

ROYAL OBSERVATORY, GREENWICH.

SPECTROSCOPIC OBSERVATIONS

MADE AT THE

ROYAL OBSERVATORY, GREENWICH,

1879.

POSITION-ANGLES AND HEIGHTS OF SOLAR PROMINENCES, observed with the SPECTROSCOPE, at the ROYAL OBSERVATORY, GREENWICH, in the Year 1879.

Note.—The Heliographic N.P.D. is reckoned from the North Pole of the Sun's Axis along the limb, either through the East or through the West point. The prominences are entered in order of Heliographic N.P.D., or Position Angle from the Sun's North Pole, in the direction N., E., S., W., not in order of time of observation.

The reference letters are to the Figures on the Plate. The "Half-prism" Spectroscope was used throughout. The numerals in the second column denote the number of Half-prisms (each composed of a crown prism cemented on to a "half-prism" of flint, so as to form a Direct-vision compound-prism). With one Half-prism, the Spectroscope is equivalent to a Spectroscope with four flint prisms of 60° ; with two, to one with about fifteen; and with three, to one with about sixty.

For viewing the prominences, 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 great purity of spectrum is obtained. In order to view a prominence in its proper proportions, the breadth is afterwards magnified by means of a small "Half-prism" (Direct-vision) placed between the eye-piece and the eye.

1879, Greenwich Mean Solar Time.	Number of Half- Prisms.	Heliographic N.P.D.	Height.	REMARKS.
d h m June 30. 1.45 1.50	2	E. 32. 5 — 34. 55 59. 15 — 64. 45	70 30	Partly detached. Partly detached. Much brighter than the other prominence. The entire limb was examined once with the slit radial on the C line.
July 1. 23. 0	2	E. $43^\circ \pm$	70	The most brilliant part of the prominence was a thin broken jet: but faint diffused clouds extended on both sides of it, covering altogether some 10° of the Sun's limb, and attaining a height of from $50''$ to $70''$. Chromosphere averaged $8''$ in height. Part only of the limb was examined, viz., from W. 4° to E. 56° , through the N. point, with the slit radial on the C line.
July 24. 1.30 to 2.15	2			No prominences were seen. The chromosphere, which averaged from $8''$ to $10''$ in height, was slightly undulating in outline, and its upper surface rendered feathery by a great number of very fine filaments. The entire limb was examined twice with the slit radial on the C line.
Aug. 9.	2			No prominences were seen. The chromosphere was faint. There was a great deal of light cloud round the Sun, rendering the search very unsatisfactory. The entire limb was examined twice with the slit radial on the C line.
Aug. 14. 21.30 to 23.30	2	E. 38. 58 — 39. 40 W. 147. 53 — 146. 16 92. 26 — 91. 0 54. 2 — 50. 46 48. 44 — 47. 19	25 40 20 50 35	First seen at about 22^h , as a faint cloud above a short jet. At $22^h.45^m$, the jet alone could be detected. At $23^h.15^m$, no prominence was visible here, although the Sun was now clearer than at the former times. Faint, broken, and partly detached. Not seen at the first examination of the limb. A short straight bright jet, spreading out at the top into a small feathery fan-shaped head. A brilliant jet, surrounded by faint clouds. A prominence roughly triangular in shape. It was much fainter than the other four, and was not seen at the first examination of the limb. The entire limb was examined three times with the slit radial on the C line. The first search was made under very unfavourable circumstances, the day being hazy, and constant clouds interrupting the observations. The sky was somewhat clearer during the last two searches, made from $22^h.40^m$ to $23^h.30^m$.
Aug. 18. 1.40 to 2. 5	2	E. 27. 21 28. 40 108. 18	30 40 20	Faint. Faint. Bright. The chromosphere was from $6''$ to $15''$ in height and very irregular in outline. Its upper surface was composed of many fine filaments fainter than the general mass of the chromosphere, and rising to a height of from $0''5$ to $2''0$ from it. They gave the chromosphere a fine feathery or fringed appearance. Atmospheric clouds passed very frequently, greatly interfering with the examination. The entire limb was examined once with the slit radial on the C line.
Aug. 21. 23.45 to 22. 1.30	2	E. 30. 37 — 31. 5 94. 9 — 95. 1	35 40	A solar cloud completely detached from the limb, its lower surface being about $20''$ above it. The breadth of the cloud itself was about $15''$. (a.) A small cloud completely detached from the limb, its lower surface being about $30''$ above the limb. The breadth of the cloud itself was about $10''$. (b.)

1879, Greenwich Mean Solar Time.	Number of Half- Prisms.	Heliographic N.P.D.	Height.	REMARKS.
d h m Aug. 21. 23. 45 to 22. 1. 30 —continued.	2	° / ° / E. 124. 13 — 125. 8 135. 43 — 137. 53	" 24 50	A straight jet showing no details. (c.) The most brilliant prominence of the four, and the only one seen in the first search. It was visible on the C, D ₃ , and F lines, but not on those of Sodium and Magnesium. (d.) The first three prominences were examined only on the C line. The chromosphere was very irregular and undulating in outline, the feathery filaments of the upper surface not being perceptible; average height from 8" to 10". Wind high, definition very variable. The entire limb was examined twice with the slit radial on the C line.
Aug. 30. 0. 25 0. 40	2	E. 130. 9 — 134. 33 W. 49. 25 — 47. 45	70 30	Fine, large brilliant prominence visible on C, D ₃ , and F, but not on the Sodium and Magnesium lines. The F line of the air-spectrum was not reversed by it, but the bright line of the prominence-spectrum was seen upon the dark line of the air-spectrum, as the former was much narrower than the latter. (a.) Small faint nebulous mass, too faint to be seen on any other line than C. (b.) The entire limb was examined with the slit radial on the C line.
Sept. 1. 1. 19 1. 20 1. 13 1. 16	2	E. 36. 16 — 37. 10 54. 6 — 55. 21 133. 6 — 136. 19 W. 149. 59 — 147. 58	35 35 30 60	A bright triangular prominence. (a.) Faint. A rounded ill-defined prominence almost entirely detached from the limb. (b.) A rectangular prominence, fairly bright. (c.) A bright prominence bending over to the west. (d.) The chromosphere varied in height from 7" to 10", and was somewhat irregular in outline. The day was rather misty. The entire limb was examined with the slit radial on the C line.
Sept. 2. 0. 4 0. 11	2	W. 148. 6 — 145. 52 57. 22	60 60	Both prominences were seen with great difficulty, for the day was very hazy, and the chromosphere faint and sometimes quite invisible. The prominences could not be seen either on D ₃ or F, and indeed even the chromosphere itself could rarely be detected on the latter line. The entire limb was examined with the slit radial on the C line.
Sept. 2. 23. 32 23. 34 23. 35 2. 23. 39 3. 0. 5 2. 23. 42 23. 27 23. 29	2	E. 33. 9 — 34. 13 37. 8 — 39. 3 42. 53 — 46. 38 63. 13 115. 43 133. 23 — 134. 23 W. 119. 6 — 117. 57 110. 57 — 110. 47	30 60 25 17 15 35 30 25	Faint. The chromosphere near is very irregular in outline, and some 12" in height. Seen on C, D ₃ , and F. On F it seemed 3" or 4" shorter than on the other lines. A fine prominence, much more regular in shape than the others. Seen on C, D ₃ , and F. Very faint on F; no difference in height or outline detected. A long low bank, with a jet rising from it at the northern end. Could not be detected on F; on D ₃ it seemed 1" or 2" higher than on C. A small elevation of the chromosphere. Much brighter at 0 ^h . 3 ^m . than at 23 ^h . 39 ^m ., and perhaps a little higher. Not seen on F, and 2" or 3" higher on D ₃ than on C. A small bright jet. Not seen in the first search. Seen on C and D ₃ . A straight regular jet. Only seen on C and D ₃ . A moderately bright triangular prominence. Seen only on C and D ₃ . On D ₃ it seemed to be 3" or 4" higher than on C. A small straight jet, only moderately bright. Not seen again at 23 ^h . 53 ^m . The chromosphere was irregular and undulating in outline, the height varying from 6" to 14". It was clearly seen on C, D ₃ , 1474 K, and F. The prominences were seen even more distinctly on D ₃ than on C; on F, if seen at all, they were very faint. The entire limb was examined twice with the slit radial on the C line.
Sept. 7. 21. 52 23. 30 23. 53	2	W. 124. 15 — 122. 0 74. 7 — 72. 3 69. 10 — 65. 40	50 35 35	The morning was very unfavourable, the Sun being only visible in short breaks between the clouds, and nothing more could be done than to measure the positions and heights of the prominences. They all seemed to show much detail, but were seen for so short a time that their outlines could not be sketched. The chromosphere varied from 7" to 15" in height. The entire limb was examined twice with the slit radial on the C line.

POSITION-ANGLES AND HEIGHTS OF SOLAR PROMINENCES, OBSERVED WITH THE SPECTROSCOPE,

1879, Greenwich Mean Solar Time.	Number of Half- Prisms.	Heliographic N.P.D.	Height.	REMARKS.
d h m Oct. 25. 1. 15 to 2. 0	2	° ' ° ' E. 39. 4 129. 4 W. 129. 56 50. 56	" 96 108 24 31	Readings only approximate. The entire limb, with the exception of 6° on each side of the S. pole, was examined with the slit radial on the C line.
Oct. 27. 1. 30 to 2. 0	2	E. 58. 15 — 59. 25 126. 55 — 129. 49	24 101	Faint. Faint. Both prominences were seen only on C and D ₃ , being about the same height on both lines, although the entire spectrum from B to F was examined. On F the chromosphere alone was seen about 6" to 7" in height. The Sun was throughout in white mist. The entire limb was examined with the slit radial on the C line.
Nov. 7. 1. 45 to 2. 10	1			No prominences were seen. The Sun was in mist, and the chromospheric lines were not bright. The entire limb, with the exception of 6° on each side of the S. pole, was examined with the slit radial on the C line.
Nov. 18. 0. 15 0. 18 0. 24 0. 27 0. 50 0. 48 0. 37	1	E. 37. 8 — 37. 38 46. 38 — 49. 8 64. 38 — 70. 28 73. 48 — 77. 18 W. 138. 12 — 136. 57 74. 12 — 71. 32 42. 47 — 36. 32	24 36 41 46 17 22 53	Seen the same height on D ₃ as on C. Not seen on F. (a.) Seen the same height on D ₃ as on C. On F 24" in height. (b.) Seen the same height on D ₃ as on C. On D ₁ and D ₂ 8" in height. On F 17" in height. Not seen on b. (c.) Seen the same height on D ₃ as on C. On F 24" in height. Not seen on any other line. (d.) Seen only on C. The Sun was faint at this time. (e.) Seen the same height on C, D ₃ , and F. Not seen on any other line. (f.) Seen only on C. The Sun was faint at this time. (g.) The prominences were examined on C, D ₃ , F, the b lines, D ₁ , D ₂ , but not on 1474 K, the Sun not being clear enough. The b lines showed no reversal anywhere. The entire limb was examined four times with the slit radial on the C line. Twice early in the morning, when the Sun was in haze and frequently lost in cloud, no prominences being seen; and twice later, when the seven above recorded were noticed.
Nov. 19. 1. 25 to 2. 5	1	E. 35. 8 — 36. 23 45. 18 — 46. 38 58. 8 — 60. 58 126. 8 — 128. 48 W. 98. 7 — 97. 12 42. 37 — 35. 12	23 19 24 17 25 43	The entire limb was examined with the slit radial on the C line.
Nov. 25. 23. 15 23. 5	1	W. 143. 20 — 139. 15 55. 35 — 53. 5	67 16	A large prominence, brilliant in parts, but mostly faint. From W. 139°. 55' to 141°. 50' it was a large faint detached cloud, which grew brighter, and approached the limb at the latter reading. Here a bright jet shot up into the middle of the cloud from the limb, attaining a height of about 41". Further to the S. the jet became broken, the lower part rapidly decreasing in height, the upper part becoming more separated from the limb and rising to a greater height than the united jet, but becoming fainter. The D ₃ line showed only the brighter portion of the prominence, and this of equal height with the same part on the C line, viz., 41". F showed only the brightest portion of the jet, i.e., to a height of about 17". A rounded mass showing no detail, and scarcely rising 10" above the chromosphere. Seen of equal heights on C, D ₃ , and F. Seen on no other line. The chromosphere averaged 7" in height. The observation was continually interrupted by cloud, and the Sun was throughout in much white haze. Limb very tremulous. The entire limb was examined with the slit radial on the C line.

1879, Greenwich Mean Solar Time.	Number of Half- Prisms.	Heliographic N.P.D.	Height.	REMARKS.
d h m Nov. 28. 0. 53	1	W. 49. 53 — 48. 13	19	Very faint. Seen the same height on D ₃ as on C. Not clearly made out on any other line. The spectrum of the chromosphere from <i>a</i> to F was examined at the following points of the limb, W. 0°, 5°, 10°, 15°, and 20°, and in each case it was seen that the height on C and D ₃ was 7", on F 6", and on 1474 K about 3"-5. No other lines were seen reversed in the chromosphere. The entire limb was examined with the slit radial on the C line.
Dec. 1. 22. 54	1	E. 35. 54 — 37. 44	48	Very faint detached cloud. Upper surface 48" from the limb. Average breadth 17". Nearest approach to the limb 19". Seen on C and suspected on D ₃ , but visible on no other line. (<i>a</i>)
23. 10		63. 14	11	A faint feathery tuft, just rising above the level of the chromosphere. Seen on C and D ₃ , but on no other line. (<i>b</i>)
22. 15		113. 34 — 115. 24	19	Very bright. Could not be found again at 23 ^h . 15 ^m . Seen the same height on D ₃ as on C. On F it was 10" in height, and on 1474 K 5". It was suspected that it was reversed on the <i>b</i> and D lines to a height of 1" from the limb. (<i>c</i>)
22. 40		W. 58. 48 — 53. 49	38	Faint. A faint cloud above a narrow jet. Seen on C and D ₃ . The upper portion of the prominence was very faint, and could not be detected on D ₃ . Height on D ₃ 19". Seen on no other line. (<i>d</i>)
22. 48		7. 56 — 6. 26	16	Faint. No detail. Seen of the same height on D ₃ as on C, but only 4" on 1474 K, and 8" on F. Not seen on D or <i>b</i> lines. (<i>e</i>) The Sun's limb was examined along the entire spectrum from <i>a</i> to F at 12 points, 30° apart, beginning at E. 7°. Usually C, D ₃ , and F were seen in the spectrum of the chromosphere of the same height, viz., about 7". Of these F was slightly the shortest, perhaps sometimes nearly 1" shorter than C. D ₃ was always as high as C, and occasionally perhaps a little higher, but as the two lines were not in perfect focus at the same time this is uncertain. 1474 K was seen nearly always, although very faint. It was about 3" or 4" in height. It was not seen at E. 127° and 157°. D ₁ , D ₂ , the <i>b</i> lines, the E group, and all the more prominent lines between C and F were never seen reversed, although examined at each point, the D and <i>b</i> lines receiving special attention. At W. 113°, the Sun being in white haze, the F line was all but lost.
Dec. 3. 0. 15	1	E. 42. 24	22	Very faint. Seen only in the first search.
0. 55		62. 34 — 65. 24	24	
0. 10		108. 54 — 111. 44	24	
		W. 56. 56 — 54. 6	38	(<i>a</i>)
		50. 36	36	Very faint. Seen only in the first search.
		38. 36	22	Very faint. Seen only in the first search. The chromosphere was undulating, and averaged 7" in height, but was often 10" or even 11". A rapid search earlier in the morning during a brief interval of sunshine showed all six of these prominences, but the three faintest could not be picked up again. The entire limb, except from W. 165° to 177°, was examined twice with the slit radial on the C line.
Dec. 6. 0. 0	1	E. 135. 54 — 137. 15	53	A considerable prominence, seen in the second search and only on C and D ₃ , and very faintly on the latter line. (<i>a</i>) The chromosphere, which averaged 8" on C, was irregular in outline, frequently attaining a height of 12". This happened at E. 35°, 109°, W. 164°, 45°, and 19°. At W. 39° it was 14" in height. At 23 ^h . 30 ^m . the entire limb was examined, but without detecting any prominences. A second search at 0 ^h . 0 ^m . showed the prominence measured above, though the limb was still ill-defined. D ₃ and F were both faint in the chromosphere, and 1474 K could not be seen at all.
The spectroscopic examination of the Sun's limb was intermitted from January 1 to June 29, partly in consequence of alterations in the S. E. Equatorial, and partly in order that the reduction of the measurements of the Photographs of the Sun might be completed with greater despatch.				

EXAMINATION of the SPECTRUM of the SUN SPOT of 1879, August 27—September 8,
made at the ROYAL OBSERVATORY, GREENWICH.

1879, August 30.

“Half-prism” Spectroscope, two-prism train, reversed.

Observer, M.

The spectrum was observed from B to a little beyond F.

The following were the principal lines observed to suffer change over the nucleus of the spot. The character of the change is indicated below :

Wave-length, tenth-metres.	Element.	Wave-length, tenth-metres.	Element.
6498	{ Calcium. Two lines. Barium. One line.	5328	Iron. Two lines.
to		5323	Iron.
6490	{ Iron. Two lines.	5269	Iron. Two lines. E group.
6462		5207	Chromium.
6449	Calcium.	5205	Chromium.
6438	Calcium.	5203	Chromium.
6278	Band α .	5201	Iron.
6168	Calcium.	5183	Magnesium.
6161	Calcium.	5172	Magnesium.
6140	Barium.	5168	Nickel.
6135	Iron.	5166	Magnesium.
6121	Calcium.	4890	{ Iron. Seven lines.
6115	Nickel.	4881	
6110	Barium.	4871	Iron. Two lines.
6107	Nickel.	4865	Nickel.
6101	Calcium.	4863	Iron.
5895	{ Sodium. } D lines.	4854	Nickel.
5889		4839	Cobalt.
5865	Titanium.	4828	Nickel.
5862	Iron.	4822	Manganese.
5856	Calcium.	4768	Iron.
5853	Barium.	4766	Manganese.
5614	Iron.	4764	Manganese.
5602	{ Iron. Five lines. Calcium. Five lines.	4761	Manganese. Two lines.
to			
5580	Two other lines, common to both.		

The Sodium (D) lines were doubled in breadth and darkness.

17 Calcium lines were doubled in intensity, and increased in breadth by about one half.

4 Barium lines were nearly as much affected as the Calcium lines.

3 Magnesium lines were somewhat broader and darker than usual.

27 Iron, 6 Nickel, 3 Chromium, 5 Manganese, 1 Cobalt, and 1 Titanium lines were slightly broader and darker ; less affected than the Magnesium lines.

The D₃ line was suspected to be present as a dark line.

Band α was much broader and darker.

The C and F lines of Hydrogen showed no change.

1879, September 1.

“Half-prism” Spectroscope, two-prism train, reversed.

Observer, M.

The Sun-spot was obviously shallower than on August 30 ; the spectrum was but little fainter than that of the ordinary disk, and the broadening or darkening of the lines was scarcely perceptible.

The D lines and the strong Calcium lines between C and D were still obviously affected, but to a much less degree than on August 30.

1879, September 3.

“Half-prism” Spectroscope, two-prism train reversed.

Observer, M.

In the space from *b* to *F* the lines of Nickel and Titanium, especially the latter, were most affected. Hydrogen in *F* and Magnesium in *b* showed no change. The Iron lines were slightly altered. The alteration in each case was an increase in both breadth and intensity. The D lines were much broader, especially towards the blue.

Between D and *b* the following lines suffer change :—

Wave-length, tenth-metres.	Element.	Wave-length, tenth-metres.	Element.
5601	Calcium and iron.	5207	Chromium, affected in a less degree.
5370	Iron.	to	
5369	Iron.	5203	
5352	Cobalt and iron.	5187	Titanium.
5351	Cobalt.	5041	Very marked { Calcium and iron.
5348	Calcium and iron.	5034	
5342	Cobalt.	4985	Very marked { Iron. Double line.
5328	Iron. Double line.	4978	
The E group	Iron.	4854	Nickel.
5209	Titanium.	4828	Nickel.
		4823	Manganese.

and several others.

The definition was not sufficiently good for the changes in different lines of the same elements to be satisfactorily compared.

The Wave-lengths and the corresponding Elements are taken from Ångström's Normal Spectrum.

The Spot, which was first seen (after an interval of cloudy weather) on August 30, when it was well advanced upon the disk, would appear to have passed off about September 7^d. 6^h, but clouds prevented any observations being made between September 4 and September 8. On September 8 a prominence 50'' in height was observed near the position of the Spot, but no faculæ were visible at that point of the limb.

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 20° from A to H, equivalent to four flint prisms of 60° , is obtained; and with a train of two half-prisms, a dispersion of 75° , equivalent to that of fifteen flint prisms of 60° .

Date, 1879, 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
May 21. 15. 30	M	1	5	β Ursæ Majoris F ...	0.891			
				H β	0.704	+ 0.187	1 towards red	0.100
15. 45	"	"	"	β Ursæ Majoris F ...	0.743			
				H β	0.728	+ 0.015	$\frac{1}{2}$ towards red	0.100
May 21. 16. 35	M	1	5	χ Ursæ Majoris F ...	1.093			
				H β	0.892	+ 0.201	$\frac{1}{2}$ towards red	0.270
17. 5	"	"	"	χ Ursæ Majoris F ...	0.862			
				H β	0.804	+ 0.058	$\frac{1}{10}$ towards red	0.270
May 21. 17. 30	M	1	5	ϵ Ursæ Majoris F ...	0.813			
				H β	0.704	+ 0.109	$\frac{1}{3}$ towards red	0.170
17. 50	"	"	"	ϵ Ursæ Majoris F ...	0.815			
				H β	0.794	+ 0.121	$\frac{1}{3}$ towards red	0.170
May 21. 18. 15	M	1	5	γ Ursæ Majoris F ...	0.707			
				H β	0.652	+ 0.055	$\frac{1}{10}$ towards red	0.170
18. 30	"	"	"	γ Ursæ Majoris F ...	0.686			
				H β	0.606	+ 0.080	$\frac{1}{10}$ towards red	0.170
May 30. 14. 0	M	1	5	Moon F.	0.563			
				H β	0.594	— 0.031		
14. 15	"	"	"	Moon F.	0.575			
14. 25	"	"	"	H β	0.578	— 0.003		
14. 35	"	"	"	Moon F.	0.598			
				H β	0.596	+ 0.002		
				Moon F.	0.634			
				H β	0.614	+ 0.020		
June 9. 15. 0	M	1	5	β Ursæ Majoris F ...	1.178			
				H β	0.985	+ 0.193	$\frac{2}{3}$ towards red	0.184
15. 20	"	"	"	β Ursæ Majoris F ...	1.192			
				H β	0.986	+ 0.206	$\frac{1}{2}$ towards red	0.184
June 9. 16. 45	M	1	5	γ Ursæ Majoris F ...	0.483			
				H β	0.357	+ 0.126	$\frac{1}{2}$ towards red	0.184
17. 0	"	"	"	γ Ursæ Majoris F ...	0.446			
				H β	0.341	+ 0.105	$\frac{1}{3}$ towards red	0.184
June 9. 17. 15	M	1	5	ϵ Ursæ Majoris F ...	0.528			
				H β	0.458	+ 0.070	$\frac{1}{4}$ towards red	0.184
17. 20	"	"	"	ϵ Ursæ Majoris F ...	0.549			
				H β	0.487	+ 0.062	$\frac{1}{4}$ towards red	0.184

The velocity of light has been taken as 186 660 miles per second, and the distance of the Sun as 92 250 000 miles.

TERRESTRIAL ELEMENTS, and CONCLUDED MOTIONS in the LINE of SIGHT, from OBSERVATIONS at the in the Year 1879.

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 7.88 tenth-metres or 303 miles per second for the F line; and with two half-prisms to 2.3 tenth-metres or 83 miles per second for *b*, and to 1.83 tenth-metres or 70 miles per second for F.

1^{rev.} of the screw for opening the slit corresponds to 0.01 inch, or about 10". The weights are on a scale 1-5 for each observation.

The slit lies north and south when the reading of the Position-Circle is 5°.

Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		Weight.	REMARKS.
	Measured.	Estimated.		
+ 12.3	+ 18.3	+ 5.2	1 1	Indirect comparison. Definition bad, images tremulous. The star-line is very dark, but broad and diffused. It is, however, more condensed in the centre than that in Altair or Vega.
+ 13.4	+ 25.8	+ 43.6	$\frac{1}{2}$ $\frac{1}{2}$	Indirect comparison. Image very tremulous. Measures doubtful. F line somewhat sharper than in β Ursæ Majoris.
+ 10.4	+ 24.4	+ 51.2	$2\frac{1}{2}$ $2\frac{1}{2}$	Indirect comparison. Direct comparison showed a displacement towards the red. The F line in the spectrum of this star resembles that in Vega, not being so condensed in the centre as in β Ursæ Majoris.
+ 12.2	+ 8.2	+ 6.3	2 2	Indirect comparison. Spectrum tremulous, but definition better than for β Ursæ Majoris.
	- 0.9		.	Coincidence very perfect, the F line in the Moon spectrum disappearing when the H β line was flashed in.
+ 10.8	+ 49.2	+ 49.1	3 2	Indirect comparison.
+ 11.4	+ 23.5	+ 30.2	3 3	Indirect comparison.
+ 10.2	+ 9.8	+ 14.8	2 2	Indirect comparison.

+ denotes recession ; - denotes approach.

Date, 1879, 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 23. 20. 0	M	1	5	β Herculis b_1 Mg ₁	0.370 0.591	+ 0.221	$\frac{1}{2}$ towards red	0.170
20. 15	"	"	"	β Herculis b_1 Mg ₁	0.555 0.662	+ 0.107	$\frac{1}{4}$ towards red	0.170
	"	"	"	β Herculis b_1 Mg ₁	0.543 0.658	+ 0.115	$\frac{1}{4}$ towards red	0.170
Aug. 22. 20. 0	M	1	5	ζ Herculis b_1 Mg ₁	0.526 0.384	+ 0.142	$\frac{1}{2}$ towards red	0.106
Aug. 25. 19. 0	M	1	5°. 20'	Moon b_1 Mg ₁	0.466 0.478	- 0.012		0.138
19. 15	"	"	"	Moon b_1 Mg ₁	0.483 0.492	- 0.009		0.138
19. 30	"	"	"	Moon b_1 Mg ₁	0.482 0.438	+ 0.044		0.138
Aug. 25. 20. 10	M	1	5°. 20'	ζ Herculis b_1 Mg ₁	0.728 0.613	+ 0.115	$\frac{1}{3}$ towards red	0.138
20. 35	"	"	"	ζ Herculis b_1 Mg ₁	0.662 0.623	+ 0.039	$\frac{1}{5}$ towards red	0.138
Aug. 25. 21. 25	M	1	5°. 20'	β Cygni b_1 Mg ₁	0.062 0.191	- 0.129	$\frac{4}{7}$ towards blue	0.138
21. 40	"	"	"	β Cygni b_1 Mg ₁	0.298 0.335	- 0.037	$\frac{1}{5}$ towards blue	0.138
Aug. 25. 22. 15	M	1	5°. 20'	ϵ Pegasi b_1 Mg ₁	0.623 0.595	+ 0.028	$\frac{1}{5}$ towards red	0.138
22. 30	"	"	"	ϵ Pegasi b_1 Mg ₁	0.663 0.648	+ 0.015	$\frac{1}{10}$ towards red	0.138
Aug. 25. 23. 55	M	1	5°. 20'	η Pegasi b_1 Mg ₁	0.770 0.858	- 0.088	$\frac{1}{4}$ towards blue	0.138
0. 55	"	"	"	η Pegasi b_1 Mg ₁	0.707 0.777	- 0.070	$\frac{1}{3}$ towards blue	0.138
Sept. 2. 21. 50	M	1	5°. 20'	γ Aquilæ b_1 Mg ₁	0.482 0.564	- 0.082	$\frac{1}{3}$ towards blue	0.135
22. 5	"	"	"	γ Aquilæ b_1 Mg ₁	0.526 0.657	- 0.131	$\frac{1}{2}$ towards blue	0.135
Sept. 3. 20. 30	M	1	5	α Coronæ F..... H β	0.303 0.126	+ 0.177	$\frac{3}{5}$ towards red	0.135
20. 45	"	"	"	α Coronæ F..... H β	0.130 0.082	+ 0.048	$\frac{1}{5}$ towards red	0.135
Sept. 3. 21. 15	M	1	5	γ Lyrae F..... H β	1.014 0.958	+ 0.056	$\frac{1}{5}$ towards red	0.135
21. 25	"	"	"	γ Lyrae F..... H β	0.981 0.887	+ 0.094	$\frac{1}{3}$ towards red	0.135
21. 40	"	"	"	γ Lyrae F..... H β	0.628 0.562	+ 0.066	$\frac{1}{4}$ towards red	0.135
21. 50	"	"	"	γ Lyrae F..... H β	0.556 0.568	- 0.012	Coincident	0.135
Sept. 3. 22. 20	M	1	5	α Delphini F..... H β	0.556 0.516	+ 0.040	$\frac{1}{5}$ towards red	0.135
22. 35	"	"	"	α Delphini F..... H β	0.678 0.534	+ 0.144	$\frac{1}{2}$ towards red	0.135

The velocity of light has been taken as 186 660 miles per second, and the distance of the Sun as 92 250 000 miles.

Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		Weight.	REMARKS.
	Measured.	Estimated.		
+11.5	+ 42.9	+ 41.6	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	Indirect comparison. Spectrum tremulous, and star-lines very faint. Wind high. Observations difficult and unsatisfactory.
+10.7	+ 41.6	+ 30.2	3	Indirect comparison. Wind high, and clouds constantly passing. Observation frequently interrupted.
	+ 2.8			The Moon was very low, and it was difficult to approach the eye-piece for observation. The measures are therefore not very satisfactory. No want of coincidence could be detected.
+10.7	+ 18.0	+ 15.7	2 2	Indirect comparison. The illumination of the bright line gave great trouble with this star and the following.
+ 6.4	- 31.3	- 38.5	1 2	Indirect comparison. The wind was high, and the definition only moderate.
+ 0.6	+ 7.3	+ 14.2	3 3	Indirect comparison. The observation was frequently interrupted by passing cloud, but in the intervals the star was better defined and brighter than in the two preceding comparisons.
+ 5.4	- 23.7	- 23.5	2 2	Indirect comparison. Observation much interrupted by passing cloud. Definition bad. The bright line of the micrometer was not in perfect adjustment.
+10.1	- 49.3	- 48.5	$\frac{1}{2}$ $\frac{1}{2}$	Indirect comparison. Bright moonlight and sky misty. Definition poor, and spectrum faint.
+11.2	+ 22.9	+ 22.0	1 1	Indirect comparison. The displacement was estimated by direct comparison to be $\frac{1}{3}$ of H β line towards the red = +27.6 miles per second, or corrected for the earth's motion +16.4 miles per second.
+ 8.0	+ 7.4	+ 6.7	2 2 2 2	Indirect comparison. The star was much higher in the sky than α Coronæ, and the spectrum steadier, so that the observations of it were better, notwithstanding its comparative faintness. Star-line narrower than that in α Coronæ.
+ 6.5	+ 21.3	+ 19.4	1 1	Indirect comparison. Star-line very broad, but not dark, being of apparently the same intensity for the greater part of its breadth, but shading off a little at each edge.

+ denotes recession; - denotes approach.

Date, 1879, 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 Sept. 3. 23. 0	M	1	5	γ Cygni F	1'014			
				H β	0'972	+ 0'042	$\frac{1}{10}$ towards red	0'135
23. 15	,,	,,	,,	γ Cygni F	1'004			
				H β	0'968	+ 0'036	$\frac{1}{10}$ towards red	0'135
Sept. 3. 23. 30	M	1	5	γ Pegasi F	0'742			
				H β	0'814	- 0'072	$\frac{1}{4}$ towards blue	0'135
23. 40	,,	,,	,,	γ Pegasi F	0'792			
				H β	0'825	- 0'033	$\frac{1}{8}$ towards blue	0'135
Sept. 3. 23. 58	M	1	5	α Andromedæ F	0'901			
				H β	0'943	- 0'042	$\frac{1}{2}$ towards blue	0'135
0. 5	,,	,,	,,	α Andromedæ F	0'844			
				H β	0'948	- 0'104	$\frac{1}{2}$ towards blue	0'135
Sept. 3. 0. 12	M	1	5	Moon F	0'368			
				H β	0'358	+ 0'010	Apparently perfectly coincident.	0'135
0. 15	,,	,,	,,	Moon F	0'366			
				H β	0'377	- 0'011		0'135
0. 18	,,	,,	,,	Moon F	0'388			
				H β	0'383	+ 0'005	Apparently perfectly coincident.	0'135
0. 21	,,	,,	,,	Moon F	0'367			
				H β	0'354	+ 0'013		0'135
Sept. 3. 0. 30	M	1	5	β Arietis F	0'862			
				H β	0'945	- 0'083	$\frac{1}{3}$ towards blue	0'135
0. 35	,,	,,	,,	β Arietis F	0'882			
				H β	0'903	- 0'021	$\frac{1}{7}$ towards blue	0'135
0. 38	,,	,,	,,	β Arietis F	0'734			
				H β	0'906	- 0'172	$\frac{2}{3}$ towards blue	0'135
0. 45	,,	,,	,,	β Arietis F	0'904			
				H β	0'941	- 0'037	$\frac{1}{7}$ towards blue	0'135
0. 50	,,	,,	,,	β Arietis F	0'746			
				H β	0'901	- 0'155	$\frac{2}{3}$ towards blue	0'135

The velocity of light has been taken as 186 660 miles per second, and the distance of the Sun as 92 250 000 miles.

1881GOAMM..41E..81A

Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		Weight.	REMARKS.
	Measured.	Estimated.		
+ 3.0	+ 8.8	+ 5.3	3 3	Indirect comparison. F line sharp in this star.
- 7.8	- 8.1	- 7.8	2 2	Indirect comparison. Star-line diffused, but not so wide as that in α Delphini.
- 8.5	- 13.6	- 20.5	3 3	Indirect comparison. The star-line is moderately broad. It is darkest in the center, from which it shades off rapidly in both directions. The edges are ill-defined.
	+ 1.3			
- 17.7	- 10.6	- 12.5	1 1 1 1 1	Indirect comparison. Star rather near the Moon; spectrum therefore faint. Star-line dark and broad.

+ denotes recession; - denotes approach.

14 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 1879.

(F for the Star or Planet 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.	Observer.	Number of Measures.	Weight.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star.	
									Measured.	Estimated.
α ANDROMEDÆ.										
1879, September 3	M	2	6	I.	^o 5	^r 0.135	F	— 8.5	— 13.6	— 20.5
γ PEGASI.										
1879, September 3	M	2	4	I.	5	0.135	F	— 7.8	— 8.1	— 7.8
β ARIETIS.										
1879, September 3	M	5	5	I.	5	0.135	F	— 17.7	— 10.6	— 12.5
β URSÆ MAJORIS.										
1879, May 21	M	2	1	I.	5	0.100	F	+ 12.3	+ 18.3	+ 5.2
June 9	M	2	5	I.	5	0.184	F	+ 10.8	+ 49.2	+ 49.1
χ URSÆ MAJORIS.										
1879, May 21	M	2	1	I.	5	0.270	F	+ 13.4	+ 25.8	+ 43.6
γ URSÆ MAJORIS.										
1879, May 21	M	2	4	I.	5	0.170	F	+ 12.2	+ 8.2	+ 6.3
June 9	M	2	6	I.	5	0.184	F	+ 11.4	+ 23.5	+ 30.2
ϵ URSÆ MAJORIS.										
1879, May 21	M	2	5	I.	5	0.170	F	+ 10.4	+ 24.4	+ 51.2
June 9	M	2	4	I.	5	0.184	F	+ 10.2	+ 9.8	+ 14.8
α CORONÆ.										
1879, September 3	M	2	2	I.	5	0.135	F	+ 11.2	+ 22.9	+ 22.0

Date.	Observer.	Number of Measures.	Weight.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star.		
									Measured.	Estimated.	
β HERCULIS.											
1879, July 23	M	3	1½	I.	5°	0'170	b ₁	+ 11.5	+ 42.9	+ 41.6	
ζ HERCULIS.											
1879, August 22	M	1	3	I.	5	0'106	b ₁	+ 10.7	+ 41.6	+ 30.2	
	M	2	4	I.	5°. 20'	0'138	b ₁	+ 10.7	+ 18.0	+ 15.7	
γ LYRÆ.											
1879, September 3	M	4	8	I.	5	0'135	F	+ 8.0	+ 7.4	+ 6.7	
β CYGNI.											
1879, August 25	M	2	3	I.	5°. 20'	0'138	b ₁	+ 6.4	— 31.3	— 38.5	
γ AQUILÆ.											
1879, September 2	M	2	1	I.	5°. 20'	0'135	b ₁	+ 10.1	— 49.3	— 48.5	
γ CYGNI.											
1879, September 3	M	2	6	I.	5	0'135	F	+ 3.0	+ 8.8	+ 5.3	
α DELPHINI.											
1879, September 3	M	2	2	I.	5	0'135	F	+ 6.5	+ 21.3	+ 19.4	
ε PEGASI.											
1879, August 25	M	2	6	I.	5°. 20'	0'138	b ₁	+ 0.6	+ 7.3	+ 14.2	
η PEGASI.											
1879, August 25	M	2	4	I.	5°. 20'	0'138	b ₁	— 5.4	— 23.7	— 23.5	
MOON.											
1879, May 30	M	4	..	I.	5	..	F	0.0	— 0.9	..	
August 25	M	3	..	I.	5°. 20'	0'138	b ₁	..	+ 2.8	..	
September 3	M	4	..	I.	5	0'135	F	..	+ 1.3	..	

OBSERVATIONS of the SPECTRA of COMETS and DOUBLE-STARS made at the ROYAL OBSERVATORY, GREENWICH, in the Year 1879.

COMET α , 1879. (BRORSEN'S.)

1879, April 17, 19, 24, and 28.

"Half-prism" Spectroscope, one-prism train.

Observers, W C and M.

The spectrum consists of the three usual cometary bands, corresponding to the three principal bands of the second spectrum of carbon, and does not now present the anomalous appearance found by Dr. Huggins in 1868. The bands were compared on several evenings with those shown by a vacuum tube containing vapour of alcohol at a pressure of 1.2 m.m., and the coincidence appeared sensibly perfect.

The position of the brightest comet-band (in the green) was measured with Hilger's bright-line micrometer on two evenings, April 19 and 28, by Mr. Maunder; on other occasions it was compared with the corresponding carbon-band indirectly by means of a movable bar in the eye-piece, 30 tenth-metres broad. The following are the results of the micrometer-readings for the less refrangible edge of the comet-band referred to the center of the brightest portion of the carbon-band, which (with a narrow slit) is less than 5 tenth-metres broad:—

1879.	Comet-band.	Wave-length inferred.	Width of Slit.
April 19	0.5 tenth-metres to blue	5190	0.009 = 16 tenth-metres.
28	4.5 „ red	5191	0.013 = 24 „

The wave-length of the less refrangible edge of the carbon-band (alcohol vapour in a vacuum tube) has been taken at 5198.3 tenth-metres. As it was not found practicable to use a narrower slit, there is probably an uncertainty of several tenth-metres in the position of the comet-band, but it appears from these observations that it coincides approximately with the band in the second spectrum of carbon (vacuum tube) at 5198 and not with that in the first spectrum (blue flame of Bunsen burner) at 5165. On April 17 several comparisons were made by Mr. Christie, by bringing up a movable bar from the blue end of the spectrum so as just not to hide the bright edge of the comet-band, and in every case the coincidence of the less refrangible edges of the comet- and alcohol-bands appeared sensibly perfect. In these observations the slit was of such a width that the bright line, with which the alcohol-band commences, had a breadth of about 30 tenth-metres. The principal comet-band extended about $\frac{2}{3}$ of the way towards F, to about the wave-length 5000, its blue end appearing to coincide approximately with a faint band of alcohol.

The second comet-band in the yellow was measured on April 28 by Mr. Maunder, and its red edge was found to be 2.4 tenth-metres to the red of the middle of the brightest part of the alcohol-band at 5610. The slit, however, was very wide, viz., 0.033 corresponding to 65 tenth-metres. This measure would place the red edge of the comet-band at 5580, whilst the band in the first spectrum of carbon is at 5635. The more refrangible end of the yellow band appeared to coincide with a well marked band in the alcohol spectrum. The third comet-band was very faint; it appeared to be in the neighbourhood of the blue band of alcohol at 4835. The relative brightness of the three bands was estimated thus: Green, 10; Yellow, 3; Blue, $\frac{1}{2}$.

μ DRACONIS.

Examination of spectra of the components of the pair.

Magnitudes 4 and $4\frac{1}{2}$.

1879, June 16.

"Half-prism" Spectroscope, one-prism train.

Observer, M.

The two stars showed no perceptible difference in their spectra, both seeming to be of the second or solar type. The E and b groups were clearly distinguished (although b was not so distinct as E) and glimpses were obtained of many other lines in different parts of the spectrum.

No measures of comparative displacement could be made, the spectra being badly defined, and the images faint throughout.

Mr. Webb, in his "Celestial Objects," gives the colours as white and pale white. It was therefore expected that the spectra would be of the first type, but so far as could be judged they were both well marked second-type stars.

COMET *c*, 1879. (SWIFT'S.)1879, June 28, 10^h.-13^h.

"Half-prism" Spectroscope, one-prism train.

Observer, M.

The comet proved to be too faint for any satisfactory work. One faint fuzzy band was seen in the green near the carbon-band at 5198 tenth-metres, but no measures could be obtained either with the bright-line or with an occulting bar. A rough guess at its position was therefore all that could be made.

COMET *d*, 1879. (PALISA'S.)

1879, Sept. 8.

"Half-prism" Spectroscope, one-prism train.

Observer, M.

Magnitude of comet 9.5 or 10. It showed no defined nucleus, being an irregularly shaped fuzzy object. The Moon had risen before it could be brought into the field of the telescope. The spectrum was therefore very faint. One bright band near the carbon-band at 5198 tenth-metres was all that could be detected, but no satisfactory measures of its position could be obtained.

RED SPOT ON JUPITER.

1879, Dec. 6.

Single-prism Spectroscope. Position-Circle = 340°.

Observer, M.

The spectrum of the spot was fainter than that of the general disk, but no lines could be detected in it. Indeed, the definition was so bad that it was hard to make out any lines even in the spectrum of the general disk. The spectrum of the spot was fainter than that of the red-brown belt immediately to the north of the equator.