δm	dl
64	4028			8	40				
65				27	39				
66				15	39				
67				25	38				
68				29	38				
69				25	36				
70				25	35				
71				22	35				
72				22	33				
73	4005			11	31				
74	4272			25	67				
75	4275			30	67				
76				57	67				
77				55	67				
78				58	67				
79				55	66				
80	4290			21	69				
81				51	69				
82				63	70				
83	4306?			31	70				
84				63	70				
85	4340			49	70				
86				64	71				
87				66	71				
88	4352			54	72				
89				63	72				
90				~~56~~ 64	74				
91	4375			56	74				
92	4383			26	74				
93				63	74				
94				62	74				

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No	Line of Series	n	m+n	[n]	[m+n]	D n	dl
95		66	75				
96		43	75				
97		55	75				
98	4415	60	76				
99		66	76				
100		69	77				
101		68	77				
102	4435	62	78				
103	4444	69	78				
104		75	79				
105		68	79				
106		62	79				
107		73	80				
108		73	80				
109	4482	72	81				
110	4490	74	82				
111		71	82				
112		79	83				
113		80	84				
114		79	83				
115		71	84				
116		73	84				
117		79	84				
118		80	84				
119		78	85				
120		80	85				
121		80	85				
122		80	85				
123		81	85				
124		81	85				
125		82	86				

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	Line	Et	Series	n	m+n	[n]	[m+n]	Δn	dl	
126				83	~~80~~ 86					157
127				80	~~87~~ 86					158
128				78	~~87~~ 86					159
129				81	~~87~~ 86					160
130				83	~~87~~ 87					161
131				78	~~87~~ 87					162
132				81	~~87~~ 86					163
133				81	~~87~~ 86					164
134				82	~~87~~ 86					165
135				87	94					166
136				85	94					167
137				88	93					168
138				90	93					169
139				84	93					170
140				88	92					171
141				87	92					172
142				87	92					173
143				87	90					174
144				86	90					175
145				87	90					176
146				85	90					177
147				88	89					178
148				82	89					179
149				85	88					180
150				84	87					181
151				84	87					182
152				79	86					183
153				80	85					184
154				67	85					185
155				78	84					186
156				78	83					187

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No	Rise & Set Series	n	m+n	[n]	[m+n]	Δ n	dl
157		77	82				
158		78	81				
159		75	80				
160		75	79				
161		72	79				
162		74	78				
163		71	77				
164		71	76				
165		73	76				
166		68	76				
167		62	75				
168		63	74				
169		66	73				
170		64	73				
171		62	72				
172		59	71				
173		65	71				
174		63	70				
175		61	69				
176		39	67				
177		59	66				
178		57	65				
179		50	64				
180		58	63				
181		39	59				
182		42	56				
183		43	55				
184		47	55				
185		46	53				
186		38	50				
187		38	50				

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λ	Line	Et	Series	n	m+n	[n]	[m+n]	Δ m	dl
188				38	48				
189				38	47				
190				31	44				
191				30	43				
192				22	40				
193				28	38				
194				24	38				
195				25	36				
196				23	34				
197				14	31				
198				19	28				
199				20	27				
200				13	24				
201				14	23				
202				14	20				
203				10	19				
204				12	15				
205				6	11				

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ζ Bootis

No	Line	Et	Series	n	m+n	[n]	[m+n]	Δ m	dl	
1				2	24	[ ]	0.50	[ ]		10
2				14	26	[0.20]	55	[35]	.28	32
3				13	29	0.150	63	48	.36	33
4				17	30	29	65	36	.38	34
5				18	31	31	68	37	.29	35
6				6	33	[ ]	72	[ ]		36
7	3970			-1	38	[ ]	84	[ ]		37
8				3	38	[ ]	84	[ ]		38
9				7	39	[ ]	85	[ ]		39
10				9	39	[ ]	85	[ ]		40
11				20	40	39	88	49	.36	41
12				28	42	60	93	33	.26	42
13				27	43	58	95	37	.29	43
14				31	44	68	97	22	.18	44
15				35	46	77	101	24	.20	45
16				32	48	70	105	35	.28	46
17				41	49	91	107	16	.14	47
18				40	50	88	109	21	.18	48
19				37	51	81	111	30	.24	49a
20				45	52	99	112	13	.11	50
21	4005			30	54	77	115	38	.30	51
22				48	55	105	117	12	.11	52
23				47	56	104	119	15	.13	53
24				49	57	107	121	14	.12	54
25				47	58	104	123	19	.16	55
26				51	59	111	125	14	.12	56
27				50	60	109	127	18	.15	57
28				43	60	95	127	32	.26	58
29				53	61	114	128	14	.12	59
30				46	63	88	133	45	.34	60
31				38	63	84	133	49	.36	61
										62

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No	Line of Series	n	m+n	[m]	[m+n]	Δ m	dl
32		45	62	99	131	32	.26
33		50	63	109	133	24	.20
34		59	63	125	133	08	.07
35		54	63	115	133	18	.15
36	4046	24	63	50	133	83	.53
37		56	64	119	135	16	.14
38		59	64	125	135	10	.09
39		56	64	119	135	16	.14
40		56	64	109	135	26	.21
41		47	65	104	138	34	.27
42		48 38	65 65	105	138	33	.26
43	4064			65	138	73	.49
44	4067	51	66	111	142	31	.25
45	4072	41	66	91	142	51	.38
46	4078	70	66	88	142	54	.39
47		55	67	117	145	28	.23
48		56	66	119	142	23	.19
a		58	67	123	145	22	.18
49		58	67	123	145	22	.18
50		62	67	131	145	14	.12
51		56	67	119	145	26	.21
52		51	67	111	145	34	.27
53		58	67	123	145	22	.18
54	4101	43	68	95	150	55	.40
55		55	69	117	155	38	.30
56		61	68	128	150	22	.18
57		56	68	119	150	31	.25
58		54	69	115	155	40	.31
59		60	69	127	155	28	.23
60		60	69	127	155	28	.23
61		51	69	111	155	44	.33
62		58	69	123	155	32	.26

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No	Line	Et	Series	n 55	m+n 69	[n]	[m+n]	Δ m	dl	No
63				~~58~~	~~80~~		155			94
64				62	69		155			95
65				56	69		155			96
66				55	69		155			97
67	4132			48	69		155			98
68	4134			48	69		155			99
69				59	70					100
70				59	70					101
71	4144			32	69					102
72				58	70					103
73				52	69					104
74				53	69					105
75				54	70					106
76				52	70					107
77				57	70					108
78				54	70					109
79				53	70					110
80				57	70					111
81	4173			43	70					112
82				51	70					113
83				53	70					114
84				50	70					115
85				51	71					116
86				52	71					117
87				49	71					118
88				47	71					119
89				53	71					120
90				59	72					121
91	4210			50	72					122
92	4215			46	72					123
93	4221			66	72					124

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No	Line	Et	Series	n	m+n	[n] ~~[m+n]~~	[m+n]	Δ m	dl
94	4227			16	72				
95				63	72				
96				61	72				
97				59	72				
98				63	72				
99				65	72				
100				65	72				
101	4251			58	72				
102	4254			61	72				
103				64	72				
104				58	73				
105				70	72				
106				66	72				
107	4272			48	72				
108	4275			56	72				
109				55	64				
110				51	63				
111				55	64				
112				52	64				
113				44	64				
114				55	64				
115				40	65				
116				48	65				
117				48	65				
118				38	65				
119				54	66				
120				63	66				
121				60	66				
122	4326			41	66				
123				61	66				
124				64	67				

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No	Line	Et	Series	n	m+n	[n]	[m+n]	Δm	dl	
125				56	67					156
126	4340			49	67					157
127				61	67					158
128				61	67					159
129				63	67					160
130				61	67					161
131	4359			60	67					162
132				62	67					163
133				59	67					164
134				56	67					165
135				63	68					166
136				37	68					167
137				59	68					168
138				58	68					169
139				59	68					170
140	4405			49	68	1.07	1.50	43ϕ	.33	171
141	4408			57	68	1.20	1.50	30	.24	172
142				65	68					173
143	4415			57	66					174
144				61	68					175
145				64	69					176
146				64	69					177
147				60	69					178
148	4435			58	69					179
149	4444			61	69					180
150				66	70					181
151				65	70					182
152				62	70					183
153				62	70					184
154	4462			58	70					185
156				65	71					186

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No	Line	Of	Series	n	m+n	[n]	[m+n]	Δn	dl
156				64	71				
157				67	71				
158				64	71				
159				59	71				
160				64	71				
161				66	71				
162				68	71				
163				68	71				
164				66	72				
165				67	71				
166				63	71				
167				64	72				
168				61	71				
169				66	71				
170				66	71				
171				65	71				
172				66	71				
173				65	71				
174				65	70				
175				64	70				
176				67	71				
177				66	70				
178				67	70				
179				67	70				
180				65	70				
181				66	70				
182				68	70				
183				68	71				
184				68	70				
185				69	70				
186				67	70				

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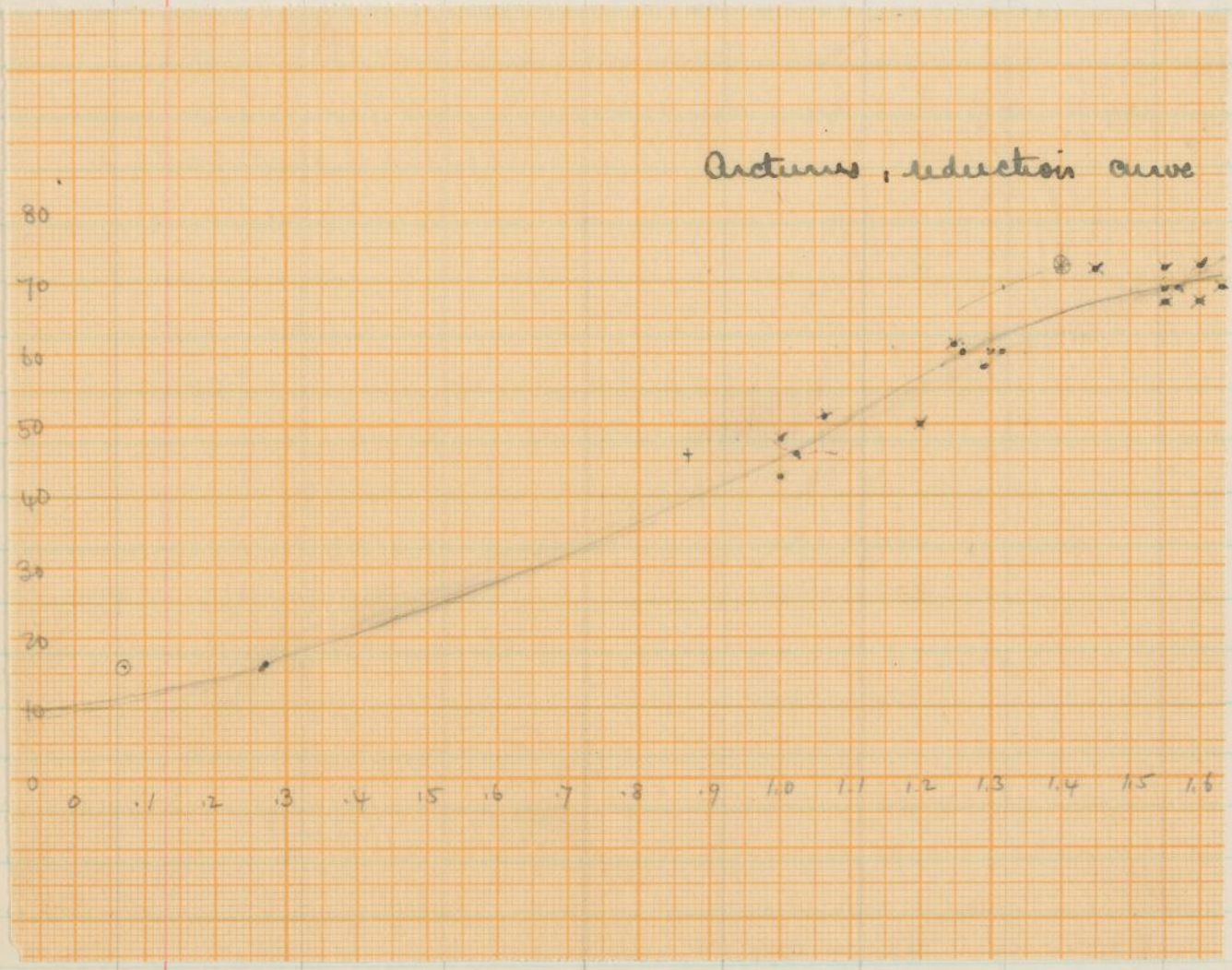
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No	Line	Et	Series	n	m+n	[n]	[m+n]	Δ m	dl
187				67	70				
188				65	70				
189				62	70				
190				64	70				
191				64	70				
192				58	69				
193				63	68				
194				60	68				
195				62	67				
196				60	66				
197				59	66				
198				60	66				
199				58	65				
200				58	64				
201				62	64				
202				61	63				
203				54	62				
204				56	62				
205				56	61				
206				56	61				
207				66	60				
208				58	60				
209				54	59				
210				54	59				
211				50	57				
212				52	56				
213				48	54				
214				47	53				
215				45	51				
216				44	51				
217				43	49				

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No	Line	Ef	Series	n	m+n	[n]	[m+n]	Δn	dl
218				43	47				
219				44	47				
220				40	46				
221									
222									
223									
224									
225									



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Arcturus. Reduction curve for preceding measures.

Line.	No.	Int.	Readings n	Readings mtn
4132	67	.56	48	69 ✓
4024	28	.30	43	60
4097	52	.49	51	67 ✓
4210	91	.25	50	72 ✓
4215	92	.53	46	72 ✓ ✓
4227	94	1.33	16	72 ✓ ✓
4254	102	.44	61	72 ✓ ✓
4359	131	.29	60	67 ✓
4536		.53		
4444	149	.42	61	69 ✓
4861	192	.27	58	69 ✓
		.27		

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Arcturus C 401 Identification of lines

1			31			61			91	4210	121								
2			32						92	4215	122	4326							
3			33						93	4221									
4			34						94	4227					154	4462			
5			35																
6			36	4046							126	4340							
7	3970		37			67	4132												
8			38			68	4144												
9			39																
10			40																
11			41			71	4144		101	4251	131	4359							
12			42						102	4254									
13			43	4064															
14			44	4067-8															
15			45	4072															
			45a	4077															
16			46	4078															
			46a	4079															
17			47						107	4272									
18									108	4275									
19																			
20											140	4405							
21	4005					81	4173				141	4408							
22																			
23											143	4415							
24			54	4101															
25																			
26																			
27																			
28											148	4435							
29											149	4444							
30			60			90			120		150			180			210		

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Analysis of γ Cyg spectrum, from p. 119

Vanadium	Series	E.P.	Int.	Δm	dl	Remarks
4209.86	$(^6D - ^4F)$	0.28	20	27	.22	V+ $5P_1 - {}^5D_1$
4191.55			10	37	.29	Fe $1^7D' - m^7D$
4189.85			12	47	.35	Si+? Co undas
4182.60			10	35	.28	Fe undas
4134.50	$^6D - 2^6D'$	0.28	60	30	.24	~~pure~~ Fe undas
4132.02			60	51	.38	Fe $1^3F - 2^3F'$
4128.08			60	61	.43	Fe+ $2^4P - 1^4D'$
4123.56			60	44	.33	La +
4116.70			4	..		
4116.48			50	..		pure
4115.18			60	*06	.05	
4111.79			100R	*15	.13	pure
4109.78			50	32	.26	?
4106.17			60	48	.36	Fe undas
4099.80			60	30	.24	Fe $1^5F - 1^5F'$
4092.69			50	07	.06	Ca $1^3D - 4^3F'$; Co+
Chromium	$1^7S - 1^7P$	0.0				
4289.72			350R	53	.39	Ti+ $1^4P - 1^4D'$
4274.80			400R	*21	.18	pure
4254.34			500R	*21	.19	pure
4580.05	$1^5S - 1^5P'$	0.94	20	*19	.16	pure
4545.96			20	*17	.15	pure, small Cr
4496.85			25	30	.24	Fe $1^5P - 3^5D'$
4652.20	$1^5D - 1^5P'$	0.98	30	*..		~~Mn~~; pure
4651.31			20	*..		
4646.17			40	*14	.12	pure

Chrom. lt. in lem

450

450

800

600

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	Series	E.P.	Int.	Δm	dl	Remarks
4626.18	cont.		20	*..		pure
4616.11			25	*14	.13	pure
4613.36			15	..		La+
4600.73			20	*..		pure
4591.44			20	..		Fe
4565.53			12	15	.13	pure? Ti+ $1^2P-1^3D'$ nearly
4412.28	$1^5D-1^5F'$	0.98	16	*..		pure
4391.77			18	34	.27	N, Mg+?
4384.99			20	25	.21	Fe+, Mg+
4373.26			8	*..		pure
4371.32			20	*..		pure
4359.66			20	19	.16	Y+ $1^3D-1^3P'$
4351.82			60	35	.28	Fe+ $2^4P-1^4D'$
4351.06			20	..		Mg $1P-5D$
4344.52			40	26	.21	Ti+ $1^2D-1^2D'$
4339.74			20	79	.52	Hγ
4339.46			40			Hγ
4337.58			30	58	.41	Ti+ $1^2D-1^2D'$
4514.50	1^7P-2^7D	2.88	8	25	.21	Fe+ $2^4F-1^4F'$
4491.68			3n	40	.31	Fe+ $2^4F-1^4F'$
4475.36			8n	*..		pure
4129.21	1^7P-2^7D	2.88	20n	..		Ba+ 1^2P-2^2D
4111.67 4110.87			20n	15	.13	V $1^6D-2^6D'$
4098.18 97.96 97.65			20n	30	.24	Ca 1^3D-4^3F

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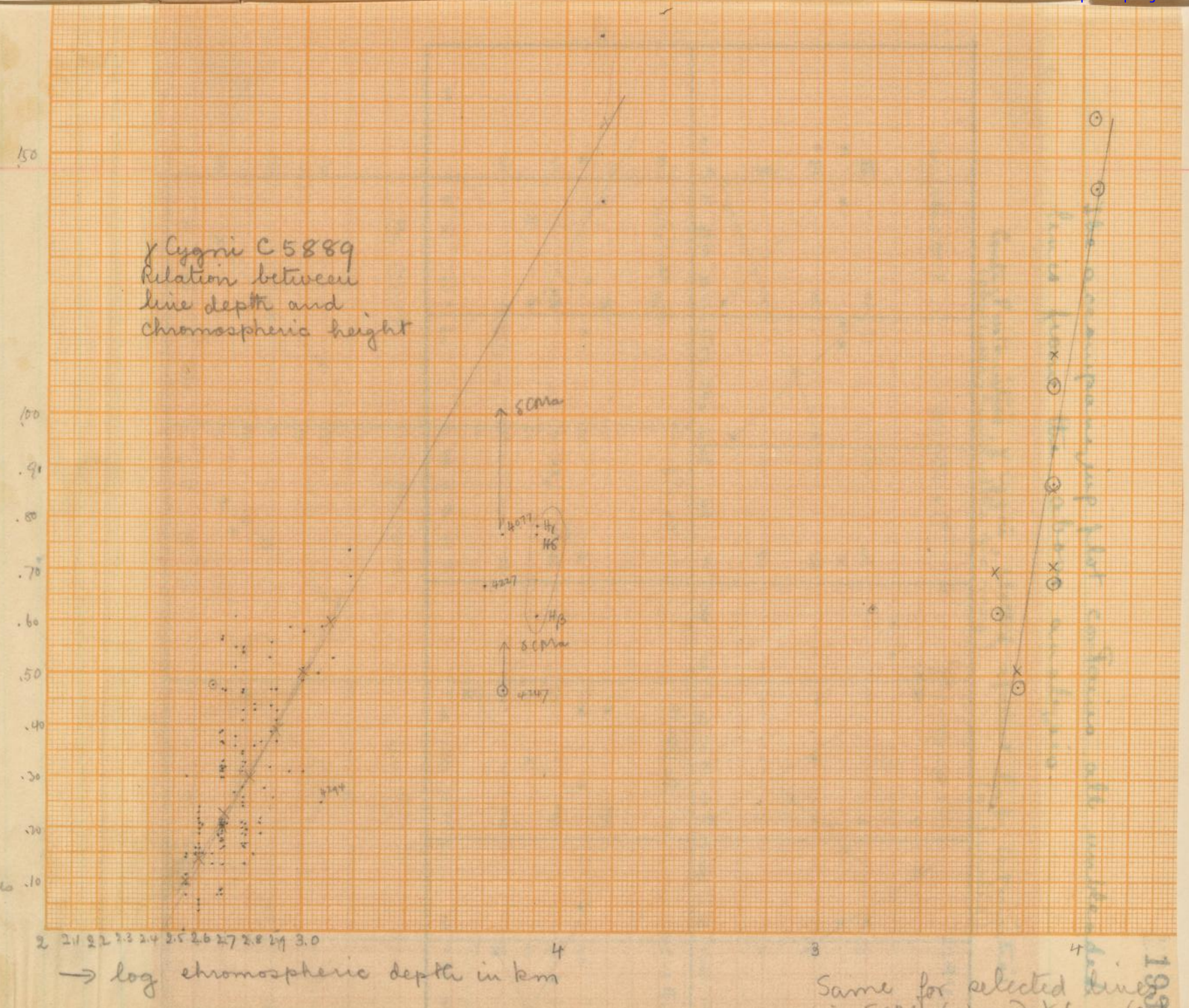
Analysis of γ Cyg spectrum

Manganese	Series	EP	Int.	Δm	dl	Remarks	
4034.49	$^6S-^6P$	0.0	100R	*32	.26	pure	750
4033.07			150R	*47	.35	pure	750
4030.76			200R	*56	.470	pure	750
4083.64	$^6D-^6D'$	2.16	12	*21	.18	pure	400
4082.95			12	..			
4079.43			10	77	.51	Sr+ $^2S-^2P$	
4079.24			12				
4058.94			10	*13	.11	Co, not very imp?	500
4055.55			20	⊗39	.30	Ti " " "	600
4048.76			15	*19	.16	pure	600
4041.37			50r	*31	.25	pure	600
4035.73			15	32	.26	V+	
4018.11			20	*16	.14	Pure	400
4823.52	$^8P-^8S$	2.29	50	19	.16	Y+ $^3F-^3D'$	
4783.43			50	*..		pure	
4754.04			50	19	.16	?	
Lowgd Lanthanum							
4141.71	$^3D-^3D'$	0.0	10	*..		pure	
4031.70			20	56	.40	Mn + preponderates	
3988.53			30	*20	.17	pure	
3921.54			10	..		-	
3886.34			15	..		-	
4724.39	$^3P-^3D'$	0.39	5	..		Y+, Mn, see above	
4613.39			4	..		Cr $^5D-^5P'$	
4526.12			5	34	.27	Ba+ $^2P-2^2S$	

Cont. on p. 212

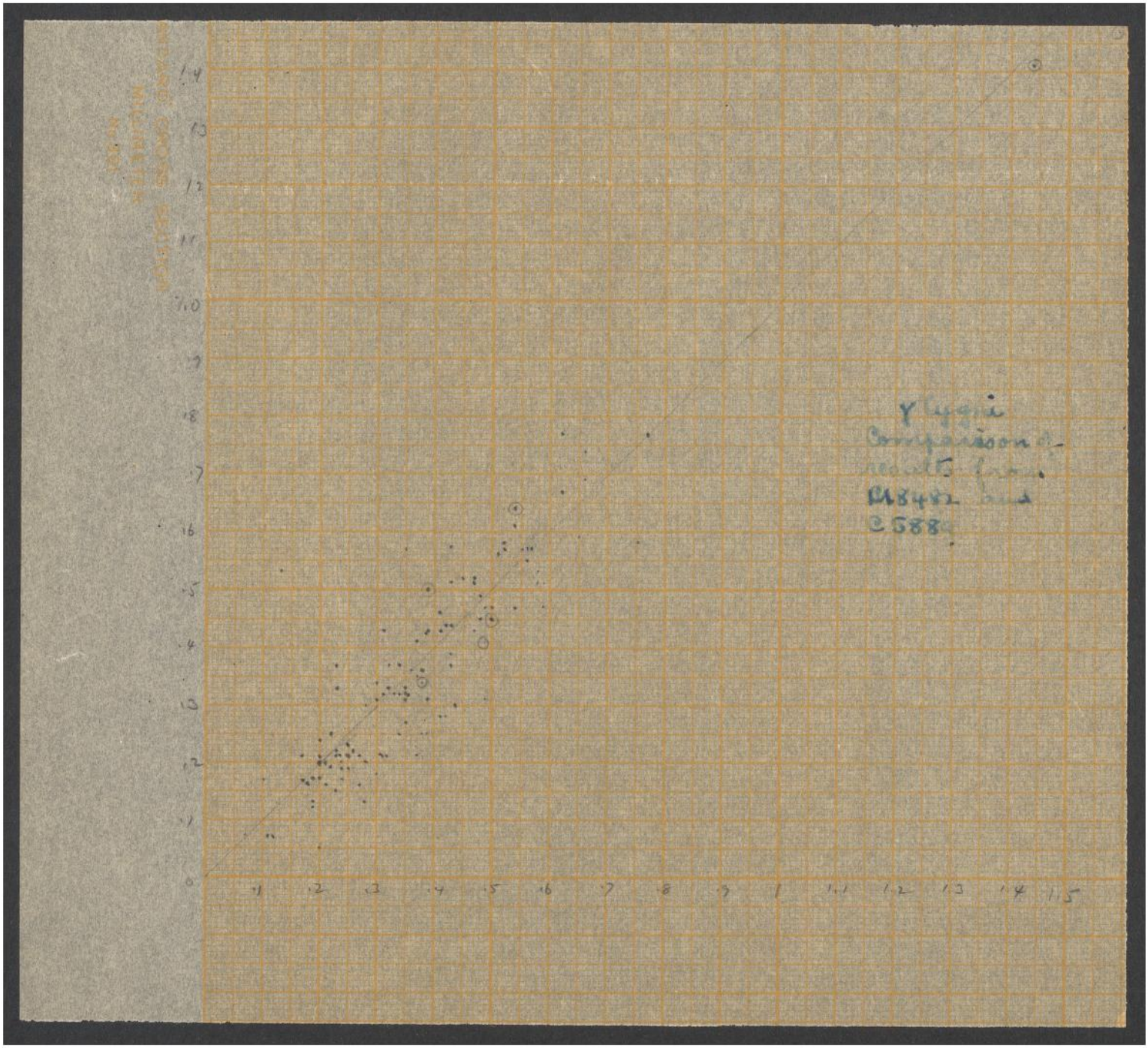
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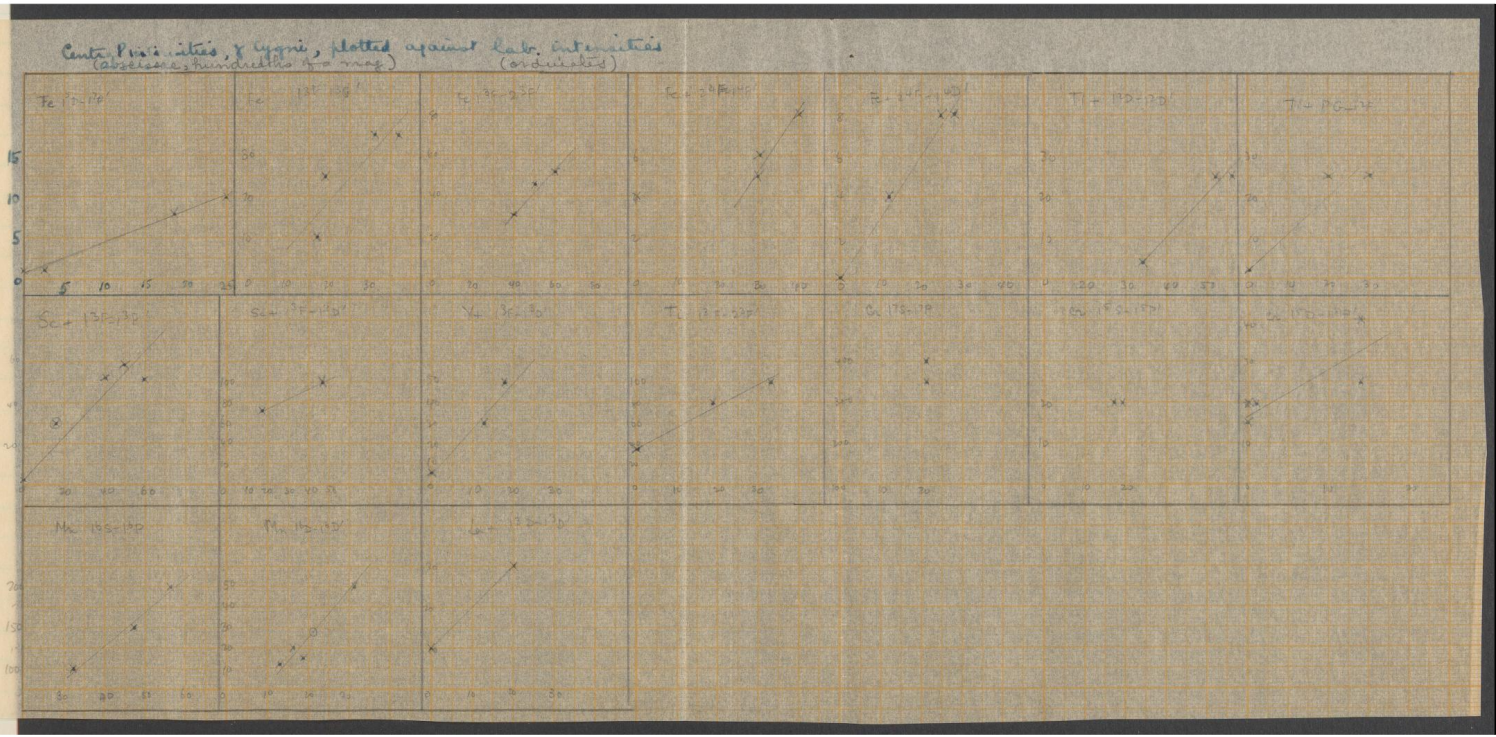


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The accompanying plot contains all unblended lines from the above analysis.

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1924phae.proj.11012

Spectrum of Betelgeuse with 1, 2, 3, 4 prisms.

1 prism λ 3875 , λ.
2 prism C 6423
3 prism λ 7972
4 prism C 1043

No.	Line Ident.	4 pr.	3 pr.	2 pr.	1 pr.	Remarks
1				✓	✓	
2				✓	✓	
3				✓	✓	
4				✓	✓	
5				✓	✓	
5a				✓	✓	
6				✓	✓	
7				✓	✓	
8				✓	✓	
9				✓	✓	almost double on 2 pr. " " " 1 pr.
10				✓	✓	
11				✓	✓	
12				✓	✓	d on 2 pr
13				✓	✓	
14				✓	✓	
15				✓	✓	
16				✓	✓	hardly res. on 1 pr.
17				✓	✓	
18				✓	✓	hardly res. on 1 pr
19				✓	✓	
20				✓	✓	
21				✓	✓	
21a				✓		
22			✓	✓	✓	21a just res on 2 pr
23			✓	✓	✓	
24			✓	✓	✓	24 just res on 1 pr, d on 3 pr
25				✓	–	26 is d on 1 pr

not recorded, spectrum faint

not recorded, spectrum faint

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No.	Line ~~Ident.~~	Ident.	4 pr	3 pr	2 pr	1 pr	Remarks
25a				✓			
26				✓	✓	✓	
26a				✓	✓		just res on 3
27				✓	✓	✓	barely res on 1
27a				✓			just res on 3
27b				✓			
27c				✓	✓		
28				✓	✓	✓	
28a				✓			just res on 3
28b				✓	✓		barely res on 3, barely on 2
29				✓		✓	
29b				✓	✓		barely res on 3, wide not res on 2, barely res on 1
29a				✓		✓	
29c				✓			
30				✓	✓	✓	
30a				✓			
30b				✓			barely res on 3
31				✓	✓	✓	
31a				✓	✓		barely res on 3, barely on 2
32				✓	✓	✓	
a				✓			barely res on 3
b				✓			barely res on 3
c				✓			just res on 3
33				✓	✓	✓	just res
a				✓			on 3
b				✓			
34			✓	✓	✓	✓	wide; unres pair? 3 and 4
34b				✓			
34c				✓			
34a			✓	✓			

not recorded, spectrum faint

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 Betelgeuse

No.	Line	Ident.	Prism 4 w	3	2	1	Remarks	No
35			✓	✓	✓	✓	almost d on 3	46
36			✓	✓	✓	✓		46
36a				✓			just res on 3	47
37			✓	✓	✓	✓		47
37a				✓			barely res on 3	47
37b				✓				47
38			✓	✓	✓			47
38a				✓			are 38a, b spurious?	48
38b				✓				48
39			✓	✓	✓	✓		48
39c				✓			barely res on 3	48
39b				✓				49
39a				✓			barely res on 3	49
40			✓	✓				50
41			✓	✓	✓	✓	barely res on 1	50
42			✓	✓	✓	✓		51
42a				✓			barely res on 3	51
42b				✓				52
42c				✓				53
42d				✓	✓			53
42e				✓				53
42f			?	✓				54
43			✓	✓	✓	✓	barely res on 3	54
43b				✓				54
43a				✓				54
44			✓	✓	✓	✓	w on 3, unres pair? w on 2	54
45			✓	✓	✓	✓		56
45a			w	✓	✓			56
45b				✓				56
46			✓	✓	✓	w		57

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No.	Line	Ident.	Prisms 4	3	2	1	Remarks
46b				✓			barely res on 3
46a				✓			
47			✓	✓	✓	✓	
47a				✓	✓	✓	
47b				✓			four barely res dips here (3) spurious?
47c				✓			
47d				✓	✓		unres on 2
48			✓	✓	✓	✓	
48b			✓	✓	✓		barely res on 4, barely on 2
48a				✓			
48c				✓			barely res on 3
49			✓	✓	✓	✓	49 d? on 3
49a				✓			
50			✓	✓	✓		
50a				✓			
51			✓	✓	✓		much detail on 3, 51 not res in 1
52			✓	✓	✓	✓	
52a				✓			
53			✓	✓	✓	✓	
53a				✓			
53b				✓			
54			✓	✓	✓	✓	
54a				✓			
54b				✓	✓	✓	barely res on 3
54c				✓			
54d				✓			barely res on 3
56			✓	✓	✓	✓	
56a				✓	✓		barely res on 2
56b			✓	✓			
57			✓	✓	✓	✓	

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 Betelgeuse

No.	Line	Ident.	Prism 4	3	2	1	Remarks	No
57a			✓	✓				71a
57b				✓				71b
58			✓	✓	✓			72
58a				✓	✓			73
58b				✓				74
58c				✓				75
59			✓	✓	✓	✓	just res on 3	75
59a				✓				75
59b				✓	✓		not res on 2	76
60			✓	✓	✓	✓		76a
60a			✓	✓				76b
61			✓	✓	✓		. defect on 1	76c
62			✓	✓	✓	✓		77
62a				✓			just res on 3	78
62b				✓				79
63			✓	✓	✓	✓		80
63b				✓	✓			80
63a			✓	✓				81
64			✓	✓	✓	✓		82
64b				✓				83
64a				✓				84
65			✓	✓	✓	✓	d? on 3, w on 2.	85
65a				✓			barely res on 3	85
66			✓	✓	✓			86
67			✓	✓	✓	✓		87
68			✓	✓	✓	✓		88
68a			✓	✓	✓			89
69				✓	✓			90
70				✓				91
71			✓	✓		✓		92

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No.	Line	Ident.	Prisms 4	3	2	1	Remarks
71a				✓			
71b				✓			
72				✓			
73			✓	✓		✓	
74				✓			
75			✓	✓		✓	
75a				✓			
75b				✓			
76			✓	✓		✓	
76a				✓			
76b				✓			
76c				✓			
77				✓			
78			✓	✓		✓	
79			✓	✓		✓	
80			✓	✓		✓	barely res on 1
80a				✓			
81				✓			
82				✓			
83			✓	✓		✓	
84				✓		✓	barely res on 1
85				✓			
85a				✓			
86				✓		✓	
87				✓			
88				✓			just res on 3
89				✓			
90				✓			
91				✓		✓	
92				✓			

no tracing made

no records — no tracing

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1924phae.proj.1104P

 Betelgeuse

No	Line	Ident	Prism 4	3	2	1	Remarks
93				✓			
94				✓		✓	
94a				✓		·	barely res on 3
95				✓		✓	
95a				✓			barely res on 3
96				✓			
97				✓			
98				✓			
98a				✓			barely res on 3
99				✓			barely res on 3
100				✓			
101				✓			
102				✓		✓	
102a				✓			
103				✓			
104				✓		✓	
105				✓		✓	
105a				✓			
105b				✓			
106				✓			barely res on 3
107			✓	✓		✓	
108			✓	✓			
108a				✓			barely res on 3
109			✓	✓	✓	✓	
110				✓			
111			✓	✓			
112				✓			
113				✓			
114			✓	✓		✓	
115			✓	✓	✓	✓	

no tracing made

no tracing made

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1924phae.proj.11017

No	Line	Ident	Prisms 4	3	2	1	Remarks
116				✓			
117				✓			barely res on 3
118				✓			
119				✓			
120				✓			
121			✓	✓	✓	✓	
122			✓	✓			
123				✓			
124			✓	✓		✓	barely res on 3
125				✓	✓		
125a				✓			
126			✓	✓	✓	✓	wide, d? on 3
127				✓			
128			✓	✓		✓	
129				✓	✓		
129a				✓	✓		barely res on 3, barely on 2
130				✓	✓		
130a			✓	✓			barely res on 3, res on 4
131			✓	✓		✓	
132			✓	✓	✓		
133				✓			
134				✓			
135			✓	✓			
136			✓	✓	✓	✓	
136a			?	✓		—	barely res on 3, spurious? res on 4, different max.
137				✓			
138			✓	✓	✓		
139			✓	✓			
139a				✓			
140			✓	✓	✓		no tracing

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 Betelgeuse

No.	Line	Ident.	Prism 4	3	2	1	Remarks
141				✓	✓		
142			✓	✓	✓		
142a				✓	✓		
143			✓	✓			
144			✓	✓			barely res on 3
144a				✓			barely res on 3
145				✓	✓		barely res on 2
146			✓	✓			barely res on 4
147			✓	✓			
148			✓	✓	✓	tracing	d on 3
148a				✓		tracing	barely res on 3
149			✓	✓	✓		
150			✓	✓	✓		just d on 2
151			✓	✓			
152				✓		no record.	
153			✓	✓	✓		
153a				✓			just res on 3
153b				✓			
153c				✓			
154			✓	✓	✓		
154a				✓			
154b				✓			just res on 3
154c				✓			
154d				✓		no record.	
154e				✓			just res on 3
155			✓	✓	✓		
155a				✓			
155b				✓			just res on 3
156			✓	✓			
157			✓	✓	✓		
157a			✓	✓			

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Prisms

No	Line	Ident	4	3	2	1	Remarks
158			✓	✓	✓		triple on 3
159			✓	✓			
160			✓	✓	✓		barely res on 2
161			✓	✓	✓		triple ? contour on 3
161a,b			✓✓	✓✓			just res on 4, barely on 3
162				✓	✓		
162a				✓			
162b			✓	✓			
163			✓	✓	✓		
163a				✓			
163b				✓			
164			✓	✓	✓		
164a			✓	✓	✓		
164b			✓	✓			
164c				✓			just res on 3
165			✓	✓	✓		
165a			✓	✓			
165b			✓	✓	✓		barely res on 3, barely on 2
165c			✓	✓	✓		
166			✓	✓			
167				✓	✓		
167a				✓			
168			✓	✓			
168a			✓	✓			
169			✓	✓	✓		
169a				✓			
170			✓	✓	✓		d ? on 3
170b				✓			
170a			✓	✓			
171			✓	✓	✓		
171a			✓	✓			

no tracing

no record.

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1924phae.proj.11001P

204 Betelgeuse

No.	Line	Ident.	Prisms 4	3	2	1	Remarks
172				✓			
172a				✓			
173				✓	✓		
173a				✓			
174				✓	✓		
174a				✓			
175				✓	✓		d on 3
176				✓	✓		
176a				✓			} barely res on 3
176b				✓			
177				✓	✓		barely res on 2.
178				✓	✓		
179				✓			
a				✓			
b				✓			} barely res on 3
c				✓			
d				✓			
180				✓	✓		
180a				✓	✓		deflect on 3
181				✓			
182				✓	✓		
182a				✓	✓		
183				✓	✓		
a				✓			
b				✓			} barely res on 3
c				✓			
d				✓			
184				✓	✓		
a			✓	✓			
b			✓	✓			

no tracing — no record — no tracing — no record

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No.	Line	Ident.	Prisms 4	3	2	1	Remarks
185			✓	✓	✓	—	triple on 3
186			✓	✓	✓	✓	
186a			✓	✓			
187			✓	✓	✓		
a			✓	✓			
b			✓	✓			
188			✓	✓	✓	✓	triple on 3, triple cont on 4?
a				✓			
b				✓			
189			✓	✓	✓		barely res on 2
190			✓	✓	✓	✓	
a			✓	✓			} barely res on 3
b				✓			
191			✓	✓			
192			✓	✓	✓		
193			✓	✓			
194			✓	✓			
195			✓	✓	✓	✓	
195a			✓	✓			
195b			✓	✓			barely res on 3
196			✓	✓	✓		barely res on 2
196a			✓	✓	✱		
196b			✓	✓			barely res on 3, well on 4
197			✓	✓	✓	✓	
198			✓			✓	
199			✓				
200			✓			✓	
201			✓				
202			✓	no tracing			
203			✓			✓	

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1924mae.proj.1101P

206 Betelgeuse

Prism

No.	Line	Ident.	4	3	2	1	
204			✓		✓	✓	
205			✓		✓	✓	
206			✓				
206a			✓				
207			✓		✓	✓	
207a			✓		✓	.	barely res on 2
208			✓		✓	✓	
208a			✓				
209			✓				
209a			✓		✓		barely res on 2
210			✓	+	✓	✓	
210a			✓				
210b			✓	no tracing			} barely res on 4
211			✓		✓		double on 4 barely res on 2
213			✓		✓	✓	
213a			✓	—			barely res on 4
214			✓				+
216			✓	✓	✓	✓	
217			✓	} ✓	✓	✓	d on 4
217a			✓				+
218			✓		✓		d? on 4
218a			✓				?
218b			✓				
219			✓	✓	✓	✓	
219a			✓		—		
219b			✓	✓			
219c			✓	✓			barely res on 4
219d			✓		+		barely res on 4
220			✓	✓	no tracing	✓	not res, but double cont, on 1
220a			✓	✓		}	

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Prisms

No.	Line	Ident.	4	3	2	1	
220b			✓	✓			
c			✓	✓			barely res on 4
d			✓	✓			barely res on 4
221			✓	✓		✓	
221a			✓				
221b			✓				barely res on 4
222	4254		✓	✓		✓	d? on 3
223	4251			✓		✓	
224	4247			✓		✓	
225	4240			✓		✓	
225a	4239			✓		✓	barely res on 1
226	4234			✓	tracing	✓	
227	4227			✓		✓	
228	4216			✓		✓	
229	4210		no tracing			✓	
230	4205					✓	
230a	4201					✓	
231	4192					✓	
231a	4188				no	✓	
231b	4182					✓	
232a	4178					✓	
233	4173			tracing	✓	✓	
234	4166				✓	✓	
234a	4162				✓	✓	
235	4159		✓		✓	✓	
235a	4155-7		✓		✓	✓	
235b	4152		✓	no	✓	✓	
236	4150		✓		✓	✓	triple on 4
236a	4148		✓		✓	✓	barely res on 1 double on 4
237	4144		✓		✓	✓	double on 4
237a	4140		✓		✓	✓	barely res on 1, double on 4
237b	4137		✓		✓	✓	barely res on 1, triple on 4

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 Betelgeuse, various prisms

No.	Line	Ident.	4 Prisms	3	2	1	Remarks
237c	4135		✓		✓		
238	4132		✓		✓	✓	
238a	4130		✓		✓	✓	
238d	4128		✓		✓		
238e			✓		✓		
238c	4126		✓		✓		
238b	4124		✓		✓		
239	4122		✓		✓	✓	
239a	4119		✓		✓	✓	
240	4117		✓		✓	✓	
240b	4115		✓		✓		
240c			✓		✓		
240a	4113		✓		✓	✓	
240c			✓		#		
240d			✓				
240e			✓				
241	4110		✓		✓	✓	
241c	4109		✓		✓		
241d	4108		✓				
241b	4107		✓	+ tracing			
241d	4105		✓		✓		
242	4102		✓	no	✓	✓	
a	4101		✓				
b	4100		✓				
c	4098		✓				
d	4097		✓		✓		
243	4096		✓		✓	✓	
a			✓				
b			✓				
244	4093		✓		✓	✓	

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No.	Line	Ident	Prisms 4	3	2	1	Remarks
244a	4090		✓		✓		
b	4089		✓				
245	4087		✓		✓	✓	wide on 2
246	4082-4		✓		✓	✓	
247	4078		✓		✓	✓	
a	4077		✓				
b			✓				
c	4075		✓				
d	4073		✓				
248	4072		✓		✓	✓	
248a	4069		✓		.		
249	4068		✓		✓	✓	
249a	4067		✓				
250	4064		✓		✓	✓	
251	4059		✓		✓	✓	defect in 4
252	4055		✓		✓	✓	
252a	4051		✓		✓	✓	
253	4046		✓		✓	✓	
254	4041		✓	+ tracing	✓	✓	
254a			.		✓	✓	
255	4035				✓	✓	d on 2
256	4031			no	✓	✓	
257	4029				✓	✓	
258	4025				✓	✓	
259	4022				✓	✓	
260	4018				✓	✓	
261	4015	end			✓	✓	d on 2
262	4013				✓	✓	
263	4010				✓	✓	
264	4005				✓	✓	
265					✓	✓	
266	3999			end		✓	d on 1
267	3990					✓	d on 1
268	3982					✓	
269	3978					✓	
270	3970					✓	

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γ Cygni. analysis of spectrum, continued

Comparison with Russell & Moore's list of widened lines, Ap. J., 63, 1, 1926

unblended lines (-eff) only used

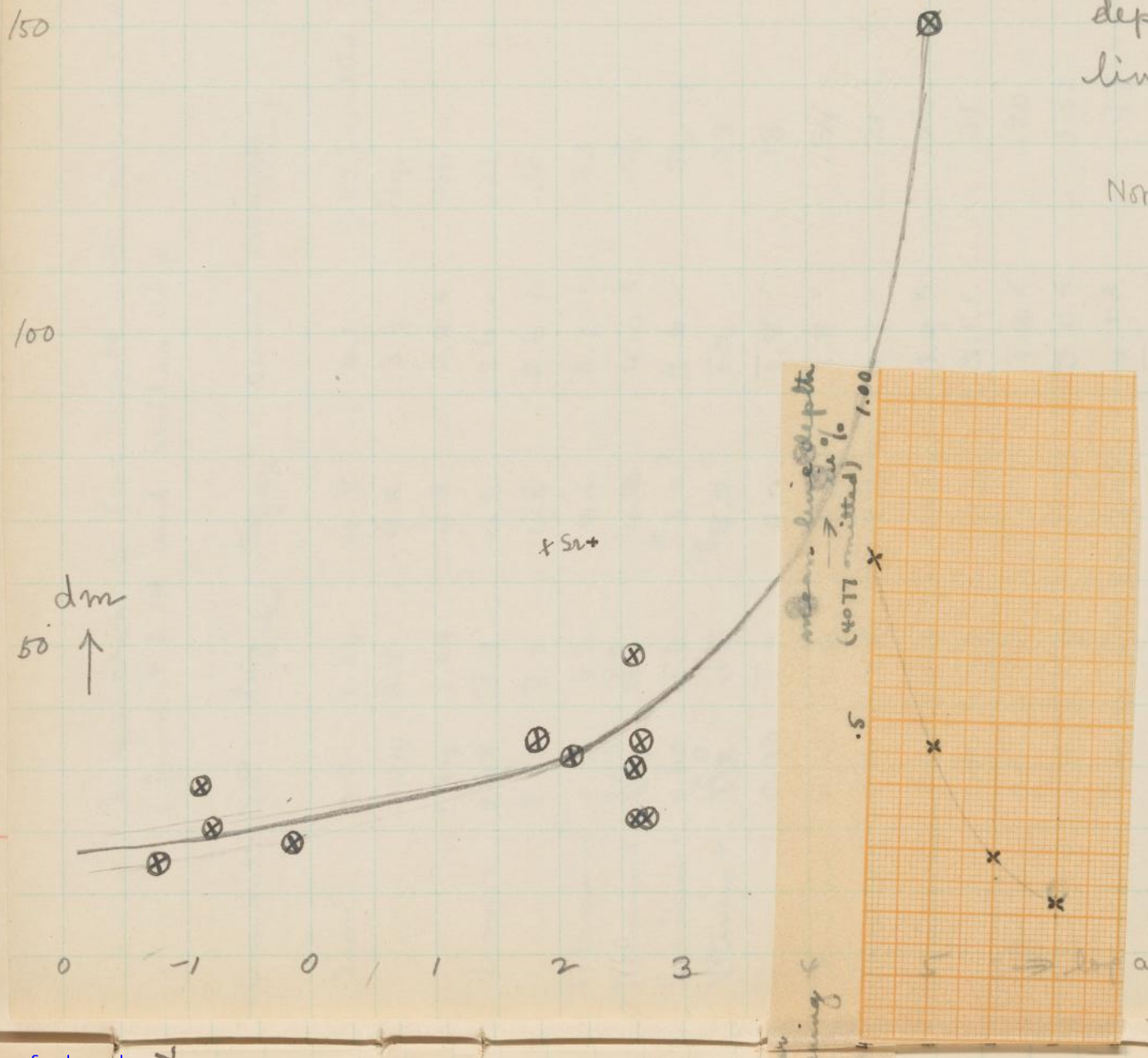
Line	Elt.	Widening (R.&M.)	Δm from p.
3933	Ca+	4	1.5
3970	Ca+	4	1.5
4227	Ca	3	.67
4415	Fe	1	bl.
4404		1	.25
4383		2	.25
4325		2	.31
4307		1	.28
4271		2	.37
4202		1	–
4143		1	bl.
4132		1	bl.
4071		2	.31
4063		2	.46
4046		2	.51
4620		1	.–
4077	Sr+	1	.77

Widening	Means 1	2	3	4	In percents 1	2	3	4
	.25	.25	.67	1.50	.20	.20		
	.28	.31			.23	.25		
		.37				.29		
		.31				.25		
		.46				.35		
		.51				.37		
Mean	.26	.37	.67	1.50	.22	.29	.46	.75

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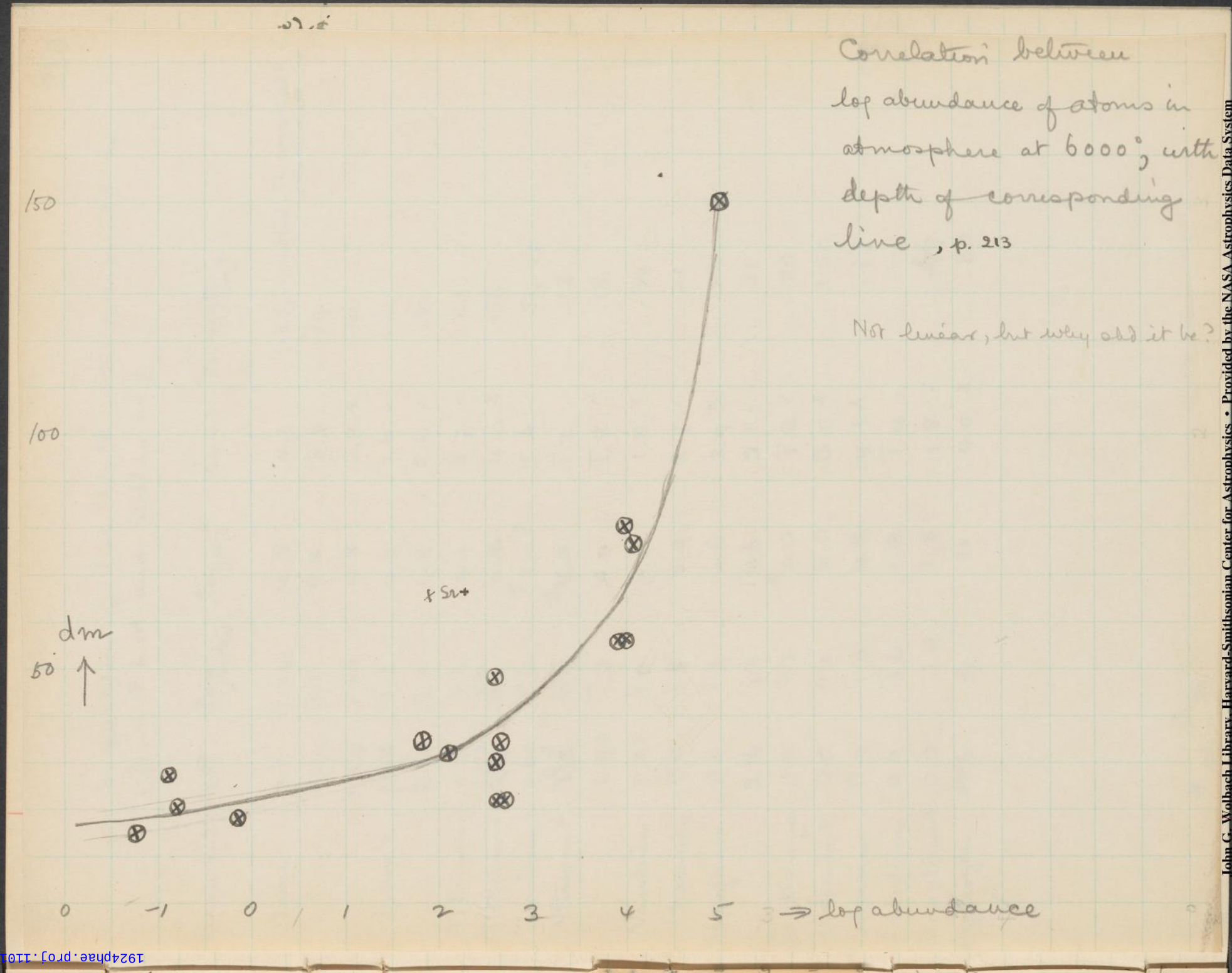
Correlation between
log abundance of atoms in
atmosphere at 6000°, with
depth of corresponding
line, p. 213

Not linear, but why odd it be?



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Comparison of line depth with computed n_r
(from F & M and Stellar at.)

Element	E.P.	$\log n_r$	$\log a_r$	sum	Δm (str. line)	
Iron	0.0	$\bar{1}.34$	4.8	4.1	[.25] omitted	A weak alt. line, see Russell, note in S.A.
	0.94	$\bar{2}.5$	4.8	3.3	.19	
	1.54	$\bar{2}.04$	4.8	2.8 x	.46	
Iron +	2.68	$\bar{3}.8$	4.8	2.6 ✓	.21	
	2.82	$\bar{3}.8$	4.8	2.6 ✓	.30	
Titanium	0.0	$\bar{2}.6$	4.1	2.7 ✓	.33	
Titanium +	~~1.08~~	~~$\bar{1}.9$~~	4.1	4.0 x	.56	
Scandium +	0.60	$\bar{1}.6$	*3.0?	2.6 ✓	.51, .47	
Yttrium +	~~0.0~~	~~$\bar{0}.2$~~	*0.0	$\bar{1}.2$	.28	
	0.93	$\bar{1}.8$	0.0	$\bar{1}.8$ ✓	.18	
Vanadium	0.28	$\bar{2}.8$	3.0	1.8 ✓	.34	
Chromium	0.0	$\bar{2}.8$	3.9	2.7 ✓	.21	
Manganese	0.0	$\bar{1}.3$	4.6	3.9 x	.56	
	2.16	$\bar{3}.5$	4.6	2.1 ✓	.31	
Lanthanum	0.0	$\bar{1}.2$	*0.0	$\bar{1}.2$ ✓	.20	
Calcium +	0.0	0.0	5.0	5.0 x	1.50	
Calcium	0.0	$\bar{1}.3$	4.8	4.1 x	.77	
Strontium	0.0	$\bar{3}.6$	1.8	$\bar{1}.4$	–	
Strontium +	0.0	0.0	1.8	1.8 ✓	.66	
Hydrogen	13.6	$\bar{7}$	11	4.0 x	.80	

* estimate

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γ Cygni

Comparison of neutral and ionized lines

Line (strongest pairs)	Δm above	Δm	4 Δm	d log n (opposite) for $10^{-5.7}$ atm.	Adopted I.P.	E.P.	
Fe	.51				8.15		
		+.23	.92	1.20			6.0
Fe+	.28				13.0	2.82	
Ti	.33				6.5	0.0	
		+.25	1.00	1.25			5.3
Ti+	.58				12.5		
Sc	..					0.0	
		.52	>2.08	3.70			3.7
Sc+	.52				12.5	0.0	
Ca (ult)	.67					0.0	
Ca (sub)	.38	+93	.3.72	3.00			7.8
Ca+	1.50	+1.12	.4.48	4.7		0.0	
Sr	..					0.0	
		+.77	>3.08	3.00			4.8
Sr+	.77					0.0	

$10^{-5.7}$ atmospheres satisfies Fe+ and Ti+ fairly well.

[Capella, from H.R. 28 $10^{-4.4}$ atm.

Ca (ult.)	.57	1.08	.4.32	1.70 *
Ca+	1.65			
Sr	..			
Sr+	.36	.36	.1.44	1.40
Ti = Ti+ about			0.0 ~~>.84~~	0.0 ~~1.40~~
Fe	.62	[.42]	[1.68]	2.20
Fe+	?.20			

log Ratio in roughly computed R_e = 1.3
log " " luminosity " = 2.6 if $p \propto \sqrt{g}$
diff of mag. = 10.4
or if $p \propto g$, ratio in luminosity = [1.3], and in m = 5.2]

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