

ROYAL OBSERVATORY, GREENWICH.

SPECTROSCOPIC OBSERVATIONS

MADE AT THE

ROYAL OBSERVATORY, GREENWICH,

1882.

OBSERVATIONS OF SOLAR PROMINENCES, MADE WITH THE SPECTROSCOPE,

POSITION-ANGLES and HEIGHTS of SOLAR PROMINENCES, observed with the SPECTROSCOPE, and OBSERVATIONS of BRIGHT LINES in their SPECTRA, made at the ROYAL OBSERVATORY, GREENWICH, in the Year 1882.

Note.—The position-angles reckoned from the north pole of the Sun's axis in the direction N., E., S., W., N., are given for the two extremities of the prominence.

The extreme height in seconds of arc is given for each prominence. Where the estimated brightness of any of the bright lines seen is given, the *average* brightness of the line has been estimated in terms of the brightness of the corresponding part of the solar spectrum. The lines are usually fainter at the extremity than at the base. Where the estimated breadth is given, the *average* breadth of the line has been estimated in terms of the breadth of the corresponding dark line in the solar spectrum, except in the case of the bright line D₃, the breadth of which is estimated in terms of the dark line C. The bright lines are usually narrower at the extremity than at the base.

The "Half-prism" Spectroscope with a train of two "half-prisms" was used throughout. For viewing the prominences and chromosphere the spectroscope is reversed end for end, the slit and eye-piece being interchanged, so that the pencil is incident on the oblique face and emerges at the perpendicular face of each "half-prism." Thus the breadth of the spectrum-lines, considered as monochromatic images of the slit, is diminished, and greater purity of spectrum is obtained. In order to view a prominence in its just proportions, the breadth can be afterwards magnified by means of a small "half-prism" (direct-vision) placed between the eye-piece and the eye.

Observer, M.

Greenwich Mean Solar Time, 1882.	Position-Angle from Sun's Axis.	Height in Seconds of arc on the C Line.	REMARKS.
Mar. ^{d h m} 1. 23. 33	^{° ' "} 24. 34 — 29. 34	" 24	Faint jet. Not seen in the first search.
22. 51	39. 4 — 44. 34	72	Fine bright prominence; much detail.
23. 32	76. 34 — 81. 34	36	Partly detached.
23. 31	102. 34 — 104. 14	29	Bright straight jet.
22. 42	104. 44 — 108. 54	48	Forked jet.
23. 0	217. 54 — 220. 4	29	Straight jet.
23. 3	225. 54 — 231. 34	43	Forked prominence.
23. 2	241. 34 — 242. 14	22	Straight jet.
22. 58	249. 4 — 249. 14	17	} Two small but bright elevations of the chromosphere.
22. 58	250. 34 — 252. 4	17	
22. 58	252. 14 — 255. 4	29	Straight faint jet.
22. 57	264. 34 — 267. 54	24	Straight jet.
22. 56	274. 14 — 280. 14	19	Low bank; irregular upper edge.
22. 55	282. 34 — 286. 14	19	Small faint prominence.
22. 52	339. 24 — 340. 4	43	Very narrow jet.
			The chromosphere averaged 8" in height. Definition variable; wind high; observation frequently interrupted by cloud.
			The entire limb of the Sun was examined twice with the slit radial on the C line only.
Mar. 3. 0. 33	34. 8 — 40. 18	55	Fine bright prominence.
0. 35	63. 28 — 67. 48	77	Fine bright prominence; portions detached; much detail.
0. 38	75. 48 — 78. 38	29	Faint; partly detached.
0. 39	81. 18 — 83. 28	29	Bright; partly detached.
0. 41	86. 48 — 87. 38	19	Straight jet.
0. 45	121. 48 — 124. 8	17	Partly detached; faint.
0. 43	130. 58 — 134. 3	22	Low bank.
0. 47	149. 43 — 150. 18	19	Partly detached.
0. 50	157. 42 — 157. 59	19	Straight jet.
0. 52	193. 43	24	
1. 12	220. 58 — 223. 18	58	Fine prominence; partly detached.
1. 11	236. 58 — 238. 8	24	
1. 10	239. 48 — 240. 8	19	
1. 10	241. 3 — 242. 48	26	
1. 9	243. 48 — 245. 8	19	
1. 8	247. 58 — 249. 48	43	Partly detached.
1. 5	298. 4 — 301. 23	26	
1. 4	301. 31 — 305. 18	24	
			Observations frequently interrupted by cloud. Part of the limb of the Sun, viz., from 30° to 194°, and from 221° to 305°, was examined once with the slit radial on the C line only.
Mar. 13. 23. 20	14. 21 — 15. 21	34	Faint.
23. 21	16. 51 — 19. 11	77	Faint.
23. 22	60. 51 — 62. 1	29	Partly detached.
23. 23	124. 1 — 125. 41	19	
23. 27	133. 21 — 134. 11	19	Small straight jet.
23. 27	139. 11 — 142. 51	38	
23. 28	162. 21 — 163. 11	48	Faint straight jet.
23. 29	167. 11 — 168. 41	36	Straight jet.
23. 30	233. 51 — 236. 21	31	
23. 14	301. 51 — 305. 11	29	Long bank with two jets.
23. 18	308. 21 — 320. 31	96	Fine tall prominence; much detail.
			The entire limb of the Sun was examined once with the slit radial on the C line only.

Greenwich Mean Solar Time, 1882.			Position-Angle from Sun's Axis.		Height in Seconds of arc on the C line.	REMARKS.		
d	h	m	°	'	''			
Mar. 15.	2. 22		60. 57	—	63. 37	43	Faint.	
	2. 23		72. 57	—	74. 47	34		
	2. 23		76. 37	—	78. 31	34	Bright straight jet.	
	2. 24		101. 47	—	104. 7	38	Much broken.	
	2. 24		104. 27	—	108. 57	43	Very brilliant; in rapid motion.	
	2. 25		112. 27	—	113. 29	29	Very bright.	
	2. 26		140. 47	—	143. 37	24	Faint.	
	2. 27		165. 57	—	168. 47	24	Faint; partly detached.	
	2. 27		222. 17	—	224. 7	38	Straight jet.	
	2. 28		274. 47	—	279. 17	38		
	2. 8		302. 37	—	306. 37	36	Faint.	
	2. 3		312. 57	—	321. 57	106	Fine bright prominence; much detail. The entire limb of the Sun was examined once with the slit radial on the C line only.	
Mar. 15.	22. 13		69. 31	—	72. 21	48	Bright prominence.	
	22. 15		130. 21	—	132. 1	36	Straight jet.	
	22. 16		166. 21	—	167. 21	34	Faint straight jet.	
	22. 20		220. 41	—	223. 51	41	Bright straight jet.	
	22. 21		245. 51	—	247. 1	22	Small jet.	
	22. 5		270. 41	—	290. 51	67	Fine bright prominence; partly detached; many jets.	
	22. 6		313. 41	—	321. 1	180	Very fine prominence; great detail; bright. The entire limb of the Sun was examined once with the slit radial on the C line only.	
Mar. 18.	1. 5		103. 25	—	109. 55	17	Low bank.	
	1. 3		117. 55	—	119. 25	19	A little tuft.	
	1. 1		123. 55	—	127. 15	31		
	0. 59		129. 15	—	132. 35	48	Much broken.	
	0. 58		132. 45	—	135. 5	41	Partly detached.	
	0. 57		160. 25	—	162. 35	48	Very faint.	
	0. 57		210. 45	—	212. 25	41	Faint; partly detached.	
	0. 55		280. 25	—	282. 55	22		
	0. 55		286. 15	—	295. 55	65	Height of greater part of prominence 29", but a jet at N. part rose to 65".	
	0. 52		320. 25	—	323. 45	29	Faint, but showing considerable detail. The entire limb of the Sun was examined once with the slit radial on the C line only.	
	Mar. 19.	23. 5		2. 49	—	4. 19	24	
		23. 6		22. 14	—	24. 49	19	Faint.
23. 7			25. 59	—	26. 39	24		
23. 8			54. 59	—	56. 49	24	Bright.	
23. 8			57. 39	—	61. 19	65	Much detail.	
23. 9			68. 9	—	69. 59	19	Bright; partly detached.	
23. 10			72. 19	—	73. 9	19		
23. 11			98. 49	—	100. 9	29	Bright; bending over to N.	
23. 12			106. 39	—	109. 39	19		
23. 13			110. 39	—	111. 59	48	Much broken; faint.	
23. 15			211. 19	—	212. 29	43	Much broken; faint.	
23. 17			267. 39	—	268. 49	24		
23. 18			292. 19	—	293. 49	19		
23. 0			295. 39	—	297. 19	24		
23. 1			312. 39	—	314. 49	24		
							The entire limb of the Sun was examined once with the slit radial on the C line only.	
Mar. 21.	0. 5		25. 13	—	26. 13	34	Very faint.	
	0. 7		51. 53	—	53. 13	34	Straight jet.	
	0. 8		72. 53	—	74. 3	29	Partly detached.	
	0. 10		138. 13	—	139. 18	29	Bright straight jet.	
	0. 11		158. 23	—	162. 53	46	Very faint.	
	0. 16		241. 13	—	242. 33	24		
						The entire limb of the Sun was examined once with the slit radial on the C line only.		
Apr. 1.	1. 26		19. 14	—	21. 34	41	Faint prominence.	
	1. 25		35. 34	—	40. 4	67	Fine bright prominence.	
	1. 21		67. 4	—	69. 14	24	Short bright jet.	
	1. 20		96. 34	—	98. 34	41	Faint.	
	1. 32		138. 4	—	139. 54	24		
	1. 31		199. 44	—	202. 44	36	Faint.	
	1. 29		224. 34	—	226. 4	26		
	1. 29		231. 34	—	249. 44	67	Very large, beautiful, and regular prominence.	
							The entire limb of the Sun was examined once with the slit radial on the C line only.	

OBSERVATIONS OF SOLAR PROMINENCES, MADE WITH THE SPECTROSCOPE,

Greenwich Mean Solar Time, 1882.			Position-Angle from Sun's Axis.		Height in Seconds of arc on the C line.	REMARKS.	
d	h	m	°	'	"		
Apr.	4.	0.22	39.5	—	41.5	41	Bright; partly detached.
		0.24	43.5	—	44.25	55	Bright; partly detached.
		0.25	104.45	—	106.5	26	
		0.30	272.45	—	273.45	22	
		0.20	331.45	—	332.15	17	
		0.21	336.45	—	338.25	22	
						The entire limb of the Sun was examined once with the slit radial on the C line only.	
Apr.	6.	1.46	16.13	—	17.23	24	Faint.
		1.40	78.43	—	82.3	41	Faint cloud; completely detached.
		1.43	197.23	—	200.3	53	Exceedingly faint.
		1.44	297.43	—	305.23	48	Brilliant prominence.
		1.45	333.43	—	335.33	41	Bright prominence.
						The entire limb of the Sun was examined once with the slit radial on the C line only.	
Apr.	7.	21.45	16.6	—	17.6	26	Straight jet; faint.
		21.44	66.56	—	67.36	29	Straight jet; very faint.
		21.43	72.46	—	74.36	19	Faint.
		21.42	102.6	—	104.6	19	
		21.58	139.56	—	144.46	55	
		21.52	251.36	—	255.6	34	
		21.49	293.26	—	293.36	29	Very narrow prominence. The C line wholly displaced towards the blue.
		21.48	302.56	—	305.56	29	
		21.48	308.36	—	309.56	19	
		21.47	334.6	—	336.26	29	
						The entire limb of the Sun was examined with the slit radial on the C line only.	
May	1.	1.45	22.50	—	24.30	34	Partly detached.
		1.44	37.20	—	41.50	36	Bright straight jet; no detail.
		1.43	55.50	—	57.30	22	Bright straight jet.
		1.41	103.30	—	104.20	34	Straight jet.
		1.41	113.50	—	115.50	34	Faint; partly detached.
		1.40	118.30	—	120.40	36	Partly detached.
		1.38	138.0	—	142.40	29	Forked prominence; considerable detail.
		1.37	163.30	—	166.30	19	
		1.35	298.0	—	299.20	22	
1.46	345.50	—	347.50	77	Fine tall prominence with considerable detail.		
						The entire limb of the Sun was examined once with the slit radial on the C line only.	
May	5.	0.39	17.52	—	21.2	31	Very faint.
		0.23	66.22	—	67.12	22	
		0.24	87.12	—	91.12	29	Bending over to the North.
		0.25	94.12	—	103.42	29	
		0.26	108.42	—	116.37	24	
		0.31	118.12	—	119.22	22	
		0.32	161.52	—	162.22	17	
		0.33	195.22	—	196.32	19	Very faint.
		0.34	199.52	—	202.12	34	
		0.35	219.12	—	222.42	43	
		0.37	223.12	—	229.32	41	
		0.38	304.2	—	309.12	34	
May	13.	1.3	71.42	—	76.2	41	Bright jet.
		1.3	77.2	—	85.22	60	Faint; considerable detail.
		1.4	89.22	—	92.22	36	Faint.
		1.4	103.12	—	108.12	55	Partly detached; much detail.
		1.5	112.32	—	118.22	19	Long low bank.
		1.6	154.22	—	156.42	50	Faint.
		1.10	216.22	—	219.42	36	Very faint.
		1.12	246.52	—	249.52	41	Very faint.
		1.13	294.32	—	298.22	79	Detached cloud; highest point 79", lowest 46".
		1.45	310.22	—	313.32	17	Straight jet.
						The entire limb of the Sun was examined with the slit radial on the C line only.	

Greenwich Mean Solar Time, 1882.			Position-Angle from Sun's Axis.		Height in Seconds of arc on the C line.		REMARKS.	
d	h	m	°	'	°	'	"	
May 16.	6.	7	18. 17	—	20. 47		24	Very faint.
	6.	8	64. 42	—	67. 47		67	Faint.
	6.	10	108. 32	—	114. 37		65	Forked prominence; considerable detail.
	6.	12	116. 12	—	119. 37		38	Faint; considerable detail.
	6.	13	131. 12	—	132. 27		34	Straight jet.
	6.	15	153. 2	—	156. 17		41	Exceedingly faint.
	6.	16	245. 32	—	246. 47		29	
	6.	17	283. 7	—	287. 2		34	Bright jet.
	6.	24	294. 37	—	297. 22		50	Very bright.
	6.	2	308. 42	—	312. 37		43	Straight jet.
6.	5	325. 22	—	326. 52		22	Small jet.	
								The entire limb of the Sun was examined with the slit radial on the C line only.
May 16.	6.	26	66. 2	—	69. 2		74	
	6.	27	109. 22	—	117. 12		43	
	6.	28	119. 27	—	123. 17		34	
	6.	30	249. 42	—	250. 42		17	
	6.	31	285. 17	—	288. 57		41	
	6.	32	295. 52	—	298. 22		50	Intensely bright.
	6.	18	306. 17	—	308. 7		24	
	6.	24	310. 7	—	314. 42		43	
	6.	25	326. 42	—	328. 2		29	
								The entire limb of the Sun was examined with the slit radial on the C line only.
May 16.	6.	38	67. 52	—	70. 12		74	
	6.	39	109. 42	—	117. 12		48	
	6.	40	119. 52	—	123. 7		29	
	6.	41	134. 42	—	135. 42		29	
	6.	42	283. 12	—	287. 32		43	
	6.	35	296. 12	—	298. 42		34	
	6.	36	311. 22	—	316. 32		43	
	6.	37	328. 42	—	329. 52		22	
								The entire limb of the Sun was examined with the slit radial on the C line only.
May 16.	20.	26	64. 5	—	67. 5		84	Bright jet.
	20.	25	79. 35	—	80. 55		19	
	20.	25	107. 55	—	114. 25		46	Bright prominence; considerable detail.
	20.	24	117. 0	—	121. 15		41	Fairly bright; considerable detail.
	20.	32	247. 45	—	249. 5		19	
	20.	31	260. 5	—	264. 5		19	
	20.	31	279. 35	—	282. 5		24	Small straight jet.
	20.	30	306. 25	—	308. 35		31	Bright jet.
	20.	29	321. 25	—	323. 25		26	
								The entire limb of the Sun was examined with the slit radial on the C line only.
May 16.	20.	43	63. 55	—	66. 35		72	
	20.	45	78. 45	—	80. 15		17	
	20.	47	105. 55	—	114. 45		48	
	20.	48	115. 5	—	120. 5		41	
	20.	37	249. 55	—	251. 15		19	
	20.	38	262. 5	—	264. 45		22	
	20.	38	280. 55	—	283. 45		29	
	20.	40	308. 15	—	310. 55		36	
	20.	41	323. 15	—	325. 45		22	
								The entire limb of the Sun was examined with the slit radial on the C line only.
May 16.	22.	8	18. 55	—	21. 10		29	
	22.	10	63. 35	—	67. 25		84	
	22.	11	107. 25	—	115. 15		43	
	22.	12	115. 10	—	121. 5		34	
	22.	14	154. 5	—	158. 25		29	
	22.	15	249. 45	—	251. 35		17	
	22.	16	252. 0	—	253. 35		17	
	22.	4	281. 5	—	283. 15		24	
	22.	5	306. 55	—	309. 45		29	
	22.	6	322. 5	—	324. 25		24	
22.	7	336. 15	—	338. 5		38	Faint.	
								The entire limb of the Sun was examined with the slit radial on the C line only.

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OBSERVATIONS OF SOLAR PROMINENCES, MADE WITH THE SPECTROSCOPE,

Greenwich Mean Solar Time, 1882.			Position-Angle from Sun's Axis.		Height in Seconds of arc on the C Line.		REMARKS.																					
d	h	m	°	'	°	'	"																					
May	17.	23. 59	13. 58	—	15. 48		29	Fine arched prominence. Small straight jet. Partly detached. Fine bright prominence. Two jets bending over to the North. Bending over to the South. Small jet. Straight jet.																				
	18.	0. 0	17. 48	—	20. 8		48																					
		0. 1	29. 18	—	30. 8		17																					
		0. 4	58. 3	—	59. 28		17																					
		0. 5	60. 33	—	64. 23		55																					
		0. 6	75. 28	—	82. 13		24																					
		0. 8	89. 58	—	92. 58		38																					
		0. 9	96. 48	—	100. 3		36																					
		0. 9	111. 8	—	112. 28		14																					
		0. 10	134. 18	—	136. 33		22																					
		0. 11	151. 33	—	153. 18		19																					
		0. 12	193. 18	—	195. 8		19																					
		0. 13	194. 58	—	196. 48		22																					
	17.	23. 46	213. 48	—	217. 48		31	Partly detached. Small straight jet. Small straight jet. Exceedingly narrow faint prominence. The entire limb of the Sun was examined once with the slit radial on the C line only.																				
		23. 47	253. 48	—	256. 8		22																					
		23. 48	257. 28	—	260. 28		24																					
		23. 49	265. 58	—	267. 28		24																					
		23. 50	268. 38	—	275. 38		31																					
		23. 50	276. 28	—	277. 38		19																					
		23. 51	290. 48	—	292. 38		22																					
	23. 58	338. 58				19																						
May	20.	2. 1	19. 0	—	24. 0		43											Very fine forked prominence. Bright arched prominence; much detail. Bright straight jet. Straight jet. Bending over to the South. Fine bright forked jet. The entire limb of the Sun was examined once with the slit radial on the C line only.										
		2. 0	50. 30	—	53. 20		53																					
		1. 58	53. 30	—	53. 50		22																					
		1. 57	70. 0	—	71. 20		19																					
		1. 55	118. 30	—	120. 50		29																					
		2. 8	124. 30	—	126. 30		43																					
		2. 6	194. 50	—	196. 50		17																					
		2. 5	212. 0	—	217. 20		62																					
		2. 3	308. 30	—	309. 50		14																					
		2. 2	345. 50	—	347. 30		17																					
	July	30.	23. 30	126. 21	—	131. 51		22	Faint. Partly detached. Bright arched prominence. Faint. The entire limb of the Sun was examined on C, D ₃ , and also on D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , E, and 1474 K. The latter seven lines showed nothing.																			
			23. 33	147. 31	—	149. 31		36																				
		23. 35	249. 41	—	251. 31		22																					
		23. 36	275. 31	—	280. 21		14																					
		23. 30	341. 31	—	344. 31		29																					
		23. 30	357. 31	—	358. 51		22																					

Greenwich Mean Solar Time, 1882.			Position-Angle from Sun's Axis.		Height in Seconds of arc.				Brightness.				Breadth.				REMARKS.							
d	h	m	°	'	C	D ₃	1474 K	F	C	D ₃	1474 K	F	C	D ₃	1474 K	F								
Sept.	7.	22. 37	14. 15	}	29	31	2?		$\frac{1}{3}$	$\frac{1}{3}$			$\frac{1}{2}$	$\frac{1}{4}$			Faint straight jet.							
		16. 45																						
		22. 36	47. 45	}	29	34	5?	24	$\frac{3}{4}$	$\frac{3}{4}$		$\frac{1}{3}$	$\frac{3}{4}$	$\frac{1}{2}$		$\frac{2}{3}$	Straight jet.							
		49. 15																						
		22. 35	60. 5	}	19	19		12	$\frac{3}{4}$	$\frac{1}{2}$		$\frac{1}{5}$	$\frac{3}{4}$	$\frac{1}{2}$		1	A low bank, arched at its northern end.							
		70. 5																						
		23. 18	71. 5	}	19	19			$\frac{1}{3}$	$\frac{1}{5}$		$\frac{1}{3}$	$\frac{1}{5}$				Faint short straight jet.							
		72. 45																						
		23. 17	78. 0	}	17	17		17	1	1		$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$		$\frac{2}{3}$	Short straight jet.							
		80. 25																						
	23. 15	130. 5	}	34	34		34	1	1		$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$		$\frac{2}{3}$	Bright straight jet.								
	133. 25																							
	23. 10	243. 45	}	24	22		14	$\frac{3}{4}$	1		$\frac{1}{5}$	$\frac{3}{4}$	$\frac{2}{3}$		1	Faint short jet.								
	244. 15																							

Greenwich Mean Solar Time, 1882.	Position Angle from Sun's Axis.	Height in Seconds of arc.				Brightness.				Breadth.				REMARKS.
		C	D ₃	¹⁴⁷⁴ K	F	C	D ₃	¹⁴⁷⁴ K	F	C	D ₃	¹⁴⁷⁴ K	F	
1884 GG MM.														
Sept. 7. 23. 2	263. 45 } 267. 55 } 283. 15 } 286. 25 }	72	72		72	$\frac{1}{3}$	$\frac{1}{4}$		$\frac{1}{10}$	$\frac{1}{2}$	$\frac{1}{3}$		?	Tall broken prominence.
22. 41		31	31	5	19	1	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{1}{3}$	1	$\frac{2}{3}$	1	1	Broken jet. Whilst being watched at about 23 ^h . 0 ^m . on the C line, a filament rose from the prominence to the height of 41". The C line on the southern edge of the prominence was displaced towards the red by 0.5 tenth-metre, corresponding to a motion of recession of 14 miles per second. At 23 ^h . 30 ^m . it was very faint, and only 14" in height.
22. 40	297. 45 } 302. 45 }	55	55		55	1	1		$\frac{1}{3}$	$\frac{2}{3}$	$\frac{1}{2}$		1	Fine bright tree-like prominence.
														The entire limb of the Sun was examined once with the slit radial on the C, D ₁ , D ₂ , D ₃ , E, <i>b</i> ₁ , <i>b</i> ₂ , <i>b</i> ₃ , <i>b</i> ₄ , 1474 K, and F lines.
Nov. 7. 23. 42	12. 14 } 14. 4 }	29	31			$\frac{1}{4}$	$\frac{1}{7}$			1	$\frac{2}{3}$			Faint; seen only on the C and D ₃ lines.
23. 58	64. 54 } 66. 29 }	17	17		17	1	$\frac{2}{3}$		1	1	$\frac{2}{3}$		$\frac{1}{3}$	The C line on the northern edge of the prominence was displaced towards the red by 1.0 tenth-metre, on the southern towards the blue by about $\frac{1}{3}$ tenth-metre, corresponding respectively to a motion of recession of 28 miles per second, and to a motion of approach of 9 miles. The F line appeared most unusually bright. The 1474 K line, the <i>b</i> , D, and E lines, and several others near E, were fuzzy and ill-defined near the limb, but the limb boiled too violently for any short bright lines to be certainly made out.
8. 0. 4	"	22												No displacement was now detected on the C line, but the prominence was slowly increasing in height, and the upper portion seemed to be becoming detached from the lower.
0. 9	85. 34 } 94. 54 }	17	17			$\frac{1}{2}$	$\frac{1}{10}$			$\frac{2}{3}$	$\frac{1}{3}$			Long low prominence; no detail; seen only on C and D ₃ .
0. 12	161. 54 } 163. 49 }	29	29			$\frac{1}{4}$	$\frac{1}{10}$			$\frac{1}{2}$	$\frac{1}{4}$			Faint; seen only on C and D ₃ .
0. 15	225. 49 } 228. 49 }	26	29		29	1	1		$\frac{2}{3}$	$\frac{3}{4}$	$\frac{1}{2}$		1	Bright straight jet. The F line was displaced 0.2 tenth-metre towards the blue, corresponding to a motion of approach of 8 miles per second.
0. 21	298. 34 } 301. 24 }	19	19			$\frac{2}{3}$	$\frac{1}{2}$			$\frac{2}{3}$	$\frac{1}{2}$			Small prominence; seen only on the C and D ₃ lines.
														The entire limb of the Sun was examined twice with the slit radial on all the lines from B to F.

OBSERVATION of a SOLAR STORM at POSITION-ANGLE (from SUN'S AXIS) 296° 20' on 1882 May 13.

A very remarkable storm took place at the above position-angle from 1^h. 12^m. to 1^h. 15^m., and had evidently been in progress for some time previously. Whilst the spectroscope was being centred on the Sun, about 0^h. 45^m. a short straight jet had been noticed here, some 26" in height. At 1^h. 13^m. there was a prominence divided into three parts, and extending from 294° 32' to 298° 22'. The uppermost part was completely detached, its highest point being 79" from the limb, its lowest 46", its average distance 65". It showed a displacement on the C line of 1.5 tenth-metres towards the red, corresponding to a motion of recession of 43 miles per second. The middle part was also completely detached; its upper surface being 38", its lower surface 22" from the limb. The lowest portion was a short straight jet, from 14" to 17" in height, and extending from about 296° 22' to 298° 22'. The uppermost portion as seen on the C line in the two minutes between 1^h. 13^m. and 1^h. 15^m. developed in the most extraordinary manner, moving in a diagonal direction along the spectrum, so that it was at the same time travelling rapidly towards the red end of the spectrum and away from the Sun's limb, growing fainter and spreading out meanwhile, and becoming diffused at its edges as it extended itself, until at last it reached the line λ 6573.5, a displacement of 11.4 tenth-metres, and attained a distance from the limb of 96", having moved through 18" in 2 minutes. By 1^h. 15^m. the entire prominence had disappeared. The uppermost part when first seen at 1^h. 12^m. was very bright, and extended from about 58" to 72", but it had spread out to the limits given above before any exact determinations could be obtained. On turning to the F line the fading fragments were just caught sight of before all had disappeared. The maximum displacement observed would correspond to a motion of recession of 325 miles per second, and the motion from the limb would be at the rate of about 68 miles per second.

OBSERVATIONS of SPECTRA of SUN SPOTS made at the ROYAL OBSERVATORY, GREENWICH, in the Year 1882.

The numeration of the spots is taken from the Photographic Results.

The observations were made by Mr. Maunder with the Half-prism Spectroscope mounted on the South-East Equatoreal. With the spectroscope in the direct position, one "half-prism" gives a dispersion of about $18\frac{1}{2}^\circ$ from A to H, and two "half-prisms" a dispersion of about 80° . Occasionally the spectroscope was reversed end for end, the slit and eye-piece being interchanged. The spectroscope in this position gives great purity of spectrum. The wave-lengths of the lines observed and the corresponding elements are taken from Ångström's *Spectre Normal du Soleil*. The wave-lengths of lines not given in Ångström's map are inferred from the wave-lengths of the neighbouring lines. Lines not given by Ångström are distinguished by an asterisk. The amount of broadening is expressed in terms of the normal breadth of the line.

SPOT No. 718.

1882 April 4.

The spectrum showed but little absorption, either general or selective. Not many lines were broadened, and these as a rule but to a slight extent. The "bands" first seen on 1880 November 27 were visible, but were faint. Definition poor. One-prism train direct. Magnifying power 28.

The following lines between b and F were observed to be changed over the spot. The C and D lines were also examined.

Wave-length.	Element.	Amount of Broadening.	Remarks.	Wave-length.	Element.	Amount of Broadening.	Remarks.
Tenth-metres.				Tenth-metres.			
6562.1	Hydrogen	..	C. Not perceptibly broadened. The edges of the line were a little fuzzy over the spot.	5120.1	Titanium	..	A "band," 1.0 tenth-metre in breadth, seen only over the spot, lies on the more refrangible side of this line. The line seems to coincide exactly with one edge of the "band." If, therefore, the "band" is only the line greatly broadened, it is displaced towards the blue by 0.5 tenth-metre.
5895.1	Sodium	$\frac{1}{2}$	The D lines.	5117.8* 5116.0*	..	..	Two "bands," each 1.0 tenth-metre in breadth, seen only over the spot.
5889.1							
5183.1	Magnesium	$\frac{1}{2}$	The b lines. These were very little affected. The edges of the lines were a little fuzzy over the spot.	5115.0 5112.5*	Nickel	..	Not seen at all over the spot. Greatly broadened; 1.0 tenth-metre in breadth over the spot.
5172.2	Magnesium						
5166.9	Iron and magnesium.			5110.9*	..	..	Greatly broadened; about 0.2 tenth-metre in breadth over the spot.
5161.8	Iron						
5158.6	Iron	1	Displaced towards the red.	5109.9 5109.0	Iron	$\frac{1}{2}$	
5156.2*	..	1	Displaced towards the red.				
		..	One of the "bands" of 1880 November 27. Breadth 0.7 tenth-metre.	5107.2	Iron	$\frac{1}{2}$	Greatly broadened; about 0.2 tenth-metre in breadth over the spot.
				5105.1	Copper	$\frac{1}{2}$	
5155.2	Nickel	$\frac{1}{2}$		5103.8	..	$\frac{1}{2}$	
5154.7	Sodium			5102.3	..	$\frac{1}{2}$	
5153.2	..	$\frac{1}{2}$		5101.0*	..	..	
5152.7	Sodium and copper						
5151.4	Iron	$\frac{1}{2}$		5099.2	Nickel	$\frac{1}{2}$	A broad band or cluster of lines, seen only over the spot.
5150.3	Iron			5098.3	Iron	Slightly	
5149.0*	..	..	Greatly broadened. About 0.3 tenth-metre in breadth over the spot.	5096.0*	..	..	A "band," 1.0 tenth-metre in breadth, seen only over the spot.
				5093.5*			
5147.6	Iron	$\frac{1}{2}$		5092.0*	..	..	
5145.9	Iron and nickel						
5144.6	..	$\frac{1}{2}$		5090.5	Iron	$\frac{1}{2}$	Three "bands," each 1.0 tenth-metre in breadth, seen only over the spot.
5138.8	Iron			5089.5*			
5138.3*	..	..	Line about 0.2 tenth-metre in breadth, seen only over the spot.	5087.5*	..	..	
				5085.5*			
5136.9	Iron and nickel	$\frac{1}{2}$	Line about 0.2 tenth-metre in breadth, seen only over the spot.				
5136.4*	..	..					
5133.1	Iron	Very slightly broadened.					
5131.0	Iron						
5128.7	Titanium						
5126.8	Iron						
5125.6	..						
5124.5	Iron						
5123.3	Iron						
5121.2	Iron						

Wave-length.	Element.	Amount of Broadening.	Remarks.	Wave-length.	Element.	Amount of Broadening.	Remarks.
Tenth-metres.				Tenth-metres.			
5083.7	..	Slightly		4990.5	Iron and titanium	$\frac{1}{4}$	
5082.6	Iron	Slightly		4988.5	Iron	$\frac{1}{4}$	
5081.9	..	1		4984.8	Iron	$\frac{1}{4}$	
5076.0	Iron	$\frac{1}{2}$		4979.8	Nickel and titanium.	Slightly	
5074.2	Iron	?			Iron	$\frac{1}{4}$	
5071.8	Iron	$\frac{1}{4}$		4977.9	..	$\frac{1}{4}$	
5070.0*	}		Four lines, each very faint and narrow on the general disk, but 0.2 tenth-metre in breadth over the spot.	4975.9	..	$\frac{1}{4}$	
5065.0*				4975.2	..	$\frac{1}{5}$	
5062.6*				4965.5	Iron	?	
5061.0*				4964.8	..	$\frac{1}{5}$	
5059.9	Iron	$\frac{1}{4}$	From this line to λ 5055.4 there extends in the spot-spectrum a broad band, apparently made up of a number of fine lines, but which the dispersion employed could not satisfactorily resolve.	4961.8	Iron	$\frac{1}{5}$	
5055.4*	}		Another broad band, also apparently made up of a number of fine lines, which could not be satisfactorily isolated.	4956.9	Iron	$\frac{1}{4}$	
5054.8*				4954.4	Iron	?	
				4952.2	Iron	$\frac{1}{2}$	
				4952.0	..	$\frac{1}{10}$	
5051.6	Iron	$\frac{1}{4}$		4949.5	Iron	Slightly	
5049.5		$\frac{1}{4}$		4947.5*	..	$\frac{1}{2}$	
5048.3		$\frac{1}{4}$		4939.0	..	$\frac{1}{4}$	
5047.9		$\frac{1}{4}$		4938.4	Iron	$\frac{1}{4}$	
5043.5	Iron	$\frac{1}{2}$		4938.0	Iron	$\frac{1}{4}$	
5041.3	Iron and calcium	$\frac{1}{2}$		4937.4	..	$\frac{1}{5}$	
5040.3	Iron	$\frac{1}{2}$		4936.5	..	?	
5037.7	Titanium	$\frac{1}{4}$		4935.2	Nickel	$\frac{1}{5}$	
5035.9	Titanium	$\frac{1}{4}$		4933.6	Barium	Slightly	
5035.5	Titanium	$\frac{1}{4}$		4932.9	Iron	Slightly	
5035.0	Nickel	$\frac{1}{4}$		4931.3	..	1	
5032.3*	..	..	A line 0.6 tenth-metre in breadth, seen only over the spot.	4929.6	Iron	$\frac{1}{5}$	
5030.3	..	$\frac{1}{3}$		4927.0	..	1	
5029.1	..	1		4926.7	Iron	1	
5027.4	Iron	$\frac{1}{4}$		4919.9	Iron	$\frac{1}{4}$	
5026.5	Iron	$\frac{1}{4}$		4918.3	Iron	$\frac{1}{4}$	
5024.2*	..	$\frac{1}{3}$		4913.4	..	$\frac{1}{10}$	
5023.8*	..	$\frac{1}{3}$		4911.3	..	$\frac{1}{5}$	
5021.9	..	$\frac{1}{3}$		4904.1	Nickel	$\frac{1}{4}$	
5021.3	Iron	$\frac{1}{3}$		4902.6	Iron	$\frac{1}{5}$	
5019.5	Iron and titanium	Slightly		4899.5	Barium	$\frac{1}{5}$	
5017.8	..	?		4896.0	..	?	
5016.8	Nickel	$\frac{1}{3}$		4892.3	..	?	
5015.6*	..	$\frac{1}{3}$		4891.0	Iron	$\frac{2}{5}$	
5014.4	Iron	$\frac{1}{5}$		4890.2	Iron	$\frac{2}{5}$	
5013.3	Titanium	$\frac{1}{5}$		4884.4	..	$\frac{1}{4}$	
5009.0*	..	..	Very greatly broadened over the spot.	4888.1	Iron	$\frac{1}{5}$	
5006.7	Iron and titanium	Slightly		4886.8	Iron	?	
5003.2	Iron	$\frac{1}{5}$		4886.0	Iron	$\frac{1}{3}$	
5002.1	Iron	$\frac{1}{5}$		4884.7	Iron and titanium	?	
4998.9	Titanium	$\frac{1}{5}$		4881.1	Iron	$\frac{1}{4}$	
4997.5	..	$\frac{1}{5}$		4879.2*	..	$\frac{1}{4}$	
4996.1	..	$\frac{1}{5}$		4877.6	Iron and calcium	Slightly	Not shown in Fievez's map.
4993.4	Iron	$\frac{1}{3}$		4875.5	Iron	1	
				4872.7*	..	$\frac{1}{3}$	
				4871.4	Iron	$\frac{1}{4}$	
				4870.6	Iron	$\frac{1}{4}$	
				4869.1*	..	$\frac{1}{4}$	
				4867.7	Cobalt	$\frac{1}{5}$	
				4865.4	Nickel	$\frac{1}{5}$	
				4864.2*	..	$\frac{1}{4}$	
				4863.7	Iron	$\frac{1}{5}$	
				4860.7	Hydrogen	..	F. Not perceptibly broadened. The edges of the line were a little fuzzy over the spot.

NOTE.—Ångström's map shows only two of the four lines between λ 5138.8 and λ 5136.4, but Fievez's *Spectre Solaire* shows all four. Only the two lines given by Ångström, viz., λ 5138.8 and λ 5136.9, could be seen on the general disk, but all four were seen distinctly over the spot, although the dispersion employed was much less than that employed by M. Fievez. This observation was repeated on May 20.

Spot No. 729.

1882 April 14.

The greater part of the spot showed scarcely any trace of absorption either general or selective, and it was only over the darkest part of the various nuclei that any marked difference in the spectrum could be perceived.

The wind was so high and the interval of sunshine was so short that but little could be made out. The spectrum, however, did not differ greatly from that ordinarily shown by Sun-spots. The "bands" were seen to be fairly distinct, and two or three fresh bands near b on the red side were noticed. The spectrum of the largest nucleus gave evidence of an absorption both general and selective rather beyond the average. Most of the lines usually broadened between C and F were affected to a considerable extent. C, F, and the two D lines were broadened by about one-half. All four lines were very diffused at their edges over the spot. The b lines were in a part of the spectrum which was very dark over the spot, and appeared enormously broadened, an appearance probably due not so much to any change in the lines themselves as to the broadening and deepening of many of the fine faint lines in their immediate neighbourhood.

The wave-lengths of the "bands" referred to above, and on April 21, are as follows:—

Group I.—5120·1, 5117·8, 5116·0.

Group II.—5096·4, 5095·3, 5094·2.

Group III.—5092·8, 5092·1.

Group IV.—5089·5, 5087·5, 5085·5.

Group V.—5058·3, 5055·8, 5053·8, 5052·5.

Spot No. 729.

1882 April 21.

The two principal nuclei of the spot were examined and their spectra showed much general absorption, but the selective absorption was not at all unusual in character or amount. A large number of lines were broadened, but none to any great extent. The D and b lines were broadened by about one-half, C and F by about one-third, and the E lines by about one-quarter. All these lines had very ill-defined edges over the spot. 1474 K was a little broader and darker, but as sharp as usual. The "bands" could just be detected. No difference was perceived between the two nuclei. The definition was very bad, the Sun being in white haze. One-prism train direct. Magnifying power 28. Position angle of slit 5°.

Spot No. 726.

1882 April 21.

The general absorption was not so marked as for Spot No. 729; the selective absorption was therefore easier to observe. C and F were about half as broad again as usual; b_1 and b_2 were broader by about one-fourth; b_3 and b_4 were scarcely affected; the D lines were doubled. All these lines were much sharper than in the spectrum of Spot No. 729; whilst the E lines and 1474 K showed much the same appearance as over that spot. The "bands," though not prominent, were more easily seen over the present spot than over Spot No. 729. No displacements were noticed, nor was any difference detected between the spectra of the East and West nuclei. One-prism train direct. Magnifying power 28. Position angle of slit 348°.

Spot No. 759.

1882 May 20.

Early in the morning it was believed that the spot spectrum showed several marked cases of twisting or displacement; but a more careful examination later on, made under more favourable circumstances, showed that this appearance was entirely due to fresh lines, of which a large number were seen over the spot, which were not distinguishable on the Sun. The "bands" were also strongly marked, and in some instances were traceable to a great distance from the spot. The definition was very variable, usually very bad.

The following lines between b and λ 5043 were observed to be changed over the spot. The C and D lines were also examined. Nothing remarkable either as to displacement or great broadening of the lines of the spectrum or as to the appearance of new lines was noticed in the spectrum from λ 5043 to F.

Wave-length.	Element.	Amount of Broadening.	Remarks.	Wave-length.	Element.	Amount of Broadening.	Remarks.
Tenth-metres. 6562.1 5895.1 5889.1	Hydrogen Sodium Sodium	$\frac{1}{2}$ 1 $1\frac{1}{2}$	C. D ₁ . D ₂ . The extension towards the blue appeared to be twice as great as that towards the red.	Tenth-metres. 5123.3 5121.2 5120.1	Iron Iron Titanium	$\frac{1}{5}$ $\frac{1}{5}$..	A "band," 0.8 tenth-metre in breadth, seen only over the spot, lies on the more refrangible side of this line. The line seems to coincide exactly with one edge of the "band." If, therefore, the "band" is really only the line greatly broadened, it is displaced towards the blue by 0.4 tenth-metre.
5183.1	Magnesium	$\frac{1}{4}$	b_1 . Very ill-defined over the spot.				Two "bands," each 0.8 tenth-metre in breadth, seen only over the spot.
5172.2	Magnesium	$\frac{1}{4}$	b_2 . Very ill-defined over the spot.				Not visible over the spot.
5171.2	Iron	..	Very much broadened, 0.3 tenth-metre over the spot.				A "band," 0.8 tenth-metre in breadth, seen only over the spot.
5168.5	Iron and nickel	$\frac{1}{4}$	b_3 . Very ill-defined over the spot.				
5166.9	Iron and magnesium.	$\frac{1}{4}$	b_4 . Very ill-defined over the spot.	5117.8* 5116.0*			
5164.7	Iron	$\frac{1}{3}$		5115.0	Nickel	..	
5164.2	..	$\frac{1}{3}$		5113.8*	..	..	
5162.3*	..	..	A "band," 0.8 tenth-metre in breadth, seen only over the spot.				
5161.8	Iron	$\frac{1}{5}$		5109.9	Iron	Slightly	
5159.6*	..	..	A "band," 0.6 tenth-metre in breadth, seen only over the spot.	5109.0 5101.0*	..	Slightly	
5156.2*	..	..	A "band," 0.7 tenth-metre in breadth, seen only over the spot.			..	Greatly broadened; about 0.2 tenth-metre in breadth over the spot.
5153.2	..	Slightly		5098.3 5096.5*	Iron	$\frac{1}{2}$	
5152.7	Sodium and copper	$\frac{3}{10}$					A broad "band" formed of three lines, connected by a dark haze, seen only over the spot. The centres of the lines have wave-lengths 5096.4, 5095.3, and 5094.2 respectively.
5151.4	Iron	$\frac{1}{5}$					Two "bands," each 0.6 tenth-metres in breadth, seen only over the spot.
5150.3	Iron	$\frac{1}{5}$					
5190.2*	..	..	A "band," 1.0 tenth-metre in breadth, seen only over the spot.	5094.0* 5092.8* 5092.1*			
5147.6	Iron	$\frac{1}{4}$		5090.5	Iron	$\frac{1}{4}$	
5145.9	Iron and nickel	$\frac{1}{4}$					Three "bands," each 1.0 tenth-metre in breadth, seen on the Sun as well as over the spot, but much less distinctly.
5144.6	..	$\frac{1}{4}$					
5142.2	..	$\frac{1}{5}$					
5141.8	Iron	$\frac{1}{5}$					
5141.4	..	$\frac{1}{5}$		5089.5* 5087.5* 5085.5*			
5138.8	Iron	$\frac{1}{4}$					
5138.3*	..	..	Line about 0.3 tenth-metre in breadth, seen only over the spot.	5083.7 5082.6 5081.9 5078.0 5076.4*	.. Iron .. Iron ..	Slightly Slightly $\frac{1}{2}$ $\frac{2}{5}$..	Not shown in Fievez's map. Seen only over the spot, 0.2 tenth-metre in breadth.
5136.9	Iron and nickel	$\frac{1}{5}$					
5136.4*	..	..	Line about 0.3 tenth-metre in breadth, seen only over the spot.				
5133.7*	..	..	Line about 0.1 tenth-metre in breadth, seen only over the spot.				
5133.1	Iron	$\frac{1}{5}$		5076.0 5074.2 5071.8	Iron Iron Iron	$\frac{1}{5}$ $\frac{2}{5}$..	Very greatly broadened; 0.6 tenth-metre in breadth over the spot.
5131.0	Iron	$\frac{2}{5}$					Displaced slightly towards the red. Diffused at the edges.
5129.4*	..	..	Line about 0.2 tenth-metre in breadth, seen only over the spot.				
5128.7	Titanium	1		5068.3	Iron	$\frac{1}{5}$	
5126.8	Iron	$\frac{1}{4}$					
5125.6	..	$\frac{1}{4}$					
5124.5	Iron	Slightly		5066.5	Iron	$\frac{1}{2}$	

OBSERVATIONS OF SPECTRA OF SUN SPOTS

Wave-length.	Element.	Amount of Broadening.	Remarks.	Wave-length.	Element.	Amount of Broadening.	Remarks.
Tenth-metres. 5064.5	Iron and titanium	$\frac{1}{5}$	Double line. The two components were not separated by the dispersion employed.	Tenth-metres. 5053.8*	..	..	Line about 0.4 tenth-metre in breadth, seen only over the spot.
5063.2*	..	..	Line about 0.2 tenth-metre in breadth, seen only over the spot.	5052.5*	..	..	Line about 0.2 tenth-metre in breadth, seen only over the spot.
5061.4*	..	..	A "band," 0.7 tenth-metre in breadth, seen only over the spot.	5051.1	Iron	$\frac{1}{3}$	
5059.9	Iron	$\frac{1}{2}$		5049.5	Iron	$\frac{1}{6}$	
5058.3*	..	..	A "band," 0.7 tenth-metre in breadth, seen only over the spot.	5048.3	..	$\frac{1}{4}$	
5055.8*	..	..	A "band," 0.7 tenth-metre in breadth, seen only over the spot.	5047.9	Iron	$\frac{1}{4}$	
				5047.0*	..	..	Line about 0.2 tenth-metre in breadth, seen only over the spot.
				5046.0*	..	..	Line about 0.1 tenth-metre in breadth, seen only over the spot.
				5044.5*	..	Slightly	
				5043.5	Iron	$\frac{1}{4}$	
				4860.7	Hydrogen	$\frac{1}{4}$	F.

SPOT No. 876.

1882 November 8. 22^h.

The spectrum of this spot was examined in a brief interval of sunlight, but only one or two lines could be observed. The D lines were doubled in breadth, the *b* lines were broader by one-half, whilst the F line was hardly, if at all, affected. One-prism train direct. Magnifying power 28. Position angle of slit 315°.

1882 November 9^d. 23^h. to 10^d. 1^h.

The group was broken up into a great number of small spots, which proved very difficult to observe on account of their small size. The spectrum could only be mapped from about F to C. One-prism train direct. Magnifying power 28. Position angle of slit 95°.

The following lines between λ 4854.9 and λ 4919.9 were observed to be changed over the spot:—

Wave-length.	Element.	Amount of Broadening.	Remarks.	Wave-length.	Element.	Amount of Broadening.	Remarks.
Tenth-metres. 4854.9	Iron and nickel	$\frac{2}{5}$		Tenth-metres. 4884.7	Iron and titanium	Slightly	
4859.3	Iron	$\frac{1}{4}$		4888.1	Iron	$\frac{1}{4}$	
4860.7	Hydrogen	?		4890.2	Iron	$\frac{1}{2}$	
4863.7	Iron	Slightly		4891.0	Iron	$\frac{1}{2}$	
4865.4	Nickel	Slightly		4899.5	Barium	$\frac{2}{5}$	
4867.7	Cobalt	$\frac{1}{4}$		4902.6	Iron	$\frac{1}{5}$	
4870.6	Iron	$\frac{1}{4}$		4904.1	Nickel	$\frac{1}{5}$	
4871.4	Iron	$\frac{1}{4}$		4907.1	Iron	$\frac{1}{3}$	
4877.6	Iron and calcium	$\frac{2}{5}$		4913.4	..	$\frac{1}{4}$	
4879.0*	..	$\frac{1}{5}$	Not shown in Fievez's map.	4916.6	..	$\frac{1}{6}$	
4881.1	Iron	Slightly		4918.3	Iron	$\frac{1}{2}$	
4883.0	..	$\frac{1}{4}$		4919.9	Iron	$\frac{1}{2}$	

SPOT No. 885.

1882 November 17^d. 23^h. to 18^d. 1^h.

The following lines were observed to be reversed, i.e., bright instead of dark, over the principal nucleus of the spot:—C, D₁, D₂, D₃, and F. Of these, C and F were exceedingly bright, particularly F; and this, notwithstanding that the mist enfeebled the blue and violet portions of the spectrum. D₃ was only perceived for a short time, apparently when the mist was lightest, about 23^h 50^m. D₁ and D₂ were not only reversed but extravagantly broadened, each line forming a very broad and ill-defined dark band, quite six tenth-metres in breadth, with a sharp, narrow, bright line in the centre, apparently at the normal place of the line. This appearance and the reversal of D₃ were noticed whenever the definition and light were a little better than usual. The reversal of C and F took place over the bright tongue, which all but divided the largest nucleus of the spot into two nearly equal portions. The reversal of the sodium lines was not noticed at the point where C and F were brightest.

The third and fourth lines of hydrogen could not be detected, but the mist made it impossible to observe the extreme ends of the spectrum.

The *b* lines and 1474 K showed no appreciable change. The strong calcium lines between C and D were doubled in breadth. The E lines were less strongly affected, and were, perhaps, one-third as broad again as usual.

The *general* absorption of the spot was small, that is, the continuous spectrum was not so much fainter than that of the general disk as might have been expected.

The Sun was not well seen, the day being misty and cloudy. Two-prism train reversed. Magnifying power 28.

1882 November 19^d. 23^h. to 20^d. 0^h.

The spectrum of the principal nucleus was again examined. The *general* absorption was more marked than on November 18, and more lines were noticed to be broadened. The general absorption was not, however, uniform; here and there, there were broad ill-defined patches, noticeably darker than the rest of the spectrum. The district lying between λ 4900 and λ 4830 was one of the most marked of these.

The C line was seen reversed right across the great nucleus. D₃ and F were suspected to be reversed, but, owing to the mist, could not be clearly seen as bright lines. D₁ and D₂ also could not be seen as bright lines, but they presented exactly the same appearance as on November 18 at those times when the mist was too dense to permit the reversal to be clearly seen; that is, they were very much broadened, were very ill-defined, and much fainter than usual in the middle. Several other lines, amongst them λ 4957, λ 4920, and λ 4918, closely resembled the D lines. The 1474 K line did not appear to be affected, but one near it, either λ 5301 or λ 5307,—there was not time to properly identify the line, but it was believed to be λ 5307,—vanished over the spot.

The calcium and iron lines between C and D were much broadened, and also those near λ 5600 and λ 5856. These were broader by about two-thirds; the E lines were broader by about one-half; the *b* lines by one-quarter. All these lines were, as a rule, well-defined, that is to say, they did not show the "smudged" appearance seen in the D lines and the three iron lines near F, mentioned above. Two-prism train reversed. Magnifying power 28.

The spectroscope was afterwards placed in the direct position, as used for observation of stellar spectra, and only one "half-prism" was employed. With this dispersion, a remarkable reversion of the F line was noticed. At the preceding edge of the great nucleus there was a broad bright flame, which, touching the F line at the extreme preceding edge of the nucleus, sloped away from the nucleus in the preceding direction, and from the F line towards the blue. It was inclined to the F line at an angle of about 40°, was 1, or, perhaps, 1½ tenth-metre in average breadth, and extended to a distance from the F line of 3 or, perhaps, 3½ tenth-metres. It was pointed at each end, and was nearly but not quite straight, being a little twisted near its centre. A displacement of 3½ tenth-metres towards the blue would correspond to a motion of approach of 134 miles per second. Time of observation, November 19^d. 23^h. 20^m.

The Sun was not well seen, the day being misty.

November 21.

The Sun was only seen through fog and was very faint. The spot-spectrum was therefore a dense black band, in which it was very difficult to perceive any details. The C and F lines were reversed over the greater portion of the area of the spot, not, however, over the very darkest part of the principal nucleus, but over all its fainter portions. D₃ and, perhaps, 1474 K seemed to be reversed over the same region. The latter line seemed to be displaced nearly 1 tenth-metre towards the red. The D lines together covered quite 10 tenth-metres, and ran one into the other; they were very ill-defined, and appeared exactly as on November 20. They extended further towards the blue than towards the red; in fact, the broadening seemed traceable twice as far in the first direction as in the second. A very large percentage of the lines between D and F had a similar appearance to that shown by the D lines and the iron lines near F on November 20, *i.e.*, they were very much broader than on the general disk, were very ill-defined, and were much fainter than the corresponding lines on the Sun, especially about their centres. It is therefore probable that a clearer day would have shown them as distinctly reversed, especially as the F line showed precisely the same "smudged" appearance whenever the fog became too thick for it to be seen as a bright line.

Group α and the lines at λ 6200 were very much broadened, principally on the side nearer the blue.

A momentary gleam of clearer sunlight showed F reversed in the most intricate and beautiful manner right across the great nucleus, not over its entire area, but at short intervals from one side to the other, even over its blackest portion. These stars of brilliant blue light were on the average about twice as broad as the dark F line on the general disk, sometimes four times as broad, and were but little, if at all, displaced.

The Sun was in a yellow fog during the whole time of examination. Two-prism train reversed. Magnifying power 28.

MEASURES OF DISPLACEMENT OF LINES in the SPECTRA of STARS, as compared with those of
ROYAL OBSERVATORY, GREENWICH,

Note.—The motion corresponding to the displacement actually observed may be inferred from the Concluded Motion by adding the Earth's Motion algebraically.

The "Half-prism" Spectroscope was used throughout. The numerals in the third column denote the number of "Half-prisms" used. Each "Half-prism" is compound, and is composed of a flint "half-prism," (*i.e.*, the half of an isosceles prism, cut by a plane perpendicular to the base,) and a crown prism, cemented on the emergent face, so as to form the half of a direct-vision prism. With one such half-prism, a dispersion of about $18\frac{1}{2}^\circ$ from A to H, equivalent to that produced by four flint prisms of 60° , is obtained; and with a train of two a dispersion of about 80° , equivalent to that produced by sixteen flint prisms of 60° . The dispersions have been inferred from measurements of the distance between b_1 and b_4 as compared with the wave-length measure.

Date, 1882, Greenwich Sidereal Time.	Observer.	Number of Half- Prisms.	Reading of Position Circle.	Objects compared.	Micrometer Readings.	Displacement.		Width of Slit.
						Measured.	Estimated in Terms of the Breadth of the Comparison Line.	
d h m			o		r	r		r
Feb. 10. 5. 0	M	1	6	γ Orionis F	0.411			
				H β	0.309	+ 0.102	$\frac{1}{2}$ towards red	0.165
5. 35	"	"	"	γ Orionis F	0.379			
				H β	0.293	+ 0.086	$\frac{2}{5}$ towards red	0.165
6. 0	"	"	"	γ Orionis F	0.335			
				H β	0.285	+ 0.050	$\frac{1}{4}$ towards red	0.165
Feb. 10. 6. 10	M	1	6	β Tauri F	0.298			
				H β	0.358	— 0.060	$\frac{3}{10}$ towards blue	0.165
6. 25	"	"	"	β Tauri F	0.268			
				H β	0.353	— 0.085	$\frac{2}{5}$ towards blue	0.165
6. 40	"	"	"	β Tauri F	0.346			
				H β	0.372	— 0.026	$\frac{1}{10}$ towards blue	0.165
Feb. 10. 7. 0	M	1	6	Sirius F	0.234			
				H β	0.225	+ 0.009	$\frac{1}{10}$ towards red	0.165
	"	"	"	Sirius F	0.293			
				H β	0.235	+ 0.058	$\frac{1}{4}$ towards red	0.165
	"	"	"	Sirius F	0.296			
				H β	0.254	+ 0.042	$\frac{1}{5}$ towards red	0.165
	"	"	"	Sirius F	0.298			
				H β	0.272	+ 0.026	$\frac{1}{10}$ towards red	0.165
	"	"	"	Sirius F	0.300			
				H β	0.254	+ 0.046	$\frac{1}{5}$ towards red	0.165
8. 0	"	"	"	Sirius F	0.298			
				H β	0.332	— 0.034	$\frac{1}{5}$ towards blue	0.165
Feb. 10. 8. 50	M	1	6	Procyon F	0.568			
				H β	0.429	+ 0.139	$\frac{2}{3}$ towards red	0.165
9. 0	"	"	"	Procyon F	0.525			
				H β	0.430	+ 0.095	$\frac{1}{2}$ towards red	0.165
Feb. 10. 9. 20	M	1	6	Castor F	0.263			
				H β	0.246	+ 0.017	$\frac{1}{10}$ towards red	0.165
	"	"	"	Castor F	0.397			
				H β	0.253	+ 0.144	$\frac{2}{3}$ towards red	0.165
	"	"	"	Castor F	0.412			
				H β	0.272	+ 0.140	$\frac{2}{3}$ towards red	0.165
9. 45	"	"	"	Castor F	0.364			
				H β	0.273	+ 0.091	$\frac{2}{5}$ towards red	0.165

TERRESTRIAL ELEMENTS, and CONCLUDED MOTIONS in the LINE of SIGHT, from OBSERVATIONS at the
in the Year 1882.

1^{rev.} of the micrometer corresponds, with one "half-prism" to 10.3 tenth-metres or 372 miles per second for the *b* lines,
and to 7.99 tenth-metres or 307 miles per second for the F line; and with two "half-prisms" to 2.0 tenth-metres or
73 miles per second for *b* and to 1.67 tenth-metres or 64 miles per second for F.

1^{rev.} of the screw for opening the slit corresponds to 0.01 inch, or about 10".

The slit lies north and south when the reading of the Position-Circle is 6°.

The estimations of the displacements have been made by *indirect* comparison with the comparison-line, except where the
contrary is expressly stated.

Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
	Measured.	Estimated.	
+ 16.0	+ 15.4	+ 11.9	Star-line and spectrum faint. Light cloud interfered with the observations. Hence the measures were made with great difficulty.
+ 16.0	+ 10.5	+ 6.3	
+ 16.0	— 0.6	— 2.1	
+ 16.4	— 34.9	— 33.1	Definition good. Direct comparison showed an unmistakeable but small displacement towards the blue.
+ 16.4	— 42.6	— 38.7	
+ 16.4	— 24.4	— 22.0	
+ 9.3	— 6.6	— 3.8	Repeated and careful direct comparisons failed to show any decided displacement at all. If there was any it was towards the red, in accordance with the measures. Direct comparison is, however, difficult when the amount of displacement is small. The clock drove badly at the time of the last measure, rendering it doubtful. The second and three following measures seemed good.
+ 9.3	+ 8.6	+ 4.6	
+ 9.3	+ 3.6	+ 1.9	
+ 9.3	— 1.3	— 3.8	
+ 9.3	+ 4.9	+ 1.9	
+ 9.3	— 19.8	— 20.5	
+ 8.5	+ 34.3	+ 28.7	Definition good.
+ 8.5	+ 20.8	+ 19.4	
+ 10.3	— 5.0	— 4.7	Star-line broad and ill-defined. Spectrum faint. Definition good for last measure.
+ 10.3	+ 34.1	+ 26.9	
+ 10.3	+ 32.9	+ 26.9	
+ 10.3	+ 17.8	+ 12.0	

Date, 1882, Greenwich Sidereal Time.	Observer.	Number of Half- Prisms.	Reading of Position Circle.	Objects compared.	Micrometer Readings.	Displacement.		Width of Slit.
						Measured.	Estimated in Terms of the Breadth of the Comparison Line.	
d h m Feb. 10. 9. 55	M	1	6	Pollux F.....	0.188	r		r
	"	"	"	H β	0.242	— 0.054	$\frac{1}{5}$ towards blue	0.165
	"	"	"	Pollux F.....	0.226			
	"	"	"	H β	0.238	— 0.012	Coincident	0.165
	"	"	"	Pollux F.....	0.268			
10. 10	"	"	"	H β	0.240	+ 0.028	$\frac{1}{10}$ towards red	0.165
	"	"	"	Pollux F.....	0.166			
	"	"	"	H β	0.194	— 0.028	$\frac{1}{10}$ towards blue	0.165
Feb. 11. 0. 0	M	1	6	Sky F	0.398			
	"	"	"	H β	0.372	+ 0.026		0.165
	"	"	"	Sky F	0.381			
	"	"	"	H β	0.371	+ 0.010		0.165
	"	"	"	Sky F	0.348			
	"	"	"	H β	0.368	— 0.020		0.165
	"	"	"	Sky F	0.384			
	"	"	"	H β	0.388	— 0.004		0.165
	"	"	"	Sky F	0.378			
	"	"	"	H β	0.370	+ 0.008		0.165
Mar. 14. 0. 0	M	1	5	Sky F	0.763			
	"	"	"	H β	0.762	+ 0.001	Coincident	0.144
	"	"	"	Sky F	0.796			
	"	"	"	H β	0.766	+ 0.030	Coincident	0.144
	"	"	"	Sky F	0.778			
	"	"	"	H β	0.768	+ 0.010	Coincident	0.144
	"	"	"	Sky F	0.790			
	"	"	"	H β	0.793	— 0.003	Coincident	0.144
	"	"	"	Sky F	0.775			
	"	"	"	H β	0.769	+ 0.006	Coincident	0.144
Mar. 14. 7. 30	M	1	5	Sirius F.....	0.621			
	"	"	"	H β	0.562	+ 0.059	$\frac{1}{3}$ towards red	0.144
7. 45	"	"	"	Sirius F.....	0.596			
	"	"	"	H β	0.543	+ 0.053	$\frac{1}{3}$ towards red	0.144
7. 55	"	"	"	Sirius F.....	0.598			
	"	"	"	H β	0.536	+ 0.062	$\frac{1}{3}$ towards red	0.144
8. 5	"	"	"	Sirius F.....	0.582			
	"	"	"	H β	0.548	+ 0.034	$\frac{1}{5}$ towards red	0.144
8. 15	"	"	"	Sirius F.....	0.531			
	"	"	"	H β	0.506	+ 0.025	$\frac{1}{7}$ towards red	0.144
Mar. 14. 8. 35	M	1	5	γ Geminorum F.....	0.398			
	"	"	"	H β	0.436	— 0.038	$\frac{1}{5}$ towards blue	0.144
8. 45	"	"	"	γ Geminorum F.....	0.488			
	"	"	"	H β	0.452	+ 0.036	$\frac{1}{7}$ towards red	0.144
9. 0	"	"	"	γ Geminorum F.....	0.373			
	"	"	"	H β	0.443	— 0.070	$\frac{1}{4}$ towards blue	0.144
9. 10	"	"	"	γ Geminorum F.....	0.378			
	"	"	"	H β	0.415	— 0.037	$\frac{1}{5}$ towards blue	0.144
Mar. 14. 9. 20	M	1	5	Procyon F.....	0.696			
	"	"	"	H β	0.648	+ 0.048	$\frac{1}{4}$ towards red	0.144
9. 25	"	"	"	Procyon F.....	0.782			
	"	"	"	H β	0.686	+ 0.096	$\frac{1}{2}$ towards red	0.144
9. 35	"	"	"	Procyon F.....	0.718			
	"	"	"	H β	0.663	+ 0.055	$\frac{1}{3}$ towards red	0.144
9. 45	"	"	"	Procyon F.....	0.698			
	"	"	"	H β	0.654	+ 0.044	$\frac{1}{4}$ towards red	0.144

1884GOAMM...44F...1C

Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
	Measured.	Estimated.	
+ 9.3	- 26.0	- 20.5	Definition good but spectrum and lines faint.
+ 9.3	- 13.0	- 9.3	
+ 9.3	- 0.7	- 3.7	
+ 9.3	- 17.9	- 14.9	
	+ 8.0		The faintness of the hydrogen spectrum rendered direct comparison absolutely impossible and made fair and trustworthy measures difficult. There was, however, no sign of any displacement. The hydrogen spectrum was very well defined though faint.
	+ 3.1		
	- 6.2		
	- 1.2		
	+ 2.5		
	+ 0.3		
	+ 9.2		
	+ 3.1		
	- 0.9		
	+ 1.8		
+ 13.6	+ 4.5	+ 11.2	Line well seen though the spectrum was tremulous. Direct comparison showed a small but distinct displacement towards the red.
+ 13.6	+ 2.7	+ 11.2	
+ 13.6	+ 5.4	+ 11.2	
+ 13.6	- 3.2	+ 1.3	
+ 13.6	- 5.9	- 3.0	
+ 18.0	- 29.7	- 32.9	
+ 18.0	- 6.9	- 7.4	
+ 18.0	- 39.5	- 36.6	
+ 18.0	- 29.4	- 32.9	
+ 15.5	- 0.8	+ 3.1	Definition fair.
+ 15.5	+ 14.0	+ 21.7	
+ 15.5	+ 1.4	+ 9.3	
+ 15.5	- 2.0	+ 3.1	

Date, 1882, Greenwich Sidereal Time.	Observer.	Number of Half- Prisms.	Reading of Position Circle.	Objects compared.	Micrometer Readings.	Displacement.		Width of Slit.
						Measured.	Estimated in Terms of the Breadth of the Comparison Line.	
d h m			°		r	r		r
Mar. 14. 10. 0	M	1	5	Castor F	0.525			
				H β	0.413	+ 0.112	$\frac{3}{5}$ towards red	0.144
10. 10	"	"	"	Castor F	0.512			
				H β	0.416	+ 0.096	$\frac{3}{5}$ towards red	0.144
10. 25	"	"	"	Castor F	0.436			
				H β	0.398	+ 0.038	$\frac{1}{5}$ towards red	0.144
Mar. 14. 10. 40	M	1	5	Pollux F	0.343			
				H β	0.415	- 0.072	$\frac{1}{3}$ towards blue	0.144
10. 55	"	"	"	Pollux F	0.324			
				H β	0.408	- 0.084	$\frac{2}{5}$ towards blue	0.144
Apr. 5. 9. 55	M	1	6	Sirius F	0.942			
				H β	0.825	+ 0.117	$\frac{3}{5}$ towards red	0.159
10. 10	"	"	"	Sirius F	0.898			
				H β	0.821	+ 0.077	$\frac{2}{5}$ towards red	0.159
10. 20	"	"	"	Sirius F	0.848			
				H β	0.798	+ 0.050	$\frac{1}{4}$ towards red	0.159
Apr. 5. 10. 35	M	1	6	Procyon F	0.955			
				H β	0.825	+ 0.130	$\frac{3}{5}$ towards red	0.159
10. 50	"	"	"	Procyon F	0.922			
				H β	0.816	+ 0.106	$\frac{1}{2}$ towards red	0.159
Apr. 5. 11. 0	M	1	6	Castor F	0.906			
				H β	0.776	+ 0.130	$\frac{3}{5}$ towards red	0.159
11. 15	"	"	"	Castor F	0.943			
				H β	0.809	+ 0.134	$\frac{3}{5}$ towards red	0.159
Apr. 6. 0. 0	M	1	6	Sky F	0.453			
				H β	0.572	- 0.119		0.159
	"	"	"	Sky F	0.429			
				H β	0.484	- 0.055		0.159
	"	"	"	Sky F	0.548			
				H β	0.500	+ 0.048		0.159
	"	"	"	Sky F	0.508			
				H β	0.443	+ 0.065		0.159
	"	"	"	Sky F	0.448			
				H β	0.450	- 0.002		0.159
Apr. 8. 9. 30	M	1	6	Sirius F	0.249			
				H β	0.188	+ 0.061	$\frac{1}{4}$ towards red	0.210
9. 40	"	"	"	Sirius F	0.251			
				H β	0.187	+ 0.064	$\frac{3}{10}$ towards red	0.210
9. 45	"	"	"	Sirius F	0.219			
				H β	0.177	+ 0.042	$\frac{1}{7}$ towards red	0.210
9. 55	"	"	"	Sirius F	0.329			
				H β	0.172	+ 0.157	$\frac{3}{5}$ towards red	0.210
10. 5	"	"	"	Sirius F	0.242			
				H β	0.187	+ 0.055	$\frac{1}{4}$ towards red	0.210
10. 15	"	"	"	Sirius F	0.243			
				H β	0.187	+ 0.056	$\frac{3}{10}$ towards red	0.210
Apr. 8. 10. 35	M	1	6	θ Leonis F	0.828			
				H β	0.810	+ 0.018	Coincident.	0.210
10. 45	"	"	"	θ Leonis F	0.838			
				H β	0.814	+ 0.024	$\frac{1}{10}$ towards red	0.210
10. 55	"	"	"	θ Leonis F	0.908			
				H β	0.788	+ 0.120	$\frac{1}{2}$ towards red	0.210

Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
	Measured.	Estimated.	
+ 16.7	+ 17.7	+ 27.9	Definition fair.
+ 16.7	+ 12.8	+ 27.9	
+ 16.7	- 5.0	- 1.8	
+ 16.3	- 38.4	- 41.1	
+ 16.3	- 42.1	- 46.0	
+ 14.1	+ 21.8	+ 28.3	Spectrum very tremulous. Direct comparison showed little or no displacement.
+ 14.1	+ 9.6	+ 14.2	
+ 14.1	+ 1.3	+ 3.6	
+ 17.4	+ 22.5	+ 25.0	Spectrum fairly steady but faint for a star of this magnitude.
+ 17.4	+ 15.2	+ 17.9	
+ 18.0	+ 21.9	+ 24.4	Spectrum rather faint but steady, and definition fair.
+ 18.0	+ 23.2	+ 24.4	
	- 36.6		
	- 16.9		
	+ 14.7		
	+ 20.0		
	- 0.6		Spectrum very tremulous but star-line very distinctly seen and easy to bisect. Direct comparison showed a small displacement towards the red, just enough to be clearly made out. The last two measures were not made under such good circumstances as the first four.
+ 14.0	+ 4.7	+ 4.7	
+ 14.0	+ 5.7	+ 8.4	
+ 14.0	- 1.8	- 4.0	
+ 14.0	+ 34.2	+ 30.8	
+ 14.0	+ 2.9	+ 4.7	
+ 14.0	+ 3.2	+ 8.0	
+ 10.9	- 5.4	- 10.9	Spectrum faint. Star-line broad but faint.
+ 10.9	- 3.5	- 3.5	
+ 10.9	+ 26.0	+ 26.4	

Date, 1882, Greenwich Sidereal Time.	Observer.	Number of Half- Prisms.	Reading of Position Circle.	Objects compared.	Micrometer Readings.	Displacement.		Width of Slit.
						Measured.	Estimated in Terms of the Breadth of the Comparison Line.	
d h m Apr. 8. 11. 20	M	1	6	δ Leonis F..... H β	r 0.376 0.468	r — 0.092	$\frac{2}{3}$ towards blue	r 0.210
11. 30	,,	,,	,,	δ Leonis F..... H β	0.422 0.485	— 0.063	$\frac{1}{4}$ towards blue	0.210
Apr. 8. 11. 45	M	1	6	Spica F..... H β	1.108 1.099	+ 0.009	Coincident.	0.210
11. 55	,,	,,	,,	Spica F..... H β	0.993 1.068	— 0.075	$\frac{3}{10}$ towards blue	0.210
12. 5	,,	,,	,,	Spica F..... H β	0.978 1.078	— 0.110	$\frac{2}{3}$ towards blue	0.210
12. 15	,,	,,	,,	Spica F..... H β	0.952 1.063	— 0.111	$\frac{1}{2}$ towards blue	0.210
Apr. 8. 12. 30	M	1	6	α Coronæ F..... H β	0.861 0.826	+ 0.035	$\frac{1}{3}$ towards red	0.210
12. 40	,,	,,	,,	α Coronæ F..... H β	0.927 0.871	+ 0.056	$\frac{1}{4}$ towards red	0.210
June 12. 15. 50	M	1	2	Arcturus F..... H β	0.546 0.598	— 0.052	$\frac{1}{4}$ towards blue	0.200
16. 10	,,	,,	,,	Arcturus F..... H β	0.548 0.608	— 0.060	$\frac{1}{4}$ towards blue	0.200
June 12. 16. 35	M	1	2	β Libræ F..... H β	0.334 0.456	— 0.122	$\frac{2}{3}$ towards blue	0.200
17. 0	,,	,,	,,	β Libræ F..... H β	0.434 0.492	— 0.058	$\frac{1}{3}$ towards blue	0.200
June 14. 16. 15	M	1	2	α Coronæ F..... H β	0.882 0.668	+ 0.214	1 towards red	0.200
16. 20	,,	,,	,,	α Coronæ F..... H β	0.908 0.676	+ 0.232	1 towards red	0.200
16. 30	,,	,,	,,	α Coronæ F..... H β	0.705 0.663	+ 0.042	$\frac{1}{3}$ towards red	0.200
16. 35	,,	,,	,,	α Coronæ F..... H β	0.814 0.652	+ 0.162	$\frac{2}{3}$ towards red	0.200
June 14. 16. 50	M	1	2	α Ophiuchi F..... H β	0.845 0.732	+ 0.113	$\frac{1}{3}$ towards red	0.200
16. 55	,,	,,	,,	α Ophiuchi F..... H β	0.963 0.821	+ 0.142	$\frac{2}{3}$ towards red	0.200
17. 0	,,	,,	,,	α Ophiuchi F..... H β	0.908 0.795	+ 0.113	$\frac{1}{3}$ towards red	0.200
17. 10	,,	,,	,,	α Ophiuchi F..... H β	0.769 0.735	+ 0.034	$\frac{1}{7}$ towards red	0.200
June 14. 17. 25	M	1	2	α Lyræ F..... H β	0.552 0.617	— 0.065	$\frac{1}{3}$ towards blue	0.200
17. 35	,,	,,	,,	α Lyræ F..... H β	0.453 0.581	— 0.128	$\frac{2}{3}$ towards blue	0.200
June 14. 17. 50	M	1	2	α Aquilæ F..... H β	0.488 0.536	— 0.048	$\frac{1}{3}$ towards blue	0.200
18. 0	,,	,,	,,	α Aquilæ F..... H β	0.468 0.552	— 0.084	$\frac{1}{3}$ towards blue	0.200
18. 15	,,	,,	,,	α Aquilæ F..... H β	0.477 0.542	— 0.065	$\frac{1}{4}$ towards blue	0.200
18. 30	,,	,,	,,	α Aquilæ F..... H β	0.348 0.560	— 0.212	1 towards blue	0.200

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Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
	Measured.	Estimated.	
+ 11.2	— 39.5	— 41.1	Spectrum fairly well defined and steady.
+ 11.2	— 30.6	— 29.9	
— 0.1	+ 2.9	+ 0.1	Spectrum bright but somewhat tremulous. Star-line faint and not well defined.
— 0.1	— 22.9	— 22.3	
— 0.1	— 30.6	— 29.8	
— 0.1	— 34.0	— 37.2	
— 4.8	+ 15.6	+ 19.7	Star-line dark. Spectrum faint. Definition poor.
— 4.8	+ 22.0	+ 23.5	
+ 13.2	— 29.1	— 28.6	Star-line somewhat faint but sharp and well defined.
+ 13.2	— 31.6	— 28.6	
+ 9.9	— 47.3	— 46.9	Star-line broad. Spectrum very faint.
+ 9.9	— 27.7	— 30.5	
+ 8.7	+ 57.0	+ 53.0	Definition good.
+ 8.7	+ 62.5	+ 53.0	
+ 8.7	+ 4.2	+ 3.6	
+ 8.7	+ 41.0	+ 32.4	
— 0.8	+ 35.5	+ 31.6	Definition fair. Star-line broad and nebulous.
— 0.8	+ 44.4	+ 41.9	
— 0.8	+ 35.5	+ 31.6	
— 0.8	+ 11.2	+ 9.6	
— 2.9	— 17.0	— 17.6	The position for observing was very uncomfortable. The measures would otherwise have been much easier to make and probably more accordant. Definition good.
— 2.9	— 36.3	— 38.2	
— 9.2	— 5.5	— 3.1	Definition very good. Last measure rough, being made rather hastily. <i>Note.</i> —The spectrum of hydrogen was compared with the sky spectrum on June 16, and the H β line seemed to be perfectly coincident with the F line of the sky spectrum. The adjustments of the spectroscope had remained unchanged from June 12.
— 9.2	— 16.6	— 11.3	
— 9.2	— 10.7	— 6.2	
— 9.2	— 55.8	— 52.5	

Date, 1882, Greenwich Sidereal Time.	Observer.	Number of Half- Prisms.	Reading of Position Circle.	Objects compared.	Micrometer Readings.	Displacement.		Width of Slit.
						Measured.	Estimated in Terms of the Breadth of the Comparison Line.	
d h m July 10. 18. 0	M	1	9	α Ophiuchi F	0.920	r		r
18. 20	,,	,,	,,	H β	1.021	— 0.101	$\frac{1}{3}$ towards blue	0.289
	,,	,,	,,	α Ophiuchi F	0.918			
	,,	,,	,,	H β	1.042	— 0.124	$\frac{2}{3}$ towards blue	0.289
July 12. 17. 15	M	1	9	α Aquilæ F	0.923			
17. 30	,,	,,	,,	H β	1.019	— 0.096	$\frac{1}{3}$ towards blue	0.289
	,,	,,	,,	α Aquilæ F	0.889			
	,,	,,	,,	H β	1.027	— 1.038	$\frac{1}{2}$ towards blue	0.289
July 15. 18. 25	M	1	9	α Cygni F	0.380			
18. 55	,,	,,	,,	H β	0.536	— 0.156	$\frac{1}{2}$ towards blue	0.289
	,,	,,	,,	α Cygni F	0.492			
	,,	,,	,,	H β	0.538	— 0.066	$\frac{1}{5}$ towards blue	0.289
July 24. 19. 25	M	1	9	β Cassiopeiæ F	0.673			
19. 40	,,	,,	,,	H β	0.648	+ 0.025	$\frac{1}{10}$ towards red	0.289
	,,	,,	,,	β Cassiopeiæ F	0.736			
	,,	,,	,,	H β	0.612	+ 0.124	$\frac{1}{3}$ towards red	0.289
July 24. 20. 0	M	1	9	α Pegasi F	0.187			
20. 15	,,	,,	,,	H β	0.324	— 0.137	$\frac{1}{2}$ towards blue	0.289
	,,	,,	,,	α Pegasi F	0.337			
	,,	,,	,,	H β	0.370	— 0.033	$\frac{1}{10}$ towards blue	0.289
July 29. 18. 30	M	1	5	α Lyrae F	0.572			
18. 45	,,	,,	,,	H β	0.698	— 0.126	$\frac{1}{2}$ towards blue	0.227
	,,	,,	,,	α Lyrae F	0.566			
	,,	,,	,,	H β	0.692	— 0.126	$\frac{1}{2}$ towards blue	0.227
July 29. 19. 0	M	1	5	Moon F	0.253			
19. 5	,,	,,	,,	H β	0.256	— 0.003		0.227
19. 10	,,	,,	,,	Moon F	0.269			
19. 15	,,	,,	,,	H β	0.264	+ 0.005		0.227
19. 20	,,	,,	,,	Moon F	0.216			
	,,	,,	,,	H β	0.254	— 0.038		0.227
	,,	,,	,,	Moon F	0.898			
	,,	,,	,,	H β	0.912	— 0.014		0.227
	,,	,,	,,	Moon F	0.908			
	,,	,,	,,	H β	0.906	+ 0.002		0.227
Aug. 2. 19. 0	M	1	5	α Aquilæ F	0.549			
19. 15	,,	,,	,,	H β	0.476	+ 0.073	$\frac{2}{5}$ towards red	0.119
	,,	,,	,,	α Aquilæ F	0.498			
	,,	,,	,,	H β	0.467	+ 0.031	$\frac{1}{5}$ towards red	0.119
Aug. 2. 20. 15	M	1	5	ζ Aquilæ F	0.258			
20. 40	,,	,,	,,	H β	0.338	— 0.080	$\frac{2}{5}$ towards blue	0.119
	,,	,,	,,	ζ Aquilæ F	0.388			
	,,	,,	,,	H β	0.373	+ 0.015	$\frac{1}{10}$ towards red	0.119
Aug. 2. 21. 15	M	1	5	α Delphini F	0.142			
21. 35	,,	,,	,,	H β	0.224	— 0.082	$\frac{2}{5}$ towards blue	0.119
	,,	,,	,,	α Delphini F	0.235			
	,,	,,	,,	H β	0.233	+ 0.002	Coincident	0.119
Aug. 2. 21. 50	M	1	5	α Pegasi F	0.719			
22. 0	,,	,,	,,	H β	0.822	— 0.103	$\frac{1}{2}$ towards blue	0.119
	,,	,,	,,	α Pegasi F	0.828			
	,,	,,	,,	H β	0.855	— 0.027	$\frac{1}{7}$ towards blue	0.119

Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
	Measured.	Estimated.	
+ 6.7 + 6.7	- 37.7 - 44.8	- 41.7 - 48.6	Definition good but spectrum faint.
- 2.6 - 2.6	- 26.9 - 39.8	- 32.4 - 49.9	Spectrum faint. Clouds forming. Line not so well seen in the second as in the first observation.
- 5.8 - 5.8	- 42.0 - 14.4	- 46.7 - 15.2	Definition variable. Spectrum bright.
- 11.2 - 11.2	+ 18.9 + 49.3	+ 21.7 + 46.2	Cloud passing. Observation difficult and unsatisfactory.
- 12.8 - 12.8	- 29.4 + 2.7	- 39.7 + 2.3	Cloud passing. Observation difficult and unsatisfactory. <i>Note.</i> —The spectrum of hydrogen was compared with the sky spectrum on July 27; the H β line seemed to be perfectly coincident with the F line of the sky spectrum. The adjustments of the spectroscope had remained unchanged from July 10.
+ 3.3 + 3.3	- 42.0 - 42.0	- 45.0 - 45.0	Spectrum faint for so bright a star, but fairly steady.
	- 0.9 + 1.5 - 11.7 - 4.3 + 0.6		Coincidence appeared perfect. Moon spectrum faint. Definition fair.
+ 2.8 + 2.8	+ 19.6 + 6.7	+ 23.2 + 10.2	Definition good. Definition good.
+ 5.5 + 5.5	- 30.0 - 0.9	- 31.5 + 1.0	Spectrum so faint that bisection of the line was all but impossible. The definition of the star-line was, however, good and the spectrum steady.
- 1.4 - 1.4	- 23.8 + 2.0	- 24.6 + 1.4	Spectrum so faint that bisection of the line was almost impossible. The definition of the star-line was, however, good and the spectrum steady.
- 11.1 - 11.1	- 20.5 + 2.8	- 21.4 + 1.8	Definition good. Spectrum steady and not too faint for work.

Date, 1882, Greenwich Sidereal Time.	Observer.	Number of Half- Prisms.	Reading of Position Circle.	Objects compared.	Micrometer Readings.	Displacement.		Width of Slit.
						Measured.	Estimated in Terms of the Breadth of the Comparison Line.	
d h m			°		r	r		r
Aug. 2. 22. 10	M	1	5	Moon F.....	0.938			
	"	"	"	H β	0.904	+ 0.034		0.119
	"	"	"	Moon F.....	0.867			
	"	"	"	H β	0.888	- 0.021		0.119
	"	"	"	Moon F.....	0.877			
	"	"	"	H β	0.890	- 0.013		0.119
	"	"	"	Moon F.....	0.900			
	"	"	"	H β	0.888	+ 0.012		0.119
22. 30	"	"	"	Moon F.....	0.962			
	"	"	"	H β	0.932	+ 0.030		0.119
Aug. 4. 21. 50	M	1	5	α Lyræ F.....	0.513			
	"	"	"	H β	0.599	- 0.086	$\frac{2}{3}$ towards blue	0.133
21. 55	"	"	"	α Lyræ F.....	0.456			
	"	"	"	H β	0.568	- 0.112	$\frac{1}{2}$ towards blue	0.133
Aug. 4. 22. 25	M	1	5	α Cygni F.....	0.787			
	"	"	"	H β	0.882	- 0.095	$\frac{1}{2}$ towards blue	0.133
22. 30	"	"	"	α Cygni F.....	0.865			
	"	"	"	H β	0.902	- 0.037	$\frac{1}{4}$ towards blue	0.133
Aug. 4. 22. 40	N	1	5	α Cygni F.....	0.817			
	"	"	"	H β	0.896	- 0.079	$\frac{1}{2}$ towards blue	0.133
22. 50	"	"	"	α Cygni F.....	0.839			
	"	"	"	H β	0.889	- 0.050	$\frac{1}{3}$ towards blue	0.133
Aug. 8. 19. 30	M	1	5	Arcturus b_1	0.115			
	"	"	"	Mg ₁	0.300	- 0.185	$\frac{1}{3}$ towards blue	0.171
19. 45	"	"	"	Arcturus b_1	0.250			
	"	"	"	Mg ₁	0.284	- 0.034	$\frac{1}{3}$ towards blue	0.171
Aug. 8. 20. 0	N	1	5	Arcturus b_1	0.172			
	"	"	"	Mg ₁	0.279	- 0.107	$\frac{1}{3}$ towards blue	0.171
Aug. 8. 20. 20	M	1	5	γ Aquilæ b_1	0.844			
	"	"	"	Mg ₁	0.891	- 0.047	$\frac{1}{10}$ towards blue	0.171
20. 30	"	"	"	γ Aquilæ b_1	0.881			
	"	"	"	Mg ₁	0.927	- 0.046	$\frac{1}{10}$ towards blue	0.171
Aug. 8. 20. 50	N	1	5	γ Aquilæ b_1	0.967			
	"	"	"	Mg ₁	0.998	- 0.031	Coincident	0.171
Aug. 8. 21. 15	N	1	5	η Pegasi b_1	0.089			
	"	"	"	Mg ₁	0.118	- 0.029	$\frac{1}{10}$ towards blue	0.171
22. 25	"	"	"	η Pegasi b_1	0.361			
	"	"	"	Mg ₁	0.374	- 0.013	Coincident	0.171
Aug. 8. 21. 45	M	1	5	η Pegasi b_1	0.828			
	"	"	"	Mg ₁	0.814	+ 0.014	Coincident	0.171
22. 0	"	"	"	η Pegasi b_1	0.799			
	"	"	"	Mg ₁	0.810	- 0.011	Coincident	0.171
Aug. 21. 20. 0	M	1	5	γ Draconis b_1	0.681			
	"	"	"	Mg ₁	0.682	- 0.011	Coincident	0.150
20. 15	"	"	"	γ Draconis b_1	0.661			
	"	"	"	Mg ₁	0.686	- 0.025	$\frac{1}{10}$ towards blue	0.150
Aug. 21. 20. 45	M	1	5	β Cygni b_1	0.684			
	"	"	"	Mg ₁	0.600	+ 0.084	$\frac{2}{3}$ towards red	0.150
21. 0	"	"	"	β Cygni b_1	0.504			
	"	"	"	Mg ₁	0.591	- 0.087	$\frac{1}{4}$ towards blue	0.150
21. 20	"	"	"	β Cygni b_1	0.461			
	"	"	"	Mg ₁	0.579	- 0.118	$\frac{1}{2}$ towards blue	0.150
21. 35	"	"	"	β Cygni b_1	0.448			
	"	"	"	Mg ₁	0.568	- 0.120	$\frac{3}{8}$ towards blue	0.150

Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
	Measured.	Estimated.	
	+ 10.4 - 6.5 - 4.0 + 3.7 + 9.2		Coincidence appeared perfect.
+ 4.1 + 4.1	- 30.5 - 38.5	- 26.1 - 31.6	Spectrum steady and bright. Definition very satisfactory.
- 3.2 - 3.2	- 25.9 - 8.1	- 24.3 - 10.5	Spectrum steady and bright. Definition very satisfactory.
- 3.2 - 3.2	- 21.0 - 12.2	- 24.3 - 7.8	
+ 14.1 + 14.1	- 82.9 - 26.7	- 69.1 - 69.1	Definition poor. Spectrum very tremulous. Measures rough.
+ 14.1	- 53.9	- 69.1	
+ 4.5 + 4.5	- 22.0 - 21.6	- 20.9 - 20.9	Definition good. Spectrum steady but faint. Star-line exceedingly faint.
+ 4.5	- 16.0	- 4.5	
- 9.0 - 9.0	- 1.8 + 4.2	- 7.4 + 9.0	Definition fair. Spectrum fairly bright but somewhat tremulous.
- 9.0 - 9.0	+ 14.2 + 4.9	+ 9.0 + 9.0	
+ 4.2 + 4.2	- 4.6 - 13.5	- 4.2 - 16.2	Wind high ; spectrum somewhat tremulous and lines rather faint and ill-defined for this star, which usually shows them very distinctly.
+ 5.8 + 5.8 + 5.8 + 5.8	+ 25.4 - 38.1 - 49.6 - 50.4	+ 42.1 - 35.7 - 65.7 - 77.6	Definition poor. Wind high, spectrum tremulous. The star-line was decidedly better seen in the three later observations than in the first.

Date, 1882, Greenwich Sidereal Time.	Observer.	Number of Half- Prisms.	Reading of Position Circle.	Objects compared.	Micrometer Readings.	Displacement.		Width of Slit.
						Measured.	Estimated in Terms of the Breadth of the Comparison Line.	
d h m Aug. 21. 22. 15	M	1	5	γ Cygni b_1 Mg ₁	0.662 0.662	— 0.000	Coincident	0.150
22. 30	,,	,,	,,	γ Cygni b_1 Mg ₁	0.610 0.691	— 0.081	$\frac{1}{3}$ towards blue	0.150
Aug. 21. 22. 50	M	1	5	α Cygni b_1 Mg ₁	0.623 0.689	— 0.066	$\frac{1}{3}$ towards blue	0.150
23. 0	,,	,,	,,	α Cygni b_1 Mg ₁	0.576 0.681	— 0.105	$\frac{1}{2}$ towards blue	0.150
Aug. 21. 23. 30	M	1	5	ζ Cygni b_1 Mg ₁	0.656 0.644	+ 0.012	$\frac{1}{10}$ towards red	0.150
23. 45	,,	,,	,,	ζ Cygni b_1 Mg ₁	0.631 0.642	— 0.011	$\frac{1}{10}$ towards blue	0.150
Oct. 8. 22. 35	M	1	5	α Cygni b_1 Mg ₁	0.692 0.611	— 0.081	$\frac{3}{10}$ towards blue	0.190
22. 50	,,	,,	,,	α Cygni b_1 Mg ₁	0.722 0.608	— 0.114	$\frac{2}{5}$ towards blue	0.190
Nov. 8. 23. 23	N	1	5	α Lyrae F..... H β	0.560 0.720	— 0.160	$\frac{3}{4}$ towards blue	0.144
	,,	,,	,,	α Lyrae F..... H β	0.294 0.360	— 0.066	$\frac{1}{2}$ towards blue	0.144
0. 4	,,	,,	,,	α Lyrae F..... H β	0.178 0.313	— 0.135	$\frac{1}{2}$ towards blue	0.144
	,,	,,	,,	α Lyrae F..... H β	0.087 0.221	— 0.134	$\frac{1}{2}$ towards blue	0.144
Nov. 8. 1. 10	N	1	5	α Persei F..... H β	0.229 0.341	— 0.112	$\frac{1}{2}$ towards blue	0.144
Nov. 9. 0. 10	M	1	5	α Pegasi F..... H β	0.889 0.907	— 0.018	$\frac{1}{10}$ towards blue	0.232
0. 30	,,	,,	,,	α Pegasi F..... H β	0.734 0.878	— 0.144	$\frac{1}{2}$ towards blue	0.232
0. 45	,,	,,	,,	α Pegasi F..... H β	0.752 0.862	— 0.110	$\frac{2}{5}$ towards blue	0.232
1. 0	,,	,,	,,	α Pegasi F..... H β	0.722 0.868	— 0.146	$\frac{1}{2}$ towards blue	0.232
Nov. 9. 1. 30	M	1	5	γ Pegasi F..... H β	0.876 0.958	— 0.082	$\frac{1}{3}$ towards blue	0.232
1. 45	,,	,,	,,	γ Pegasi F..... H β	0.853 0.962	— 0.109	$\frac{2}{5}$ towards blue	0.232
Nov. 9. 2. 0	M	1	5	β Persei F..... H β	0.618 0.518	+ 0.100	$\frac{2}{5}$ towards red	0.232
2. 10	,,	,,	,,	β Persei F..... H β	0.478 0.482	— 0.004	Coincident	0.232
Nov. 9. 2. 30	M	1	5	Capella F..... H β	0.999 0.933	+ 0.066	$\frac{1}{4}$ towards red	0.232
3. 5	,,	,,	,,	Capella F..... H β	0.875 0.855	+ 0.020	$\frac{1}{10}$ towards red	0.232
Nov. 10. 0. 55	N	1	5	Capella F..... H β	0.343 0.311	+ 0.032	$\frac{1}{4}$ towards red	0.097
1. 3	,,	,,	,,	Capella F..... H β	0.339 0.301	+ 0.038	$\frac{1}{4}$ towards red	0.097

Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
	Measured.	Estimated.	
+ 1'0 + 1'0	- 1'0 - 31'1	- 1'0 - 40'9	Definition poor. The first measure appeared the better.
- 0'8 - 0'8	- 23'7 - 38'2	- 39'1 - 59'1	Definition fair. Wind still high and spectrum unsteady but bright.
- 0'6 - 0'6	+ 5'1 - 3'5	+ 12'6 - 11'4	Definition poor. Spectrum faint and unsteady.
+ 6'0 + 6'0	- 36'1 - 48'4	- 47'0 - 60'7	Spectrum faint for so bright a star. Thin cloud or light mist. Spectrum rather too narrow. Lines steady but faint. Definition fair.
+ 7'5 + 7'5 + 7'5 + 7'5	- 56'6 - 27'7 - 48'9 - 48'6	- 59'3 - 42'0 - 42'0 - 42'0	Star spectrum very bright. Satisfactory observation.
- 4'2	- 30'2	- 30'3	Considered good. The sky clouded up suddenly before another measure could be obtained.
+ 14'6 + 14'6 + 14'6 + 14'6	- 20'1 - 58'8 - 48'4 - 59'4	- 22'2 - 52'5 - 44'9 - 52'5	Star spectrum faint. Star-line ill-defined. Definition poor.
+ 11'8 + 11'8	- 37'0 - 45'2	- 37'1 - 42'1	Definition poor. Spectrum faint.
- 2'1 - 2'1	+ 32'8 + 0'9	+ 32'4 + 2'1	Definition fair. Spectrum bright.
- 9'3 - 9'3	+ 29'5 + 15'4	+ 28'3 + 16'9	Spectrum faint, but definition fair. Sky clouding over. Last measure bad. Interrupted by cloud.
- 9'1 - 9'1	+ 18'9 + 20'8	+ 24'8 + 24'8	A good measure. Tolerably good. Line fairly distinct.

28 COLLECTED RESULTS FOR MOTIONS OF STARS IN THE LINE OF SIGHT, FROM SPECTROSCOPIC OBSERVATIONS

COLLECTED RESULTS for MOTIONS of STARS in the line of Sight, from SPECTROSCOPIC OBSERVATIONS made at the ROYAL OBSERVATORY, GREENWICH, in the Year 1882.

(F for the Star or Moon is compared with H_{β} of Hydrogen, and b_1, b_2, b_4 with Mg_1, Mg_2, Mg_3 of Magnesium.)

(+ denotes Recession ; - Approach.)

Date, 1882.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.	
								Measured.	Estimated.
β CASSIOPEIÆ.									
July 24	M	2	1	9	0.289	F	- 11.2	+ 34.1	+ 33.9
γ PEGASI.									
November 9	M	2	1	5	0.232	F	+ 11.8	- 41.1	- 39.6
β PERSEI.									
November 9	M	2	1	5	0.232	F	- 2.1	+ 16.8	+ 17.3
α PERSEI.									
November 8	N	1	1	5	0.144	F	- 4.2	- 30.2	- 30.3
α AURIGÆ (<i>Capella</i>).									
November 9 10	M N	2 2	1 1	5 5	0.232 0.097	F F	- 9.3 - 9.1	+ 22.5 + 19.9	+ 22.6 + 24.8
γ ORIONIS.									
February 10	M	3	1	6	0.165	F	+ 16.0	+ 8.5	+ 5.4
β TAURI.									
February 10	M	3	1	6	0.165	F	+ 16.4	- 34.0	- 31.3

Date, 1882.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
γ GEMINORUM.										
March	14	M	4	1	$\circ$ 5	r 0.144	F	+ 18.0	- 26.4	- 27.4
α CANIS MAJORIS (<i>Sirius</i>).										
February	10	M	6	1	6	0.165	F	+ 9.3	- 1.7	- 3.3
March	14	M	5	1	5	0.144	F	+ 13.6	+ 0.7	+ 6.4
April	5	M	3	1	6	0.159	F	+ 14.1	+ 10.9	+ 15.4
	8	M	6	1	6	0.210	F	+ 14.0	+ 8.2	+ 8.9
α GEMINORUM (<i>Castor</i>).										
February	10	M	4	1	6	0.165	F	+ 10.3	+ 19.9	+ 15.3
March	14	M	3	1	5	0.144	F	+ 16.7	+ 8.5	+ 18.0
April	5	M	2	1	6	0.159	F	+ 18.0	+ 22.5	+ 24.4
α CANIS MINORIS (<i>Procyon</i>).										
February	10	M	2	1	6	0.165	F	+ 8.5	+ 27.6	+ 24.1
March	14	M	4	1	5	0.144	F	+ 15.5	+ 3.2	+ 9.3
April	5	M	2	1	6	0.159	F	+ 17.4	+ 18.8	+ 21.5
α GEMINORUM (<i>Pollux</i>).										
February	10	M	4	1	6	0.165	F	+ 9.3	- 14.4	- 12.1
March	14	M	2	1	5	0.144	F	+ 16.3	- 40.3	- 43.6
δ LEONIS.										
April	8	M	2	1	6	0.210	F	+ 11.2	- 35.0	- 35.5
θ LEONIS.										
April	8	M	3	1		0.210	F	+ 10.9	+ 5.7	+ 4.0

30 COLLECTED RESULTS FOR MOTIONS OF STARS IN THE LINE OF SIGHT, FROM SPECTROSCOPIC OBSERVATIONS

Date, 1882	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
α VIRGINIS (<i>Spica</i>).										
April	8	M	4	1	$\circ$ 6	r 0.210	F	— 0.1	— 21.2	— 22.3
α BOOTIS (<i>Arcturus</i>).										
June	12	M	2	1	2	0.200	F	+ 13.2	— 30.4	— 28.6
August	8	M	2	1	5	0.171	b_1	+ 14.1	— 54.8	— 69.1
		N	1	1	5	0.171	b_1	+ 14.1	— 53.9	— 69.1
β LIBRÆ.										
June	12	M	2	1	2	0.200	F	+ 9.9	— 37.5	— 38.7
α CORONÆ.										
April	8	M	2	1	6	0.210	F	— 4.8	+ 18.8	+ 21.6
June	14	M	4	1	2	0.200	F	+ 8.7	+ 41.2	+ 35.5
α OPHIUCHI.										
June	14	M	4	1	2	0.200	F	— 0.8	+ 31.6	+ 28.7
July	10	M	2	1	9	0.289	F	+ 6.7	— 41.2	— 45.2
γ DRACONIS.										
August	21	M	2	1	5	0.150	b_1	+ 4.2	— 9.0	— 10.2
α LYRÆ (<i>Vega</i>).										
June	14	M	2	1	2	0.200	F	— 2.9	— 26.7	— 27.9
July	29	M	2	1	5	0.227	F	+ 3.3	— 42.0	— 45.0
August	4	M	2	1	5	0.133	F	+ 4.1	— 34.5	— 28.8
November	8		4	1	5	0.144	F	+ 7.5	— 45.5	— 46.4
ζ AQUILÆ.										
August	2	M	2	1	5	0.119	F	+ 5.5	— 15.5	— 15.3

Date, 1882.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.	
								Measured.	Estimated.
β CYGNI.									
August 21	M	4	1	^o 5	^r 0.150	b_1	+ 5.8	- 28.2	- 34.2
γ AQUILÆ.									
August 8	M	2	1	5	0.171	b_1	+ 4.5	- 21.8	- 20.9
	N	1	1	5	0.171	b_1	+ 4.5	- 16.0	- 4.5
α AQUILÆ (<i>Altair</i>).									
June 14	M	4	1	2	0.200	F	- 9.2	- 22.2	- 18.3
July 12	M	2	1	9	0.289	F	- 2.6	- 33.3	- 41.1
August 2	M	2	1	5	0.119	F	+ 2.8	+ 13.1	+ 16.7
γ CYGNI.									
August 21	M	2	1	5	0.150	b_1	+ 1.0	- 16.1	- 21.0
α DELPHINI.									
August 2	M	2	1	5	0.119	F	- 1.4	- 10.9	- 11.6
α CYGNI.									
July 15	M	2	1	9	0.289	F	- 5.8	- 28.2	- 30.9
August 4	M	2	1	5	0.133	F	- 3.2	- 17.0	- 17.4
	N	2	1	5	0.133	F	- 3.2	- 16.6	- 16.0
August 21	M	2	1	5	0.150	b_1	- 0.8	- 31.0	- 49.1
October 7	M	2	1	5	0.190	b_1	+ 6.0	- 42.2	- 53.9
ζ CYGNI.									
August 21	M	2	1	5	0.150	b_1	- 0.6	+ 0.8	+ 0.6
η PEGASI.									
August 8	N	2	1	5	0.171	b_1	- 9.0	+ 1.2	+ 0.8
	M	2	1	5	0.171	b_1	- 9.0	+ 9.5	+ 9.0

32 COLLECTED RESULTS FOR MOTIONS OF STARS IN THE LINE OF SIGHT, FROM SPECTROSCOPIC OBSERVATIONS

Date, 1882.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
α PEGASI.										
July 24	M	2	1	9	0.289	F	- 12.8	- 13.3	- 18.7	
August 2	M	2	1	5	0.119	F	- 11.1	- 8.9	- 9.8	
November 9	M	4	1	5	0.232	F	+ 14.6	- 46.7	- 43.0	
MOON.										
July 29	M	5	1	5	0.227	F	..	- 3.0	..	
August 2	M	5	1	5	0.119	F	..	+ 2.6	..	
SKY SPECTRUM.										
February 11	M	5	1	6	0.165	F	..	+ 1.2	..	
March 14	M	5	1	5	0.144	F	..	+ 2.7	..	
April 6	M	5	1	6	0.159	F	..	- 3.9	..	

OBSERVATIONS of the SPECTRA of URANUS, of sundry STARS, of COMETS *a* and *b* 1882, and of an AURORA, made at the ROYAL OBSERVATORY, GREENWICH, in the YEAR 1882.

URANUS.

1882, March 16^d. 7^h₂.

Single-prism Spectroscope. Micrometer B.

Observer, M.

The spectrum showed four broad *dark* bands, and two or three very faint lines. The bands seemed to be shaded at the edges on both sides. The measures of the positions of the faint lines are very rough. The following wave-lengths for the bands and lines were inferred from a curve formed from measures of the lines in the solar spectrum; the index error for the time of observation being determined by measures of the positions of the D lines of sodium and of the sharp edges of the principal bright bands in the spectrum of a Bunsen flame.

	Band or Line.	Wave-length.
		tenth-metres.
	Spectrum begins about	5960
	Band I. Diffused, broad and dark band	5714
	Band II.	5430
	Faint line	5232
	Faint line	5039
	Faint line	4906
	Band III., probably F.	4857
	Band IV.	4593
	Spectrum ends about	4450

TYPES OF STARS.

1882, March 16.

Single-prism Spectroscope.

Observer, M.

The spectra of the four following stars, of which the three last are not in Secchi's *Catalogo delle Stelle di cui si è determinato lo Spettro luminoso*, were examined to determine the type to which they belong.

δ Leonis. Type I. F and *g* strongly marked. F broad and diffused.

θ Leonis. Type I. F and *g* strongly marked. F narrow, darker, and more condensed in the centre than in δ Leonis.

μ Ursæ Majoris. Type II. A fine example. The *b* lines very strong, and the E group distinct.

ψ Ursæ Majoris. Type I. apparently. The F line very faint and diffused. The lines in the spectrum seen with great difficulty.

COMET *a* 1882 (WELLS).

1882, April 22.

Single-prism Spectroscope.

Position Circle, 348°.

Observer, M.

Only a continuous spectrum could be detected. This was very fairly bright from the star-like nucleus, and a faint spectrum could also be traced for some distance down the tail. With a fairly narrow slit the spectrum could be traced from a little below D to a little below F, say from λ 5900 to λ 4900. The sky clouded before any more definite observations could be secured.

1882, April 24.

Single-prism Spectroscope.

Position Circle, 348°.

Width of Slit, 0^m.03 and 0^m.09.

Observer, M.

Only a continuous spectrum could be detected. This was not equally bright throughout, there being two ill-defined maxima in the green and greenish-blue. The spectrum was traceable from about λ 6000 to λ 4400.

34 OBSERVATIONS OF SPECTRA OF URANUS, OF SUNDRY STARS, OF COMETS *a* AND *b* 1882, AND OF AN AURORA,

1882, May 11.

Half-prism Spectroscope. One "half-prism" reversed.

Magnifying power, 28. Position Circle, 270° .

Observer, M.

The Comet gave simply a continuous spectrum, which was easily traceable from about λ 6100 to about λ 4700. No bright bands or break of continuity was detected either with a wide or narrow slit. The continuous spectrum seemed remarkably bright from the nucleus, considering the comparative faintness of the Comet, and the high dispersion, 5° from A to H, employed.

1882, May 13.

Half-prism Spectroscope. One "half-prism" reversed.

Magnifying power, 15. Position Circle, 270° .

Observer, M.

Very careful and repeated examination failed to show any definite bands. Once or twice an ill-defined maximum was suspected, a little to the red of the green band of the Bunsen-flame spectrum, in other words near E; but as the spectrum is naturally brightest about this point, but little weight can attach to the suspicion.

The spectrum was traced for a distance from the centre of the nucleus of nearly one minute in each direction, and from about λ 6150 to about λ 4300.

1882, May 20.

Half-prism Spectroscope. One "half-prism" reversed.

Magnifying powers 15 and 28. Position Circle, 270° .*also* Single-prism Spectroscope.*also* Eyepiece-prism.

Observer, M.

With none of these dispersions could any bright bands, properly so called, be distinguished; but two faint broad *dark* bands, or what gave that impression, crossed the spectrum. Practically the same observation as on April 24, when two maxima of light were noticed, the maxima observed on that occasion lying respectively between and on the blue side of the two minima observed now.

A third dark band was suspected near D on the blue side of that line.

These dark bands seemed to be sharp at the edges, but were all exceedingly faint, the most refrangible least so, the middle one much fainter, the third by far the faintest of the three.

The spectrum described above was that from the nucleus and head. The tail showed a very short continuous spectrum visible only in the green. At least it gave that impression. It might be mistaken for the bright green band of carbon, but it seemed too regular for this to be the case, there being no trace of a sharp edge towards the red to be detected. It also extended too far towards the red. The spectrum from the nucleus was traced from about λ 6150 to λ 4300.

The following measures were obtained with the Single-prism spectroscopy of two of the dark bands, as compared with the sharp edges of the bright bands in the blue and green of the spectrum of a Bunsen-flame, the wave-lengths being inferred by means of a curve formed from measures of the lines in the solar spectrum.

	tenth-metres.	
Band in the blue.....	4818	4811 and 4855.
Band in the green.....		5493.

1882, May 22. 9^h. to 10¹/₂^h.

Single-prism Spectroscope.

Observer, M.

The continuous spectrum alone was visible, but the sky spectrum in its neighbourhood was so strong that no bright bands could possibly have been seen unless they had been exceedingly bright. Only the spectrum from the central nucleus could be examined, and this was too narrow to show dark bands. The sky clouded over at half-past ten.

1882, May 31.

Single-prism Spectroscope. Micrometer B.

Observer, M.

The hindrances to observation were very great, the Comet being in a very awkward position. It was also very difficult to keep it on the slit.

The spectrum from the nucleus was a bright but very narrow ribbon of light of irregular intensity.

The spectrum of the Comet was compared with those of sodium and of a Bunsen-flame.

Nature of Object.	Wave-length.
	tenth-metres.
A bright point near D.....	5902.7
A dark space about 120 tenth-metres in breadth follows ..	...
An irregular bright streak not nearly so distinct as that near D.....	5328
Another streak somewhat better defined	5146
A dark space near F	4862
Another dark space a little further towards the blue, not measured.....	...

The above measures are exceedingly rough.

These irregularities were only seen at times. At times, however, the whole spectrum seemed full of bright lines, but the hindrances to observation were so great that no continued view could be obtained of them.

The general appearance of the spectrum was not altered from May 20, except that its greatly increased brilliancy allowed the details to be better seen.

1882, June 7.

Half-prism Spectroscope. One "half-prism" direct.
Magnifying power, 14. Position Circle, 92°.

Observer, M.

The moment the Comet came on the slit the exceeding brilliancy of the line in the yellow was remarked. There was also a continuous spectrum, but no lines either bright or dark were noted in it. The yellow line was, however, so exceedingly brilliant, and so far outshone the rest of the spectrum, that it would be scarcely an exaggeration to say that the Comet shone by monochromatic light. The Comet rose in cloud, and was not seen in the spectroscope until 15^h. 30^m.; it was clearly seen in the 3ⁱⁿ finder, as a planetary disk of very nearly the same colour as Mars, until 15^h. 50^m. four minutes after sunrise, when it was accidentally lost, and the sky clouded over before it could be picked up again. The tail was masked by the daylight.

A very rough measure of the position of the bright line gave its wave-length as 5894.5 tenth-metres, or 2.5 tenth-metres to the red of the D lines, a displacement which, assuming its identity with the pair of yellow sodium lines, would correspond to a receding motion of 79 miles per second. The actual movement of recession of the Comet at the time was 18.5 miles per second.

1882, June 10, 18^h-22^h.

Observer, M.

The Comet was seen in full daylight just after perihelion passage at 20^h, with the 12 $\frac{3}{4}$ inch equatoreal, using negative eye-pieces with powers of 60, 130, 220, and 310. With the lowest power, a light red glass was necessary, but with the powers 220 and 310 the light of the sky was not too strong for the eye, and the Comet could be easily seen as a dull yellow stellar point of light, the disk being no larger than that of a star. It was judged to be not so bright as Capella, which had been seen previously, making every allowance for the much brighter background on which the Comet was seen. On putting in the transit micrometer (which has a much larger field) to determine its place, the Comet was lost, after having been seen distinctly for a quarter of an hour, and it was not picked up again afterwards. A white haze had gradually formed round the Sun, and the sky became overcast about noon.

COMET *b* 1882.1882, October 25, 15^h–18^h.

Half-prism Spectroscope. One "half-prism" direct.

Width of Slit, 0^r.732.

Observer, M.

The Moon was so bright, and there was so much mist, that the Comet was not seen until 17^h. At 18^h it was lost in daylight.

The spectrum showed the usual three bands, but no sodium lines. The bands, which were, as usual, sharp and very bright at their less refrangible edge, and gradually faded away towards the blue end of the spectrum, each extended so far in that direction as almost to touch the next band, and rendered it very difficult to ascertain whether there was a continuous spectrum or not. It was believed that there was one, but that it was faint.

Direct comparison showed that the three bands were generally coincident with the three principal bands given by a Bunsen-flame. But a small displacement towards the red was noticed in the case of the green band. It was also suspected that different parts of the nucleus showed very considerable displacements *inter se*, but the faintness of the spectrum and the short time available for observation prevented the suspicion from being verified as thoroughly as could have been wished. The cometary band was very sharp at the less refrangible edge, most unusually so for a comet, and was much better defined than the band of the flame spectrum, and the individual measures each seemed very satisfactory, but, as will be remarked, they gave widely differing results. It was also noticed that when the telescope was moved by means of the slow-motion rods the edge of the band would seem to shift its position with regard to the occulting bar, by an extreme amount of 0^r.1, or perhaps even 0^r.2 in one or two instances.

Measures of the Green Band.

Objects compared.	Micrometer Readings.	Displacement.		Inferred Wave-length of Comet Band.	Motion in Miles per Second corresponding to observed Displacement.
		In Revolutions.	In Wave-length.		
	r	r	tenth-metres.	tenth-metres.	
Comet	1 ^r .000				
Bunsen-flame	1 ^r .052	– 0 ^r .052	– 0 ^r .54	5163 ^r .5	– 19 ^r .5
Comet	1 ^r .098				
Bunsen-flame	0 ^r .918	+ 0 ^r .180	+ 1 ^r .85	5165 ^r .9	+ 66 ^r .8
Comet	0 ^r .942				
Bunsen-flame	0 ^r .922	+ 0 ^r .020	+ 0 ^r .21	5164 ^r .2	+ 7 ^r .6
Comet	0 ^r .862				
Bunsen-flame	1 ^r .012	– 0 ^r .150	– 1 ^r .55	5162 ^r .5	– 56 ^r .0
Comet	0 ^r .961				
Bunsen-flame	1 ^r .013	– 0 ^r .052	– 0 ^r .54	5163 ^r .5	– 19 ^r .5
Comet	0 ^r .383				
Bunsen-flame	0 ^r .380	+ 0 ^r .003	+ 0 ^r .03	5164 ^r .0	+ 1 ^r .1
Comet	0 ^r .339				
Bunsen-flame	0 ^r .432	– 0 ^r .093	– 0 ^r .96	5163 ^r .0	– 34 ^r .7
Comet	0 ^r .552				
Bunsen-flame	0 ^r .369	+ 0 ^r .183	+ 1 ^r .88	5165 ^r .9	+ 67 ^r .9
Comet	0 ^r .509				
Bunsen-flame	0 ^r .519	– 0 ^r .010	– 0 ^r .10	5163 ^r .9	– 3 ^r .6
Comet	0 ^r .570				
Bunsen-flame	0 ^r .532	+ 0 ^r .038	+ 0 ^r .39	5164 ^r .4	+ 9 ^r .0
Means.....		+ 0 ^r .007	+ 0 ^r .69	5164 ^r .1 ± 0 ^r .22	+ 2 ^r .5

1882, October 30, 15^h₂ to 18^h₂.

Half-prism Spectroscope. One "half-prism" direct.

Width of Slit, 1^r.183.

Observer, M.

The usual three cometary bands were seen, and a faint continuous spectrum, but nothing further could be made out. The blue and yellow bands were too faint for measurement, but closely coincided in position with the corresponding bands of the spectrum of the Bunsen-flame. No displacement of the green band could be detected with any degree of certainty; nor could any bright lines be detected upon it.

Measures of the Green Band.

Objects compared.	Micrometer Readings.	Displacement.		Inferred Wave-length of Comet Band.	Motion in Miles per Second corresponding to observed Displacement.
		In Revolutions.	In Wave-length.		
	r	r	tenth-metres.	tenth-metres.	
Comet	0'419				
Bunsen-flame	0'372	+ 0'047	+ 0'48	5164'5	+ 17'3
Comet	0'353				
Bunsen-flame	0'334	+ 0'019	+ 0'20	5164'2	+ 7'2
Comet	0'210				
Bunsen-flame	0'254	- 0'044	- 0'45	5163'5	- 16'2
Comet	0'218				
Bunsen-flame	0'214	+ 0'004	+ 0'04	5164'0	+ 1'4
Comet	0'188				
Bunsen-flame	0'168	+ 0'020	+ 0'21	5164'2	+ 7'6
Comet	0'320				
Bunsen-flame	0'278	+ 0'042	+ 0'43	5164'4	+ 15'5
Comet	0'302				
Bunsen-flame	0'322	- 0'020	- 0'21	5163'8	- 7'6
Comet	0'288				
Bunsen-flame	0'322	- 0'034	- 0'35	5163'6	- 12'6
Comet	0'271				
Bunsen-flame	0'335	- 0'064	- 0'66	5163'3	- 23'8
Comet	0'306				
Bunsen-flame	0'288	+ 0'018	+ 0'19	5164'2	+ 6'9

Means..... - 0'001 - 0'12 5164'0 ± 0'09 - 0'4

1882, November 10, 17^h.

Half-prism Spectroscope. One "half-prism" reversed.

Observer, M.

The blue band was no longer visible, the yellow band was exceedingly faint, and even the green band was too faint for measurement. The latter showed a very sharp edge on its less refrangible side, a circumstance noticed on both the former occasions when the spectrum of the Comet was observed, and the more remarkable that the bands in the spectra of comets are generally somewhat diffused. It is probable, therefore, that on a better view the band might have been resolved into fine lines.

The mean of all the measures of the less refrangible edge of the Green Band in the Comet's spectrum gives the following result for its wave-length.

5164'0 ± 0'1 tenth-metres.

Thalén's wave-lengths for the less refrangible edges of the bands in the spectrum of the Bunsen-flame have been assumed throughout, as follows :—

	Band.	Wave-length.
		tenth-metres.
	Yellow band	5633'0
	Green band	5164'0
	Blue band	4736'0

1884GOAMM..44F...1C

AURORA.

1882, November 17, 5^h. 20^m. to 9^h. 0^m.

Hand Spectroscope ("half-prism"). One "half-prism."

Observer, M.

The Aurora at the commencement of the observation was a red one, of no particular shape, a ruddy glow extending all over the N.W. About 5^h. 30^m. a brilliant arm shot up from the N. horizon to the zenith, principally red but with a green vein in it. The rosy colour disappeared soon after this. The principal red display lay between Vega and ϵ and η Ursæ Majoris, a broad band of light. A fainter band, at right angles to the first, went down to Boötes,— α Coronæ Borealis shining in the centre of it,—and up toward and nearly to the zenith.

The green Aurora during the time of observation consisted, with one remarkable exception, of little else than a pale green light fringing the upper edge of the London smoke cloud. The exception was the sudden appearance of a magnificent streak of light, much more brilliant than the great Comet, and about one-quarter as long again. When first seen it had already risen some 20°, and just at that moment it bore a great resemblance to the Comet in general outline. Rising in the E.N.E., and slowing mounting, it seemed nearly to follow a parallel of declination, passed just above the Moon, and sank with an even regular motion down to the W. It faded somewhat after passing the meridian, and disappeared at about 6^h. 5^m. 59^s. G. M. T. It took about two minutes to cross the sky. It slowly increased in length up to meridian passage and decreased after it, its greatest length being perhaps about 30°.

No view was obtained of the spectrum of the red Aurora, nor of this great bright cloud.

The single-prism Spectroscope, when pointed to the pale green light in the north, showed the green Auroral line very brilliantly, and also a great number of faint lines further to the blue. But it was quite impossible to see the pointer, and no measures could be made.

The Hand "half-prism" Spectroscope showed only the green line, and the following determinations were obtained of its position as compared with that of the D lines given by a sodium-flame, the wave-length being inferred by means of a curve formed from measures of lines in the solar spectrum between D and *b* :—

		Auroral Line Centre.	D Lines Centre.	Wave-length of Auroral Line inferred.	
		r 0·810 0·599	r 1·532 1·338	tenth-metres. 5531 5524	

Auroral Line.			D Lines.			Wave-length of Auroral Line inferred.
Blue Edge.	Red Edge.	Inferred Reading for Centre.	Blue Edge.	Red Edge.	Inferred Reading for Centre.	
r 0·565 0·535 0·444	r 0·603 0·715 0·755	r 0·584 0·625 0·600	r 1·177 1·203 1·172	r 1·464 1·432 1·322	r 1·321 1·318 1·247	tenth-metres. 5525 5542 5561

Mean wave-length of Auroral line.....5537 $\pm$ 4·5 tenth-metres.