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Harvard College Observatory.

Notes to sketches of sun by L. Trouvelot.

Volume I.

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KG 11365. 327

June 12 1873

Equatorial in N. Dome adjusted to focus for today disk No. 1 Guides exactly
" " " " " fill the circle " " 2 6¼ " "

Scale telescope.
Measure from eye-piece to image of Sun adjusted correctly for this day made with a piece of tape: distance from eye-piece to narrowest part of beam measured with a rule: total distance from narrowest part of beam to screen $25\frac{27}{32}$ inches.

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ND+
150

Notes on Solar Spots,

Auroras,

and various meteorological phenomena,

from the French of L. Trouvelot;

the original notes having been made on the margins and backs of his sketches of the sun, made at Medford, Mass., from Oct. 30, 1870, to Jan. 22, 1872, (probably,) both inclusive, and afterwards made at Cambridge, Mass.

Volume I.

1870 October 30 to 1873 April 13 inclusive.

Nos. 1 to 591 inclusive.

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In the following list of Mr. Pouvelot's drawings the first column contains the current number, marked on the back of each drawing. The second column gives the date, and when the hour is marked on the drawing, it is entered in the third column. The hours are generally not indicated between the middle of May, and August, 1874. The notes relating to the solar spots, auroras, and meteorological phenomena are distinguished either by being entered in separate columns, or by the underscoring of those relating to the spots with black ink and those relating to auroras with red ink. The hour is always that of civil time.

TG 11 369.325

A date underscored with red ink is one on which a photograph was taken at Cambridge, see below.

The telescopes used were small, not showing distinctly the faculae, which are remarked upon as clouds or disturbed regions until the autumn of 1871. The telescope used at first was replaced by another May 13, 1874. The drawings represent the sun as it appears to the naked eye, or through a telescope which does not invert. The top of each drawing, determined by the position of the lines of writing upon the paper, represents that part of the sun's limb nearest the zenith; the north and south points are occasionally marked by "nord" and "sud." These points, and the places of the spots, were determined by the eye only, without mechanical assistance. But on and after Sept. 28 1874, the image of the sun was usually projected on the back of the paper and the

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proper places for the spots determined by pricking holes through the paper, so that the sketch represents the sun, as before, in the position in which it appears through a telescope which does not invert. When the sketch, after Sept. 28, 1871, was made by eye only, the fact is stated in the notes, in most cases, perhaps in all. See notes in brackets to sketch No. 2388, on opposite side of this leaf: also on last pages of the book.

Notices of auroras not seen by the observer himself are frequently entered in the notes. "Aurora U.S." signifies that an aurora was seen in some part of the United States according to a list of auroras by Prof. Loomis, which Mr. Trouvelot consulted. Notices of auroras seen in Europe are mostly extracted from the "Bulletin Hebdomadaire de l'Association Scientifique de France." Auroras marked + are from the list in the "New York Meteorology 1850-1863, 2nd series."

A few remarks in brackets [ ] have been added in making the translation. Some inferences which Mr. Trouvelot occasionally made from his observations and entered among his notes have been omitted at his request. Matter in parentheses ( ) is, regularly, that extracted by Mr. Trouvelot from periodicals, not his own observations.

When two dates appear on the same sketch, the date of the sketch can usually be easily determined, but it is often doubtful to which date or hour various scattered remarks should be assigned.

In the column of dates, those underscored with red ink are dates upon which photographs of the sun were taken at Harvard College Observatory.

Barometer readings are marked B. They are half an inch too low until July 20, 1872. Values are only approximate.

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Note April 30, 1873. The telescope with which Mr. Trouvelot usually made his drawings before removing to Cambridge was examined today. It has an erecting eye-piece, which, when drawn out beyond the focus, gives an inverted image projected on a screen. When Mr. Trouvelot had determined the places of the spots by a projection, he pricked them in so that their relative position appeared on the other side of the sheet. He then made his sketch on this other side, always turning the sheet in such a way that the top of the sketch, (determined by the position of the lines of writing,) should represent the top of the sun, as seen through an erecting eyepiece, or with the naked eye, and that the right of the sketch should contain the preceding point, the left the following point, of the sun's disk. He secured this, whatever telescope he used, by always inspecting the sun on the day of his sketch with his own glasses, with the erecting eyepiece, and placing his sketch and the lines of writing upon it, so as to correspond. Consequently, he must have turned over the sheet from top to bottom when he used his own telescope & from side to side when he used either of the telescopes at the Observatory. After Feb. 25, 1872, the drawing was made on the same side with the projection, so that left & right are reversed.

Note June 12, 1873. Mr. Trouvelot, on joining the Observatory, first used the Searle telescope in making his sketches: afterwards the West Equatorial. Both these telescopes, with the eye-pieces used by him, were examined today for the purpose of ascertaining the distance from the narrowest part of the beam, emergent from the eye-piece to the screen which received the projected image, as recommended by C. H. F. Peters, Astr. Nachr. No. 1526 (Vol. 64.)

[For continuation of this note see last pages of this book.]

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[In the early pictures, the word "rien" means "no aurora", according to Mr. Trouvelot's explanation.]

	1870	Hour civil time		
1	Oct. 30	4		
2	" 31	4		
3	Nov. 1	10, 3½		
4	" 4	1½		
5	" 7	3		
6	" 11	11		
7	" 13	3	Extent of large spot: Penumbra 1/61 Sun's diameter Umbra —"—	Aurora at midnight.
8	" 16	3	{With sketch of large spot Nov. 14}	" " 11
9	" 19	2	Great spot seems larger	
	" 25	2	(See back of No. 78)	
10	" 27	3½		
11	" 28	9½, 1½	{Limb somewhat mottled in equatorial regions only; most so near the spots.}	
12	" 30	1½	Spot No. 4 not seen Nov. 28. Group of spot No. 7 is extended.	No aurora
13	Dec. 2	2	Many new spots since Nov. 30.	
	" 3		No new spot.	
14	" 20	1½		
15	" 21	1½	Spot 5 of yesterday disappeared. Group 3 much augmented; 1 to 4 spots for one.	

Observations of 1871 on next page.

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	1871	Hour civil time			
17	Feb. 10	2	Few spots since Dec. 21.	Aurora at 9	3
17	" 13	2			
18	" 15	2	Surface of sun quiet. At 4, some mottling near groups 6, 9, 10. 42 spots in all.	No aurora	3
	" 16		Spots exactly the same.		3
19	" 17	1			
20	" 20	1½			3
	" 21		No new spot. Spots 3, 4, 6, 7 have increased	Some auroral light at 11½.	3
21	" 22	2	Spots 3, 4, 6, 7 have increased.		
	" 23		Spots 3 & 5 considerably contracted. In spot 6 the projection of penumbra which indents the umbra seems at times to vanish & then reappear.		3
22	March 2	4½	Spots of March 1st exactly like these.	Aurora March 1, moon high in sky. No aurora March 2.	3
23	May 13	2	(New telescope.)	Fine aurora with streamers.	
24	" 14	10, 5	Spots 7 & 8 not visible 13th " 9 & 10 " " 10½ M. 14th visible 5 P.M. "	Aurora with streamers.	3
25	" 15	4½	4 spots of group 7 have disappeared.	No aurora	3
	" 16		Spots unchanged. No drawing.	No aurora	3
26	" 17	10	Nos. 12 & 13 have been brought on by the sun's rotation. The 3 spots of group No. 11 have been formed since the 16th "	No aurora	4
27	" 18		Spot 10 disappeared, 11 diminished.	No aurora	
28	" 19		Spots 2 & 4 have appeared.	Fine aurora: streamers to Polaris.	4
	" 20		Spots about the same. No drawing.		
29	" 21		Spot 3 has appeared. All the other spots of the 20th much diminished. Many have disappeared from their groups.	Aurora.	4
	" 22		Spots unchanged.	Day stormy Thunder shower in the evening.	4

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	1871				
30	May 23	Many new spots have appeared: for instance, spots 1, 5, 6, 7, 8, 9, while spots 11 & 1 have disappeared.	No aurora, but the north horizon loaded with the cirrus which precede auroras	Storm passed off; weather fresh.
	Aug. 6	[Drawing on the back of No. 30.] Spot 3 disappeared. 2 & 4 increased.		
31	May 24	Spots 7 & 9 are invisible. Group 1 is smaller.	No aurora	
32	" 25	Spot 6 has appeared. One spot in group 5 has disappeared. Spot 8 divided into two. The 3 spots of group 6 are invisible.		
33	" 28	Spots 5, 8, & 1, 3, are smaller. Spots 6, 7, & group 9 have appeared.	No aurora	Cloudy on May 26 & 27
34	" 29	Group 9 developed, & has 11 spots instead of 5. Many spots have passed off to the west & group 1 is smaller. Spots 2 & 3 formed since yesterday unless they are the double spot of group 9 moved westward.		
35	June 4	Since May 29 the sun has been obscured by haze. Very few spots.	No sign of aurora	Thunder-storm with hail about 1 P.M.
36	" 5	9 A.M. Spots 4 & 5 have appeared; group 6 is new, with mottled appearance near it.		
37	" 6	4 P.M. Spots 3, 6, 7 have appeared. Spots 3 & 6 of yesterday no longer visible.		
38	" 8	4 P.M. Spot 4 vanished. Spots 4, 8, 9, 10 appeared.		
39	" 9	Spot 2 smaller, almost vanished. Spots 6 & 7 drawn together. Spot 8 enlarged. Spot 4 become double. 2 spots 11 have appeared		
40	" 10	Spots 11, 3, disappeared. Spots 3, 7, 11 appeared. Group 9 composed today of 3 spots, yesterday of 2.	Faint aurora 9 P.M. Lasted less than 1 hour.	
41	" 12	Spots of June 11 same as June 10, so far as observable. Today spots 11, 2, 3, have disappeared, & spots 11, 12, 2, & 3 have appeared.	Strong light, perhaps aurora, in the NNW horizon, lasting till after 9 P.M. No arch or streamers.	June 11 was cloudy.
42	" 13	Spot 1 disappeared. Spots 7, 12, & group 9 much smaller. Spots 8 & 6 a little larger		
43	" 14	Spots 7 & 4 disappeared. Group 9 has now only 2 spots & group 11 but 1. Group 8 elongated. Spot 18 group 4 appeared since yesterday.		

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	1871				
44	June 15	Spot 6 appeared, 2 become double, 1 smaller.			
	" 16	Sun not seen.		Weather cloudy	
	" 17	Sun seen, but could not be drawn. Fewer spots, and those rather smaller than larger.	Rather remarkable aurora June 17.		
	" 18			Rained all day.	
45	" 19	Drawing incomplete, made at sunset; but there are no other large spots 2 & 6 are the only spots of the 15th still left. 3 & 1 are new and the 14 western spots have passed off.		Cloudy & rainy.	
46	" 20	Spots probably the same as yesterday, though spot 4 was not drawn then, and I do not remember seeing it.		Thunder storm towards 5 P.M. Lightning struck & burned Hayden's house.	
47	" 21	No new spot. Spots 3 & 6 disappeared.	Aurora without streamers. Light over a dark segment. It still continued at 11 P.M.		
48	" 22	Spot 3 is new. The two spots of group 1 have separated farther. One of them is longer.	Aurora this evening.		
49	" 23	Spot 3 gone. Spot 3 new. Double spot 2 on the limb & will go off in a few hours.		June 24, Rain all day.	
50	" 25	Spot 4 no longer double. Group 3 has two small spots.			
51	" 26	Spots 2 & 5 are new: also a small spot in group 3.			
52	" 29	These spots are nearly all new, except 2. Round spots 4 & 6 are luminous circles, brighter than the rest of the disk, and there is another similar circle not enclosing a spot.		Cloudy June 27 & 28	
53	" 30	Spots of group 5 larger. Spot 4 smaller but become double. Spot 6 larger, with a small one near it. Spot 7 is new.			
54	July 1	Spot 3 gone off, 2 vanished. Group 6 larger & has a small new spot. Spots 4 & 5 smaller. Spot 2 close to the limb begins to look double.			
55	" 2	Spot 2 double or even triple, & very large, with signs of disturbance near it. The 2 spots of group 3 are new. Sun seen only at intervals.	Weather too cloudy to see whether there was any aurora.	Tempestuous and cloudy	

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56	July	3	Spot 1 gone. Group 2 composed of many umbrae. 6 growing fainter. 4 perhaps larger. 7 composed of four small spots. Spot 1 is new, 3 larger, 8 new.		
57	"	4	Spot 8 gone off. 3 is larger. The two spots of group 8 are new.		Cloudy all the evening & night.
58	"	5	Spot 5 gone. Group 8 has 3 spots instead of 2. A spot in group 6 is longer. A large long spot is formed in group 4. Groups 2 & 3 are larger. 5 is a new spot.	Aurora for a few minutes only.	
	"	6	No drawing.	Light probably auroral, between two clouds in the north at 9 P.M.	Hot & cloudy
59	"	7	Spots of groups 3 & 8, and some from group 4 have disappeared. Group 2 & spot 6 smaller. 5, which was a simple spot is a group of 4. On the whole, the spotted surface is less.		Thunder-storm in the night.
60	"	8	4 & 6 have disappeared. Spot 2 continues to decrease. 5 also decreases. 3 is new.		
61	"	9	Group 3 reduced to one spot.		
62	"	10	Spots of groups 5 & 2 still decreasing. Spot 8, two small spots of 4, two large spots of group 6, are all new.		Cloudy July 11 & 12
63	"	13			
64	"	14	Group 1 divided into 3 large & 2 small spots. They are larger than yesterday.	Moderately bright aurora 9 P.M. to midnight.	
65	"	15	Group 5 is new.	Very faint aurora.	
66	"	16	Spots 6 & 7 new. Another large spot in group 5.		Night cloudy.
67	"	17	Spot 7 become double, 8 new. 4 is smaller & has only one spot left, 5 also smaller.		
68	"	18	Same spots as July 17. Sun not visible July 19.		July 19 cloudy.
69	"	20	Spots all considerably larger. Group 5 disappeared, but groups 5 & 9 are new. 7 & 8 both larger. 4 has 3 spots today & 1 is larger.	Sky dark yesterday evening, but towards 1 A.M. today there was a light like an aurora in the southern horizon. The rest of the sky was cloudy.	Earthquake July 20: see account on next page.

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July 20 At 3 minutes before 1 A.M. we were awakened by a shock of earthquake, which lasted about half a minute. The shock was very strong. All the house & furniture vibrated & creaked. The doors swung. The movement, which seemed to come from the S.S.E., was rather a rapid vibration than an undulation.

70 July 22 Yesterday was cloudy, Groups 1, 2, 3, 4, have disappeared. Group 7 is considerably smaller, & group 6 larger. Group 10 has 3 spots. Spot 1 is new.

According to the Herald a remarkable aurora was seen at Springfield between 1 & 2 A.M. today. There was an aurora towards midnight. Luminous clouds were seen having a pulsating movement from the north to the zenith.

71 " 23 All the spots considerably smaller & many wholly gone; for instance many from Groups 7, 6, 10.
Aurora this night towards 1 A.M.

" 24 Foggy, sun hardly visible. Spots about as yesterday.

" 25 Rain all-day, wind east.

" 26 Sun showed itself in the morning, but could not pierce the

" 27 fog; & it rained a little. (See No. 77)

72 " 28 Group 6 almost wholly disappeared. Seen in profile, this group looks like cirro-cumulus clouds

Storm towards 3 P.M.

73 " 31

Cloudy July 29 & 30. Winds East 29th with rain Thunder after noon. East wind, Rain 30th also. July 31 also stormy, with rain.

Aug. 4 (Drawing on the back of No. 73.) Same spots as Aug. 3, but group 1 more extensive.

74 " 1 Group 3 has 2 spots - Spot 4 has disappeared & 5 is new.

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75	Aug. 2	Group 5 larger, 1 smaller.		Storm yesterday & one today towards night. 2 cases of ball lightning noticed as in sketch.
76	" 3	Group 5 has one spot only. 2 is gone & 1 smaller. Spot 2 is new. All the spots seem farther north.		
	" 4	(See No. 73.)		
77	" 5	6½ P.M. Spot 5 disappeared. Group 3 reduced to 1 spot; 5 rather less than greater.		Rained heavily at 5 A.M.; cloudy part of the day.
	July 27	Spots 4 & 5 are new (Drawing on the back of No. 77.)		
		since the 23d the weather has been foggy & rainy. Many spots have disappeared, for instance, groups 1, 10, 7. One small new spot appears east of spot 1.		Thunder-storm at night.
	Aug. 6	(See No. 30.)		
78	" 7	8 A.M. Group 1 almost wholly gone. Spots of groups 2, 4, 5, increased. 6 P.M. No change since morning.		
79	" 8	6⅚ P.M. Sun seen through fog.		Cloudy all day, storm towards 6 P.M. Shooting stars.
80	" 9	9½ A.M. Unchanged at evening.	Aurora all night.	
81	" 10	8 A.M. Spots smaller, especially group 9, and considerably effaced.	Aurora all night, faint at first, brighter towards midnight, perhaps still continuing.	
82	" 11	Spots considerably lessened. (9 A.M.)		Shooting stars this evening.
83	" 12	9 A.M.		Cloudy all night [previous?]
84	" 13	10 A.M., 5 P.M. (2 new spots added on second observation.) Group 2 lessened, 1 increased. 3 increased & surrounded by mottled spots showing much disturbance. 4 is a wholly new group		
85	" 14	6 P.M.		Morning cloudy & cold.
86	" 15	11 A.M.		Night [previous?] cloudy with rain toward morning. Morning cloudy.
87	" 16	1½ P.M. {Drawing made with difficulty owing to clouds.}		Night & morning cloudy.

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	1871	Hour of civil time	[Character of notes changed here. In this copy notes on the spots will be underscored with black ink; notes on aurora with red ink.]
88	Aug. 17	9½	Observed again in the evening. Dog days end today at 6 P.M. Faint auroral light. The Herald says "fine aurora, with arch and streamers."
89	" 18	9½	Heat lightning (?) all the evening though there were no clouds. The flashes came from all points of the horizon, but at 9 P.M. came from behind clouds low in the north.
90	" 19	8	On the back are some drawings of small spots made today with the telescope on Boston Common. The axes of the spots are not always coincident with solar radii, so that the cavities run obliquely into the photosphere like caverns, as is shown in the sketch.
91	" 20	10	The night was cloudy with rain, wind east.
92	" 21	4	Morning cloudy; sun seen only an instant; wind N.E.
93	" 22	8	
94	" 23	9	Wind east in the morning, with heavy fog. The night was cloudy. One cloud in the north seemed feebly illuminated, perhaps by aurora. Rain towards morning.
95	" 24	10	Rain 3 to 4 A.M. Sun observed again at 6 P.M. Night dark. According to Herald, fine aurora.
96	" 25	2	Day dark & cloudy. Sun sketched with difficulty among clouds. Sky hazy as in the last of the dog days. Wind S.W. Dark all night.
97	" 27	11½	Rain all day Aug. 26; sun not to be seen. Wind S.W. Tornado in the forenoon on the Florida coast, coming

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1871 Aug. 27 — Harv. Sketch and time

north. Today much haze; small spots hardly visible, but those drawn are correct. The air was quiet at first, but towards 10 A.M. it became disturbed, & now (11½) the wind is strong S.W. Perhaps the circle of the tornado reaches to or near this place. [Additional note.] Saturday the 26 a tornado raged in S. Carolina. The wind rose here about 10 A.M. Aug. 27 & blew hard all day from the S.W. Towards night I saw several flashes of heat lightning, that is, those pale flashes coming from no definite place & scarcely visible, resembling the light seen when the optic nerve is pressed by anything, or when a galvanic circuit is formed by two metals one on the tongue & the other on the eyelid. Towards 11½ [P.M.] the wind rose violently and torrents of rain fell. Wind first S. soon W. and afterwards N. This tornado lasted only 15 to 20 minutes, & directly afterwards there was a perfect calm, wind scarcely perceptible, and the moon soon appeared among heavy clouds. Clear by the morning of Aug. 28.

98 Aug. 28 8 Clear after yesterday's tornado: little change on the sun: only one new spot, which is farther south than any I have before observed. In the middle of the day several objects crossed the

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	1871		
	Aug. 28		sun's disk, approximately with the wind, which was E. to S.E. When one was seen, others generally followed immediately. The paths of seven of them are marked on the sketch. One, which passed across at 1 P.M. (on the sketch from left above to right below) fell very slowly, like a piece of paper in air, or a coin in water, with a fluttering motion. One seemed triangular. One large one, which crossed slowly seemed to be an insect with one pair of transparent and one of thicker wings. None went against the wind, that is, from W. to E., nor nearly in that direction, although some hundreds were seen. After 1 P.M. there were fewer, and on looking again several times in the afternoon nothing was seen.
99	Aug. 29	5½	Rain all day, east wind; spots hardly visible.
100	" 30	8	Clouds all day, occasional showers. Rain began about 6 P.M. and continued through the night. Spots on the first sketch not faint enough. Another sketch, in the upper left hand corner, of the spots near the centre of the disk.
101	Aug. 31	9	Became clear in the morning: fine all day. Night very clear. No aurora.
102	Sept. 1	9	Clear. Objects like those of Aug. 28 seen crossing the sun; confidently believed to be insects

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	1871			
	Sept. 1			or atmospheric dust, rather than anything cosmical. At night the wind turned to the E. and it grew cooler & cloudier. The change coincided approximately with the passage off the disk of a solar spot. The clouds were singularly arranged, seeming to radiate in long bands from the waning moon, as shown in sketch on the back
103	Sept. 2	6		Sky covered all day with thin motionless clouds, through which the sketch was made with much difficulty. No wind.
104	"	3	9	Thin motionless clouds as yesterday. 4 spots seen distinctly for an instant & sketched. Probably the same as yesterday. No wind.
105	"	3	11½	Clouds still remaining, but the sun comes out clear at times. Towards 4 P.M. the wind became E. to S.E.
106	"	4	8	Night hazy, but sky clear this morning, though there is a slight E.S.E. wind. Group of spot A (perhaps too large in the sketch) has drawn together, and the spots are larger. Group b is new, c has disappeared. Night dark.
107	"	5	9	Sky clear. Wind light, S.E.
108	"	6	9	Sky clear, wind S.W. Aurora by nightfall, gone at 10 P.M.
109	"	7	8	Observed again 4 P.M.; no change since morning. Spots a, b, g, have disappeared. At the limb near f is a region brighter than the rest of the

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	1871 Sept. 7		disk as also around a. Fine aurora by nightfall, with streamers, and afterwards a long band through the magnetic zenith from east to west.
110	Sept. 8	8	(Sun observed again 1 P.M.) Clear, somewhat cold. Region of spot a still disturbed. Fine aurora, with streamers and flashing, about 11½ P.M. to midnight. The streamers ordinarily inclined eastwards were perpendicular. Red streamer in the west. Towards 4 A.M. there was still a faint light.
111	Sept. 9	9	Clear, cold. (Sun observed again at 6 P.M.) Spot a seen with much difficulty at 10 A.M. Dark mists in the north.
112	Sept. 11	8	(Aurora U.S.)
113	" 11	5	Much change since morning, many new spots. From 8 to 9 P.M. very faint light in the north over a dark cloud, thought, but not confidently, to be auroral. Later in the night there was a distinct aurora without streamers. Light rather bright.
114	Sept. 12	9	Hazy, sun hard to see. Clear about 10 A.M. & later. Sun observed again a little before sunset. Spots more developed than in the morning. Group a reduced to one spot.
115	Sept. 13	10	Sky cloudy in the morning, wind S.E. About 9¾ A.M. strong S.W. wind which gave occasional views of

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	1871		
	Sept. 13		the sun for several seconds at a time. Afterwards dense clouds. Shortly before sunset, the sun was seen again through rather dense haze. The spots are still further developed since yesterday and during today. Night dark. (Aurora, U.S.)
116	Sept. 14	3	Fine & clear; cold, wind W. All the umbrae are perhaps too large on the sketch; the penumbrae possibly too small. 2 spots (towards the right, below, on the sketch) are rather black. Others close by are barely visible. No aurora up to midnight. (Aurora U.S.)
117	Sept. 15	10	Sky overcast this morning: there are now large clouds, almost continuous, in two strata; the upper clouds move eastwards, the lower westwards. From about noon the sky was wholly overcast for the rest of the day, and it rained all night.
118	Sept. 16	2	Sky overcast all day. Sketch made with difficulty; sun seen only at 2 P.M. through small openings. Rest of the day cloudy though the wind was west. At night it was clear in the north and about midnight the sky was clear and the stars bright. No aurora.
119	Sept. 17	9	No clouds, but not very clear; wind S.W.; grew cloudy about 2 P.M. Shower for half an hour at 4 P.M., afterwards clear again. No aurora. The night was clear. (Aurora U.S.)
120	Sept. 18	9	Clear, cold, wind strong N.W. by W. No aurora seen.

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		1871		
121	Sept. 19	11	Morning densely overcast, wind S.W. The sky is still hazy. Thick clouds again all day after about 1 P.M. Night overcast.	13
	Sept. 20		Cloudy all day, sun wholly invisible. Half an hour after sunset it cleared off: orange streak in western horizon. Night clear: no aurora seen. (Aurora U.S.)	13
122	Sept. 21	8½	Clear, wind N.W. Night clear: no aurora.	
123	Sept. 22	9½	Sky very clear, wind N.E. Faint aurora towards midnight, dark segment extending at least 35 to 40 degrees above the horizon.	13
124	Sept. 23	9	Clear, wind S.W. (Observed again 6 P.M.: no change.)	
125	Sept. 24	9	Hazy, wind light, S.W. Sun seen with difficulty.	
		2	Observed again. Sky a little clearer, wind stronger S.W. The 2 spots d are plainer; one has an umbra, while in the morning faculae and a spot with penumbra only, were observed. The 2 spots of group c were not visible in the morning.	13
126	Sept. 25	9	Hazy, wind light N.W. Faculae brighter round spot g.	
	Sept. 26		Wholly cloudy, wind E. Night rainy.	13
127	Sept. 27	10	Still hazy, sun seen through haze occasionally, wind W.	
128	Sept. 28	10	Began to take projections of the sun, [as explained in introduction to these notes.] Sky clear, wind W. No aurora seen last night.	
129	Sept. 29	10½	Cloudy, but sun seen very clearly between clouds. Wind S.W.	13
130	Sept. 30	8¾	Clear, wind N.W. Spot a almost vanished, c	

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	Sept. 30		come together as a single spot, the umbra of which is not quite as large as the drawing makes it.
131	Oct. 1	4	Clear this morning, but large clouds came on towards noon from the N.W. Difficult to make sketch. Wind S.E. Night dark & rainy. Faculae in place of spot 2.
132	Oct. 2	12	Sun scarcely visible through haze; could not be taken by projection. Wind S.E. Night dark. (Aurora U.S.) Umbra of spot e too large in sketch.
133	Oct. 3		Spot i very small. Wind S.E., sky wholly cloudy, sun seen only 2 or 3 times in the day for a few minutes, and then scarcely visible. A little rain towards night. Clear except about the horizon at 7 P.M.; stars shining. Thick haze again at 9 P.M. No aurora seen.
134	Oct. 4	9	Somewhat hazy, but spots well seen. Faculae near k and g. Spot m should be drawn smaller and not so plain. Fine aurora without streamers at 7 P.M.; still visible, though much fainter, at 11 P.M., notwithstanding the moonlight.
135	Oct. 5	9	Somewhat hazy, wind light S.W., night overcast. Faint faculae at bottom of sketch.
	Oct. 6		Rain all day, sun not seen. (Aurora U.S.)
	Oct. 7		Rain all day, sun not seen. Wind S.E., becoming W. by evening. (Aurora U.S.)
136	Oct. 8	2	Clear by morning, wind W. New spots have appeared in a large group, in the southeast. At 4 P.M., there being enough haze to allow the

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Oct. 8 sun to be looked at with the unprotected eye, 14
this group was distinctly seen with the naked
eye by myself and Diana. Its general
elongated form could be seen, but not the details. 14
From 4 to 9 P.M. the magnetic needle varied towards
the west, and at 11 A.M. Oct. 9 it had
again varied still farther west.
I could not make sure that there
was any aurora, for the sky was
covered with thick haze almost as far as
70 to 75 degrees of altitude. Besides, the
spots have rather diminished than increased.

137 Oct. 9 11 Clear, wind rather strong, S. W. At night, 14
stars shining, no aurora.

138 Oct. 10 10 Sky rather clear, but great clouds from time
to time. Wind strong, S. W. (Aurora U. S.)

Oct. 11 Rain all day, equinoctial storm. Wind S. W., 14
very warm, rain in torrents at night.

139 Oct. 12 4 All the morning and till 3 P.M., heavy rain. 14
Wind west after noon, and sky became
clearer: large blue patches in the west at 4 P.M.
Night very clear. (Aurora U. S.)

140 Oct. 13 11 Very clear sky, wind N. W. 14

141 Oct. 14 9 Sky much overcast, sun seen with difficulty. 14
[Sketch seems not to be from a projection.]
Rest of the day same weather. Wind
light, S. W. (Aurora U. S.)

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142 Oct. 15 2 Morning cloudy, sun hard to see, wind strong S.S.W. Sky still very hazy, wind S.W., very strong. (Aurora U.S.)

143 Oct. 16 1 Sun seen only through haze. Wind S.W, very light, morning cold, hazy. Spot c drawn rather too large. (Aurora U.S.) This day a terrific hurricane attended by a very high tide, unexampled in the history of the town, did much damage in Halifax, N.S. Same day and the next, great storms on Lakes Superior and Huron. (Nature, Nov. 30 1871, p. 89.)

144 Oct. 16 3½ See the other drawing this date, No. 143. Spots at c drawn much too large. This evening at 9 P.M. a rather bright aurora in the north without streamers. [No. 144 seems not to be a projection.]

145 Oct. 17 10 Fine, but whitish haze over almost all the sky. Wind S.W., light. (Aurora U.S.)

146 Oct. 18 10 Cloudy at first, now beginning to clear off. Hardly any wind, N.W. Aurora at 9 P.M. rather bright with arch but no streamers. Still continuing about midnight.

147 Oct. 19 1 Very cloudy, spots hard to catch. Wind S.W, cold.

148 5 Sun seen again, indistinctly. Spot A a little larger, and a spot had come on at the east. (Aurora U.S.) Second drawing correct, taken on that of the next day, which was drawn by projection.

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149 Oct. 20 9 Sky clear among great clouds, wind W., strong.

150 Oct. 21 8 Sky clear, wind S.W., cold. Faculæ near c.

151 Oct. 22 2 Strong S.W. wind. Sky all hazy, sun hard to see, but it was clear enough for 5 minutes to allow a good projection of the spots. Spot b should be nearer the centre, so as to leave more space between b & c.

152 Oct. 23 8½ Hazy wind light, S.W., Night overcast. Spots of group A more developed.

153 Oct. 24 Cloudy all day except for a few seconds: no sketch. Sun seen for an instant, morning of Oct. 25. No change except of position in the spots. Positions as in the sketch. On the 24th the wind was S.W., hot. Night overcast. Magnetic disturbance at 9 P.M. (Aurora U.S. Also observed in Australia.) on the 24th probably ?

Oct. 25

154 Oct. 25 Cloudy, sun seen a moment at 7 A.M. not long enough to project the image: wind N., cold. Night overcast. (Aurora U.S.)

[From Mr. Trowbot's explanation of his notes, it seems probable that No. 153 is a sketch intended to show the approximate position on the 24th of the spots seen on the morning of the 25th.]

Oct. 26 Rain all day.

Oct. 27 The group near the limb must have gone off today. Rain all day. Wind changed to S.W. at 5 P.M.

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155 Oct. 28 8 Cloudy & overcast all day. At 3 P.M. the small spot A considerably larger, and two small spots had appeared southeast of it, (as seen on Oct. 29 in the morning.) Light rain. Magnetic disturbance between 8 A.M. & 3 P.M.

156 Oct. 29 9½ Fine. Sky clear, with passing clouds. Wind N.W., pretty strong. Large circles, indicated only by a light shade, around spots b & m. The small spot below n made its appearance between 10 A.M. & 1½ P.M.

157 Oct. 30 8½ Fine, cold, wind light, S.W. Spots 1 & 2 (s & x) are new. (Aurora U.S.)

158 Oct. 31 8 Overcast & very cloudy; almost impossible to see the sun. Spots at p, m, n, but not those at i, drawn by projection. Night overcast.

159 Nov. 1 7 Sun seen for some ten minutes through interstices of clouds. The spot in the south, but not that in the N.W., drawn by projection. No other spots seen. Wind S.S.W., strong, sky overcast; some drops of fine rain as early as 8 A.M. Sky clouded all day, much overcast about sunset. Afterwards sky clear in the west. At 7 P.M. the magnetic needle stood at 5' 30" W. and at 7h 41m P.M. it was at 50' east, having thus varied in declination 55' 30". An aurora was conspicuous at this time.

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160 Nov. 2 7 Sky very clear; cold; wind N.W. (Aurora in Piedmont.) (Nature Nov. 30, 1871, p. 96.) (Aurora in Sweden.) Magnetic perturbation at Havana. (Nature Feb. 29, 1872, page 347.)

161 Nov. 3 8 Fine, but with cloudiness: wind hardly perceptible, N.W. (Aurora at Paris. Aurora U.S.)

162 Nov. 4 7 2/3 Fine, cold. Wind S.W., very light. Sky somewhat hazy, Clouds after noon. The western sky was somewhat clear at sunset. (Aurora U.S.)

163 Nov. 5 12 Cloudy all the morning, now very clear. Wind at first N.W., now W. Change on the sun. The southern group has now only one spot: that farther west has two; and the others are now developed. Two spots have appeared towards the east. The magnetic needle, which should regularly have passed by this time to the west is still 5' east.

3 Spots 1, 2, 3, formed since noon; needle agitated. Spot 4 also new. 5 had not been seen at noon. Faculae in the east.

4 5/12 Spots 6 & 7 have appeared since 3 P.M. (Aurora U.S.)

164 Nov. 6 8 Fine, Cold, Wind W., light, not a cloud. Spot A disappearing; group B enlarging.

4 Nothing to add of much importance. A has almost vanished; The two spots C last visible. The chief spots of groups B and D have increased. Night clear. (Aurora U.S.)

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165 Nov. 7 9 Clear, fine, cold. Wind N.W., pretty steady. Spot A disappeared. Spot 1 is double. Spot 2 has appeared. Double spot 3 diminished.

11 1/3 Nothing new. Spot 3 just on the limb, is hardly visible. Faculae following 4.

4 No spangs. (Aurora in Europe.)

166 Nov. 8 9 Cloudy, but sun seen at times. Wind S.W., rather strong: nothing very important. The sky remained cloudy through the day, but the sun could often be clearly seen between the clouds. The wind changed to W.

4 1/4 The two chief spots of group d have separated considerably. The present position of the eastern spot is marked on the sketch with a small cross (+).

167 Nov. 9 9 Fine, sky clear, wind W., light. Not much change. The spots of group g without umbrae are disappearing. Only one is seen plainly; there are traces of another. The small group h is still lessening: group e is scarcely visible. k is a little new spot. The rest is as yesterday.

3 1/2 Nothing of much consequence.

6 Aurora. Needle previously 8' W. reached 47' E. at 6 1/3 P.M.: difference 55'. Red light, particularly, as usual, in the N.W., where it formed a pyramid with its base almost on the horizon & reaching much higher than elsewhere. A smaller & fainter

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Nov. 9 similar pyramid in the N.E. At 6 [?] perhaps 9] P.M. the red mostly gone and only a pale light remained over a dark segment in the N. The needle had returned to 0. Towards 11 P.M. there were bright streamers. Between midnight & 1 A.M. 17
then were still streamers, but pale & colorless, colors not having appeared since 6. No undulatory or pulsating movement noticed nor even any such lateral movement of streamers from E. to W. as is often seen. Electrometer slightly charged during the aurora. (Aurora in Piedmont; Nature Nov. 30 1871.)
(Magnetic disturbance at Havana; Nature Feb. 29 1872.)

Nov. 10 Sun almost hidden at rising; a small part seen, showing spot g. Clouds continued heavy.
Wind E. with rain at 1 P.M.: also melting snow and sleet. Rain all day, sun invisible.
168 Aurora by nightfall. (Aurora in Piedmont; Nature Nov. 30, 1871 p. 96. Also in England at 5¾ P.M. Nature Nov. 23, 1871, p. 61. Magnetic disturbance at Havana; Nature Feb. 29 1872.)

Nov. 11 4 Morning cloudy, sun seen only towards 3 P.M.

169 Nov. 12 8 Fine, clear, cold, wind N.W., light. Spots about 17
as yesterday: g has lost its little spot, d too has only one spot: the little spot h is not seen, f has lost its small spot with penumbra. The small group m, the small spot n, & the double spot s to the east have appeared since 4 P.M. yesterday. There is an accidental mark on

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Nov. 12 — the drawing near s between the two spots s & t.

4 — Nothing new. A cross + marks the present place of the large spot at q. Faint aurora most of the night. (See [notes on] shooting stars [in some other memorandum?])

170 Nov. 13 8 — Fine, clear, mild, wind W. Spots m & m larger, especially m; perhaps also a & d. Small spot c no longer seen; t & s well in view. Group q, near the limb, will soon go off.

10 1/3 — No change. (Aurora in Sweden. Aurora U.S.)

By nightfall the sky grew cloudy; somewhat clear about midnight.

Nov. 14 — Cloudy all day, sun not seen. Overcast or rainy throughout the United States (see journal). Night very dark, wind first S. then E. About 11 A.M. needle varied 10' & was rather agitated all day. (Aurora U.S.)

Nov. 15 — Towards the middle of the night the wind grew violent and tempestuous. Rain began at daybreak and had not ceased at 2 P.M. Wind still S.E., strong.

171 — " — 4 — Sun seen indistinctly for some ten minutes; 3 rather large spots about as in the drawing could be made out. The sky again became suddenly overcast and it was raining 5 minutes later. (Aurora U.S.)

Nov. 16 — Overcast & rainy all day. Wind E. forenoon, N. afternoon. (Aurora in Europe. Aurora U.S.)

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172 Nov. 17 9½ Just cleared up; still cloudy but clear spaces among the clouds. Wind N. From Nov. 13 till now no view of the sun could be taken, the sky being constantly cloudy & the weather tempestuous. Spots today not easily recognizable; much change in the past three days; s & t can be recognized, & n seems to be the same spot with that of the 13th, but if a is the same it has moved farther east. Groups q & m, & spots f & d, are gone off the visible hemisphere. Small spot b no longer seen. Since Nov. 13, u, v, x, & y have appeared; (y is too large on the sketch.) Magnetic disturbance observed at Leghorn Nov. 17; Bulletin of Paris Observatory. 17
Night clear; no light seen.

173 Nov. 18 8 7/12 Sky very clear, wind N.W., light; no clouds. No change since yesterday. Magnetic needle further E. than at the same hours yesterday. Small spot z new; y has two umbrae.
11 Eastern spot of group a scarcely visible.
4 Group y larger. Spot with penumbra only this morning has now an umbra. 17

174 Nov. 19 8½ Sky very clear; cold, wind N.W., light; no clouds. Spots a & n not seen: a [should be n] gone off, a shut up. Spots d, b, c, are new; u, y, group t, larger than yesterday.
2½ Group y somewhat larger, with two very 17

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Nov. 19 small spots appearing to the S.W. of it. No decided movement of magnetic needle. Cloudy towards night. Faint aurora without streamers. (Bulletin of Paris Observatory says: aurora observed in Sweden, and next day strong winds in England and France.)

Nov. 20 Cloudy & rainy all day. Sun not seen. Magnetic needle hardly moved, oscillating only 2′ or 3′, without decided movement, but rather towards the W. than E. (Aurora U. S.)

175 Nov. 21 8½ Light whitish mists in the sky, wind S.W., light. Extent of spots considerably diminished since Nov. 19. Group y is reduced to One Spot; x, v, w, s, have disappeared; t only remains from the large cluster, and that is contracted. The two small spots at e ~~which~~ which will soon pass off have been formed, & spot a has come on, since Nov. 19.

1 No change, but group c seems more visible than this morning. Clouds came on about 3 P.M.; no gaps to be seen among the clouds during the night. (Aurora U.S.)

176 Nov. 22 10¼ Morning cloudy with snow, clearing up at 10 A.M. Adèle sketched the sun. The spots seem the same as yesterday, but she thinks that there was something connecting spots b [probably d is meant] and z. Spots e and b have disappeared: f is new.

177 Nov. 23 9 Fine, clear; wind N.W. Spots y & x have disappeared. A strip of penumbra with darker specks on it connects z & d. There is a small penumbra near a.

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Nov. 23 1 Spot u has appeared since 9 A.M.
3½ Small spot v not seen either 9 A.M. or 1 P.M.
Between 6 & 9 P.M. there was a faint aurora, with dark segment but no streamers. At the same time, the sky, which had been remarkably clear, was covered with long strips of mist moving from south to north. At 10 P.M., sky much less cloudy; but clouds crossed it at intervals during the whole night. Towards morning it was wholly overcast.

178 Nov. 24 10 Cloudy morning, wind S.E.; just cleared off a little; same wind, stronger than in the morning. More than half the sky is now clear. Spots t, u, v, c, have disappeared. Band between z & d much more distinct than yesterday; the spots which compose it are much plainer, and begin to show umbrae. Spot e is new.
After 11 A.M. clouds came on again, wind still S.E. Sun disappeared before noon & was not seen again. Night cloudy; at 11 P.M. it had been raining more or less since 2 P.M.

179 Nov. 25 8½ Fine, with some large white clouds traversing the sky. Wind moderate, N.W. Spot a has lost its small companion without umbra. The group e, z, d, has contracted somewhat. e is larger & more open, & 2 small spots have appeared north of it. A small penumbra has also appeared west of d.

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	Nov. 25	11 3/4	The two spots g have appeared since morning.
		3 5/6	Little or no change. Sky very clear, wind still N.W. After midnight it became cloudy. (Aurora U.S.)
180	Nov. 26	10	Cloudy since 2 A.M. Sun seen sometimes, and projection successful, but after 10 A.M. the clouds
		11 5/12	were closer. Wind S.W., light. It rained at times the rest of the day. Night foggy and rainy. The two small spots north of e were not seen. The large group e, z, d, is beginning to diminish. It is perhaps somewhat exaggerated in the sketch; & should be a little smaller.
181	Nov. 27	3 5/6	Cloudy till 3 P.M., then beginning to clear off: clear after 4 P.M. Many of the spots in group e, z, d, have disappeared, also f. Spot a larger: g & i on sketch more towards the east [than drawn?]
182	Nov. 28	10	Sky very clear, but image of sun unsteady. Wind N.W. Little change since yesterday. Last night very cold; first winter night; there was frost on the windows. Some scattered stratus in the S.W. Faculae near e, d.
		12	Nothing of much consequence.
		1 1/2	Cirro-cumuli rather numerous.
		4	Nothing remarkable. Cirro-stratus in the horizon. Night cloudy.
183	Nov. 29	3	Cloudy; wholly overcast, with some snow; clearing up towards 3 P.M.; quite clear at nightfall. Group d no longer in sight. Group g more developed. Small spot c, seen Nov. 30, probably visible, but Adèle has not drawn it.

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184 Nov. 30 10 Sky very clear, wind W., strong: thermometer now —8 centigrade. Since yesterday the important group b has appeared, also spot c.

12 No perceptible change.

3½ The most eastern spot of group g is more distinct than it was this morning. Wind still strong from the west, and though the air seems clear, the image of the sun is unsteady and seems to be slightly veiled.

185 Dec. 1 9½ Fine & clear; wind S.W. by W.; some light cirrus clouds have just crossed. Spots c & h so much diminished as hardly to be visible; the sketch makes them too plain. Group g also smaller; but group d, one spot with umbra, one without, has appeared. Spot a is nearing the limb.

The sky was clear all day, with occasional cirro-stratus clouds. (Aurora U.S.)

186 Dec. 2 8½ Fine, clear; wind S.W., rather fresh. Spot a gone off. Spots c & h no longer visible. The sky, which yesterday began to be covered with cirrus clouds has become clear again.

187 Dec. 3 8 Sun visible at rising only for a few minutes, when the sky was rapidly covered with thick mists; wind S.W., hardly perceptible. Projection successful, and the spots are in their proper places, but there was not time enough to make the details accurate. No noticeable

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Dec. 3 Change since yesterday: group b is nearing the limb. Faculae near k.

10½ Sun seen again: spots i & h no longer visible. Cloudy all day & night.

Dec. 4 Cloudy with rain, wind E., light, all the

188 2⅙ morning. Towards 11 A.M. the magnetic needle moved west 8′15″. Began to clear off at 2 P.M. and the sun showed itself at times till 3 P.M., afterwards it grew cloudy again. Towards sunset it was partly clear, but cloudy in the west. About 7 P.M. the wind became S.W. About 10½ P.M. it cleared off.

189 Dec. 5 7⅔ Fine, clear; wind violent this morning. Image of the sun very tremulous and unsteady owing to the shaking of the building in the wind and to the disturbances of the air. Group d will go off in a few hours. Faculae about m.

11 Cumulus clouds gathering, changing to cirrus as they rise. Wind tempestuous; sun as before.

1½ Wind as violent as ever, horizon foggy to windward, clouds turning to cirrus as before; sun always visible. Group d is within its own width of the limb.

3⅙ No change.

190 Dec. 6 8½ Fine, cold. Wind S.W., rather strong.

4 Spot m growing smaller. Light cirrus clouds seen towards 2 P.M., increasing. At 10 P.M. stars of less altitude than 45° not seen. A little snow during the night.

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191 Dec. 7 $10\frac{3}{4}$ Cloudy with a little snow last night & early today; began to clear off at about 10 & is now quite clear: wind S. W., moderate. Spot m a little fainter, but spot n has appeared since 4 P.M. yesterday: two small penumbrae beginning to show themselves N. W. of m: faculae in the E.

12 Sun seen through haze: no important changes noticed. Soon afterwards the sky was wholly overcast: sun invisible.

$4\frac{1}{2}$ Sky still overcast, wind still S. W. Night wholly overcast.

192 Dec. 8 $8\frac{5}{12}$ Sky pretty clear before sunrise; but cirro-cumuli began to be formed at 8¼ A.M. and soon covered the whole sky so that the sun could be seen only at intervals: wind S W, light. Warm for the season. Spot k smaller than yesterday. Group m, n, consists of penumbrae only; no umbrae remain in it. Spot s is new. (Aurora U. S.)

193 Dec. 8 10 Sky now clear except some stratus in the horizon. Spot k growing still fainter. Group m, n, seems plainer.

$11\frac{1}{3}$ Spots of group m, n, growing larger. Fine, some cumuli.

1 Spot k seems still smaller. The magnetic needle farther west than usual: now at 11 15. Large cumuli continue.

$1\frac{5}{6}$ New spot seen at n. Cloudy the rest

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Dec. 8 of the day, and towards night some snowflakes. At 10½ P.M. sky remarkably clear, wind rather strong. Rather fine aurora, with long dark segment and fine light above, all not over 45° altitude. No streamers. Magnetic needle moved farther than usual today, reaching 11 30. This evening, during the aurora, it was steady and quiet; on being moved it soon recovers its position with little oscillation. The existence of an aurora could not be inferred from its action. Just at 11½ P.M. a shooting star was seen in the S.W., moving from above downwards.

194 Dec. 9 9 Sky very clear, wind S.W., rather strong. Near Spot k two penumbræ have shown themselves. Spot o is well in view. Group m is more developed. A spot r has appeared at the E. No traces of spot n to be seen. The two spots in the north of group m are surrounded by a common penumbra. The spot in the middle of the same group should be nearer that in the S.E. of it, as yesterday, only larger. The umbræ of these two spots are hardly visible, but the penumbræ are pretty large. The needle is 5′ farther west than usual this morning.

10¾ Spot s noticed. It was not seen this morning. Wind W., rather strong. Large cumuli passing.

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Dec. 9 12 Spots of groups k & m seem to be developing. Wind very strong, many cumuli:

1 Spot p hardly to be seen.

3 1/6 Since 1 P.M. two penumbrae have appeared south of m; they are marked t on the sketch. The northern spot of group k is now the smaller & the southern the larger. Very fine, few cumuli, strong wind.

4 1/6 Spots t more conspicuous: sky quite clear, wind gone down. Aurora, beginning at 8½ P.M., streamers ten minutes later of an unusual kind, being short & not any where higher than 25° or 30°. Magnetic needle little disturbed, being however at 1' east at 9 11/12 P.M. No traces of aurora left at 10 P.M. The streamers began to appear in the N.E. Night calm, no wind, stars brilliant.

195 Dec. 10 8 Very clear before sunrise, but overcast as soon as the sun rose with gray haze, the horizon remaining clear: haze condensing to cirro-cumuli soon after, with long bands of stratus a little above the horizon. Spot p no longer visible: small spot u new. The two spots m, especially the umbrae, are rather too large on the sketch: it is nothing but penumbra and is too

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Dec. 10 distinct on the sketch, especially its small spot. Yesterday there were three spots in group m, now only two. At 9 A.M. the wind, which had been light the previous night, grew stronger. It was S.S.W.
(Aurora in Sweden. Aurora U.S.)

196 — " — $10\frac{5}{6}$ Sky clearer; still cirro-cumuli & whitish mists almost everywhere. Wind S.W., rather strong. Group k is growing fainter & is rather too distinct on the sketch. Faculae near r. Towards $11\frac{1}{3}$ it clouded over entirely, and the sun did not show itself again till after 4 P.M. a little before sunset, through an opening in the stratus; but none of the spots could be seen. Wind gone down. Evening cloudy, no stars seen. Quite clear later, stars bright. This lasted till one or two hours before sunrise; then cloudy again.

197 Dec. 11 10 Sun seen some minutes at sunrise, then hidden behind thick clouds covering the sky. Clearer towards $9\frac{1}{2}$ A.M. clouds collecting into cumuli with open spaces among which the sun would be seen. Clouded over again an hour later. Wind S.W., feeble. Since $10\frac{5}{6}$ A.M. Dec. 10 group n has approached the limb; m has its two spots in one penumbra, and t has its spots more separated: n has two spots today: r has enlarged its umbra; two small spots at o are new, and two

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Dec. 11 Large black spots, probably of great dimensions, are coming on at the west. Large bright faculae between x, r, s.

2 Sky growing somewhat clearer since noon; the sun begins to appear through haze. The total eclipse took place some hours ago [this eclipse visible in the East Indies.] The rest of the day was cloudy: sun could be seen through haze but spots could not be seen. Sun not seen at sunset. Half an hour later, it was clear, with stars, but dark cloud banks all round the horizon. This condition lasted all night, horizon dark, upper sky clear. No auroral light seen. Towards morning, cloudy with a little snow. The night was very calm.

198 Dec. 12 11 2/3 A little snow this morning. Sun appeared a moment at sunrise: sky almost entirely covered with great cumuli: blue spaces from time to time. Two strata of cumuli: the upper hardly moves, the lower, not very high, moves rather rapidly before the wind, which is N. W. Spot o a little smaller and the two spots k are gone. Groups m, t, u, r, all smaller.

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Dec. 12 $12\frac{5}{6}$ Sky remarkably clear. Another new spot coming on at the W. The two spots o have disappeared; m has 3 spots; t only has one; y is new. The needle is at 12° 15' W. at $1\frac{12}{60}$ P.M. The spot in the middle of group z ought to be placed farther east.

4 No change. Dark & thick clouds cover almost all the sky except a long & remarkably clear strip in the W.

Night very calm, not a breath of wind. Sky remarkably clear, stars shining brightly. At $11\frac{1}{3}$ P.M. an aurora was in progress; not very large, but with short streamers. It also emitted two great waves of diffused light passing from north to South. In 5 minutes' watching I saw 3 shooting stars passing northwards. Towards morning the sky was densely clouded.

Dec. 13 [Dec. 12, apparently by error, in original.] Cloudy all day; snow towards noon, lasting through the day and night; not very heavy. Wind E. morning, N.W. afternoon. Needle not moving far westwards. (Aurora U. S.)

199 Dec. 14 3 [See also No. 198 under erroneous date of Dec. 13.] Cloudy all the morning, wind N.W.; needle farther west than yesterday. Began to clear up in the W. at 1 P.M. and at $1\frac{1}{2}$

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Dec. 14 P.M. the sun could be indistinctly seen; wind shifted to S.E., with clear horizon in the S.W.; sun now (3 P.M.) free from clouds. Since the 12th, Spots y, u, s, t, m, have disappeared: o & r are smaller; so are groups x, z: the small spot a is new, as are spots b & c, which will soon pass off the limb. Directly after sunset the whole sky was covered by thick clouds, except the west, which remained strikingly clear. Some half an hour after midnight. No vestiges of aurora seen. (Aurora U.S.)

Dec. 15 Cloudy all day: sun seen through the substance of the clouds at times but not plainly enough to show the spots. Evening very calm. At 10 P.M. some stars could be seen near the zenith but the horizon was cloudy all round. Magntic needle steady.

200 Dec. 16 8 2/3 Fine, wind S.W.; some cloudiness becoming visible after 9 A.M. Spots o, b, c, a, have disappeared: r is no larger, but is triple: x has a larger surface and more umbrae; z is rather smaller & e is separated into two spots. Spot f and the fine group g, (with faculae) have appeared since the 14th.

10 Since 9 A.M. the magnetic needle has moved from 1 E. to 5 20 W. Spot k

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Dec. 16 was not visible this morning, and between c & z there are now two small penumbræ i & k.

12 Fine, no change.

2½ Apparently no change. Some cloudiness gathers and vanishes alternately.

4¼ Spot m has appeared since morning. Magnetic needle still far W. The sun set among stratus clouds rising from the west to the zenith, becoming more continuous as they rose. The clouds near the zenith at the edge of this bank have the cumulus form: the east is clear. From 7 to 11½ P.M. there was a magnetic disturbance; an aurora suspected from the fact that the needle was at 2′ 45″ W. at 7 P.M., at 2′ 45″ E. at 8⅔ P.M., at 4′ 40″ E. at 10½ P.M., W. again at 11½ P.M. and a slight jar caused it to move at once to 4′ 30″ W. and soon after it was at 6′ 30″ W.; at 11⅔ P.M. it was at 7′ W. The sky was wholly overcast. (Aurora N. S.)

201 Dec. 17 1 Overcast all the morning, some sleet at 9 A.M. with S. wind: toward 11 A.M. wind S.W. Sun somewhat visible under clouds between noon & 1 P.M. Spots g, e, x, taken by projection; the others sketched by eye only.

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Dec. 17 Spots seem smaller, especially those of e, x, k, z. Magnetic needle more west than usual; at 1⅓ P.M. it stood at 12′45″.

202 2½ See previous drawing of this date. It cleared off and gave a good view of the sun. Wind fresher from the S.W. Magnetic needle still 12′30″ W. Since yesterday the triple spot z has become simple and smaller: a like change in e; k has lost a penumbra and is hardly visible: z has now but one spot: y & x are somewhat smaller; group n considerably smaller: on the whole the spotted area is lessened. The little group h is new, & a spot at f has changed its place: group h too distinct on the sketch; so are the two spots N.W. of group n. At 9⅓ P.M. the magnetic needle suddenly moved 3′ going to 9′ E., but the sky was cloudy. Towards 1 A.M. (Dec. 18) a bright meteor moved in the S. from E. to W., describing a curve. Its light was seen through the window curtain. At this time the sky was rather clear, & the stars could be seen: but the northern horizon was cloudy.

203 Dec. 18 7¾ Sun visible some minutes at sunrise, afterwards hidden behind continuous clouds: wind S.W., scarcely perceptible. The seven

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Dec. 18 Spots marked here were taken by projection. [Apparently the projected spots are g, h, e, k, n, x, y.] This is the position of the spots at 7 3/4 A.M. Spot e is considerably smaller, group h has only one small spot left, as likewise f; n is larger but the group of penumbrae in that region has almost vanished; m, r, if they are the same spots as yesterday's, have approached each other. Cloudy all day with thick snow. Wind shifted to the E. in the afternoon, & it rained. At night it cleared off a little, and at 9 P.M. it was clear and remained so the rest of the night. Up to 11 P.M., after which I did not sit up, I saw no sign of aurora. (Rain throughout California with heavy winds. Aurora U. S.)

204 Dec. 19 9 Sky was clear all previous night & this morning: cirrus formed immediately after 9 A.M.: the needle was only just W. at 9 1/3 A.M.: wind light, S.W. No great change in yesterday's spots; the large spot t has come on at the west. Snowing pretty hard towards 3 P.M.: at 10 P.M. the snow had ceased, but it was still cloudy.

205 Dec. 20 10 1/2 Cloudy all previous night & this morning, but by 8 A.M. there were signs of its clearing off. At 10 1/2 A.M. hardly any clouds, wind S.W. Spots z, k, & the two small ones of group g

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Dec. 20 have disappeared: f is hardly visible: spots x, y, n, are perhaps a little smaller; the fine spot u & the penumbra v have come on at the W.

2

1 The spot n is vanishing & has now no umbra. The penumbra between n & y is increasing & has now a fine umbra. Sky pure blue with a few scattered cumuli in the horizon, wind still S. W., rather strong: f can hardly be seen, though the sky is so clear.

4¼ No change; still clear & fine.

The night was very clear, at midnight the northern & eastern horizon was obscured by thick cumuli; a little later the wind rose & blew rather hard.

206 Dec. 21 9½ Sky unusually clear: cold, thermometer −15° [centigrade, presumably: temperature at Cambridge at same time about 0 Fahrenheit:] at 8 A.M. Wind W. rather fresh. Spot f quite invisible, z must be on the limb. One of the penumbrae N. of g has disappeared but another has appeared a little W. of the remaining one. The small group w is new & the spot z is visible, seeming to occupy the same position with that of which I lost sight Dec. 20. Group u, t, v, is little changed,

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Dec. 21 so far as appears: one small spot has shown itself S. of t. The drawing exaggerates spot n, which should be one quarter smaller.

11 Wind strong.

12 5/6 No change.

3 2/3 No change; seeing bad from state of atmosphere: magnetic needle now 13' W.

[Later,] some stratus in the north. At 11 P.M. great cumuli occupied all the sky to the S. & W., soon reaching the zenith & finally covering the whole sky with rounded clouds. The rest of the night was cloudy.

207 Dec. 22 Wind S. W., light. Sun somewhat visible at sunrise, but I did not see it; at 8¼ A.M. I could use the telescope but the clouds were too thick to see any spots, and soon the sun could not be seen at all. Between noon & 1 P.M. it could again be seen, but as before the spots could not be seen, and the sun disappeared again at 1 P.M. The magnetic needle was farther east this morning than usual. At 8 [P.M.?] the wind, still very light, shifted to N. At 9 5/6 [P.M.?] a fine compact damp snow was falling.

208 Dec. 23 The fine, ~~heavy~~ snow continued to fall all the previous night; this morning there is a very fine freezing rain or sleet. Sky wholly cloudy; wind N., not strong. The

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Dec. 23 frozen rain continued from 9 A.M. to and after 4 P.M. when the wind was still N., hardly perceptible. At 1 [P.M.] the wind shifted to S. and blew hard, with heavy rain. It grew warm & the snow rapidly melted. Towards 10 [P.M.] the magnetic needle retrograded from 3 or 4 W. to 6 W., where it still was at 11 [P.M.]. At midnight the wind was tempestuous, carrying off a window blind, not abating till 3 or 4 A.M., when it shifted to W.S.W., on which the rain ceased & the sky began to clear off. No snow left at 8 A.M. next morning, & the sun began to come out.
(Aurola N.S.)

209 Dec. 24 9 Stormy last night till towards morning, when the wind went down & it cleared up. A very good view of the sun. Wind W. Spots n, x, y, n [perhaps m of No. 205 is meant,] z, h, e, have disappeared, also the two small ones N.E. of g: Spots c, d, a, b, are new: g seems a little smaller. Faculae near g.

11 No change: clear & fine.

1 2/3 No change. I think g is smaller.

3 g is smaller. Cirro-cumuli in the sky.

4 1/4 No change. There is not much cirro-cumulus at present. In the evening, scattered cirri.

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210 Dec. 25 10¼ Cloudy & foggy this morning; sunrise not visible. Towards 9 A.M. the clouds broke up a little & soon showed blue patches among cumuli. Wind S.W., light. Small group w has vanished; c, d, have disappeared: there is a region of faculae in the place of c, another near g. Spots of group a more open, & much larger than yesterday, while g is smaller. Group b is a little too large on the sketch, & should be better separated into two distinct groups. At 3½ P.M. much cumulus cloud. At sunset long rows of cumulus converging from all quarters to the sun. At 10½ P.M., calm, much cumulus. [Sketch on the back showing disposition of clouds at sunset.] There were 5 or 6 of the long rows above mentioned; one in the S. had an altitude of about 30°, extending from the S.W. horizon, where the sun had set, to the N.E. where the moon had just risen. The other rows were shorter, hardly 90° long. (Aurora U.S.)

211 Dec. 26 8 Cloudy, wind N., light. Sun seen occasionally till 10 A.M., after which the clouds were continuous the rest of the day. Towards 5 P.M., a little rain began, which lasted through the night; it was not very heavy; the wind continued from the N. The sketch was made by projection, but

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Dec. 26 as it was very cloudy and there was little time to spare I could not sketch the details of the small spots, if there were any. The small spots do not appear well upon the projected image, particularly when the seeing is not very good. It is therefore uncertain whether d not spots v and the two others of the group u, t, had been wholly obliterated, but v certainly must have been smaller than yesterday or it would have appeared on the projected image.

212 Dec. 27 9 Rainy all previous night & till sunrise, but then the clouds began to break up at once, and soon there were enough clear spaces for a good view of the sun. Wind S.W., light. Since Dec. 25 there are changes: spot g has disappeared.

1 No change seen, wind very strong. Towards 11 A.M. there was a squall & the wind shifted to W. The sky was wholly black but cleared off in 30 minutes: cumulus clouds passing, large and numerous: wind rather strong. Between noon & 1 P.M. the wind shifted towards N. & is now N.W.

4½ No change: wind N.W., strong: sky nearly free from cumuli; clear & freezing.

In the evening the wind was W.,

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Dec. 27 very strong, with heavy gusts at times. It went down in the latter part of the night.

213 Dec. 28 $8\frac{5}{12}$ Sky remarkably clear, with only a few small scattered cumuli in the horizon: wind W., steady. Little change since yesterday: spot d perhaps a little larger: some small penumbræ between b & c have disappeared, but spot b is perhaps a little larger. Close to it is an accidental spot on the sketch, printed out by a line. The penumbra about spots a, b, is a little exaggerated on the sketch, and should be reduced to its size on yesterday's sketch.

$1\frac{1}{4}$ No perceptible change. Some cumuli passing. Wind same as before, pretty fresh. No faculæ seen with my telescope. Magnetic needle only 5' W. at 11 P.M.

4 Spots a & b now occupy the positions marked on the sketch by small dots. Stratus from the western to the eastern horizon passing through the south. Higher up, extending to some 40° of altitude, light whitish mists seem to be swept along by the wind. The north is quite clear: the sun is about to set among the clouds, without apparent change since morning. At $8\frac{1}{3}$ P.M. the magnetic needle is 0 30" W: at $9\frac{1}{2}$ P.M. at 2' E.: at this time the sky is completely covered by great cumuli: large circle round the moon. At $10\frac{1}{2}$ P.M. the needle has retrograded to 2' 30" W. The cumulus clouds mountain half diminished: all

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Dec. 28 the east is clear from the zenith to near the horizon. The sky was cloudy the rest of the night, and in the latter part of it the wind blew pretty hard. (Aurora U.S.)

Dec. 29 Snow all day, cleared off at night.

214 Dec. 30 Sky wholly cloudy: here & there, clouds not so thick as yesterday, and some long bands of Stratus can be seen; wind S.W. The sky remained overcast through the day, with some symptoms of clearing off; & sometimes the continuous layer of cloud was broken by some appearance of cumulus. Towards 3 P.M. the wind shifted to E.: at 7 P.M. there was some very fine sleet. The magnetic needle went farther west today than for several days previous, reaching 12′ when farthest west. It retrograded in the night as in the two previous nights. Fine sleet much of the night.

215 Dec. 31 Overcast this morning: at 10½ A.M. wind N.W., fine sleet falling: at noon, fine rain [or sleet] has ceased: it is unusually calm; the vane remains in any position in which it may be placed. Overcast all day, no change at sunset. At 7 P.M. calm as ever, with more fine sleet. At 11½ P.M. the fall of exceedingly thin & fine sleet, and the perfect calm had continued since nightfall; a little fog.

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216 Jan. 1 At sunrise, sun slightly visible, but no appearance of spots could be seen, although the part of the disc was examined where the spot seen three days before should have been. The weather continued through the day neither fair nor foul, the sun occasionally showing itself, but only under thickish clouds. It was not seen at sunset, but a few minutes afterwards the western sky was flame-colored. Towards 8 P.M. the upper regions of the sky were clear of clouds, but not perfectly clear, for the stars were not brilliant: all round the horizon were cloud banks, & from S. to N. through W. was a paler band of considerable width resting on the horizon.

217 Jan. 2 $9\frac{2}{3}$ Sky clear, wind N. In the last 4 days spots b & c have diminished; b is a little too large in the sketch: a, t, d, have disappeared.

218 Jan. 2 $4\frac{1}{6}$ See No. 217. Between 11 A.M. & 2 P.M. cumuli threatened to cover the sky, but afterwards it grew clear again. Since morning group f has appeared. Wind N., light. This night the stars shone, but in the last part of the night it grew cloudy & became wholly overcast. At 5 A.M. [Jan. 3] the sky was almost everywhere covered.

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219 Jan. 3 Cloudy all day. There were also two atmospheric currents all day. The clouds moved from E. to W.: the vane pointed first W., then N.W., & finally N. At 5 P.M. both currents still continued. The sun was not seen, even under clouds. The magnetic needle was farther E. than usual. Some sleet at 8 P.M.

220 Jan. 4 Fine close rain, wind S.E. At 11 A.M., the rain ceased, the wind shifted to N.W., & the sky cleared off a little. At 4 7/12 P.M. the wind had not changed since 11 A.M., but the sky still remained very cloudy & overcast, without rain. Sunset not visible.

221 Jan. 5 Sunrise not visible, but sky less cloudy than yesterday. Long dense stratus clouds on the horizon, especially in the east: the horizon is nearly clear and shows blue sky on the N.W., W., & S.W. Cumulus clouds, but not fully formed, in the upper sky. Wind N., rather fresh, but not extending to the clouds, which do not seem to move in any direction. At 9 1/3 A.M. the sun sent some gleams through the clouds, but only for an instant. Cloudy all day, the western horizon remaining clear all day: the sun could just be seen at sunset, but the clouds were too thick for the spots to be seen. Immediately afterwards

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Jan. 5 it cleared up & at 6 P.M. all the stars could be seen. The night was very clear. George asserts that he saw a faint auroral light at 11½ P.M. (Aurora at Modena.)

222 Jan. 7 9½ Sky remarkably clear; wind rather strong previous night, now violent; W. this morning, shifting to N. with increased force at 9½ A.M., making the seeing bad though the sky is clear; there is as it were a light veil above. Since yesterday spot h has disappeared; f is smaller: the rest are little altered: m, k, are near the limb & will go off today.

1 2/3 No apparent change, wind still violent, now a little S. of W.; weather clear, cold, no clouds of any kind, compact or diffuse.

3½ No change: a little less wind.

4½ No change: spot m is nearly within its own width of the limb: wind has just shifted to S.W., and has again become violent. (Aurora at Aosta, Genoa, Modena, & Florence.)

[Apparently there was a sketch on Jan. 6 not with the others at present (April 15, 1873.) If found hereafter, it will be entered out of place, with a note to refer it to its proper date.]

223 Jan. 8 8¼ Clear, with stratus & cirro-stratus clouds; wind S.W., not very strong. Spot k is now on the limb & will soon go off: spot a has appeared during the night. f is no longer

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visible: group e somewhat changed, now almost collected into a single spot. This group is a little too large in the sketch. The magnetic needle is farther E. this morning than it has been for a long while: it stands at 3' 15". The clouds are remarkably arranged in three bands diverging from a point in the western horizon, and, after passing the meridian, converging again to a point in the eastern horizon. The most southern band lies along the horizon; its greatest width is 15°; it is composed wholly of stratus cloud, rather thick. The second band is 15° wide, & crosses the meridian about 45° S. of the zenith. It is entirely composed of cirro-cumuli, and passes over the sun, which it covers. The third band is north of the zenith about 45° on the meridian. It is composed of cumuli, is narrow, not quite continuous & has a gap at the true north of about 10°.

10½ The bands have disappeared & there is less cirrus.

1⅔ Spot k still seen distinctly on the western limb.

2 Only two of the three cloud bands of the morning now remain: the southernmost is as before but now rises to at least 30° altitude; it is full of compact stratus reaching

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Jan. 8 to the horizon. The northern band is about like that of the morning, but is not quite so high. The middle band has disappeared.

3 1/6 No change seen, but the magnetic needle, which at 1 P.M. was only 5 15 W. is now at 11 15. There is now much more cirrus than at 1 P.M. (Earthquake at Moncalieri.)

4 1/4 No change.

224 Jan. 9 9 Fine, wind S.W., light. At 7 5/6 A.M. the magnetic needle was at 7' 45" W., where I have never before seen it at that time of day. There are changes in the spots: a seems larger than yesterday & the small spot b has appeared beside it; g & the spot just N.E. of g are also larger. The two spots e are farther apart than they were yesterday.

By 10 A.M. Stratus clouds were rising & changing to cirrus, which soon covered almost all the sky. This condition continued through the day, the sun being occasionally visible for a moment.

1 Observed the sun by projection in the Cambridge telescope: still saw distinctly the two spots n. The sun set in heavy stratus clouds which were all red. Another magnetic disturbance about 7 to 8 P.M. Night somewhat hazy, some stars seen through the haze. (Aurora in Scotland.)

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225 Jan. 10 9 2/3 The previous night was cloudy, towards morning the sky was almost wholly overcast, but at sunrise almost all the clouds disappeared. At about 9 A.M. more light cirro-stratus clouds gathered: wind N.W. Since yesterday spot i has disappeared: the two spots n are scarcely visible this morning: they are even too visible on the sketch: the small spot b has diminished & has now no umbra: one only remains of the two or three small spots e, & that is smaller: the two spots f have appeared since yesterday. 11 1/2 The spots g seems to increase: there seems also to be some increase in group a f b, in which the little penumbra to the f. was not seen this morning. Sky much clearer.

After 1 P.M. the sun was hardly visible & all the sky was overcast. The magnetic needle did not reach 7' W. The sun was not visible at sunset, but directly afterwards it must have shone out between clouds below the horizon, for all the west was lighted up with brilliant red extending to some clouds almost in the zenith. This light lasted more than an hour. At 6 1/6 P.M. some traces of it were still to be seen, the sky being still wholly overcast. At 7 1/2 P.M. the sky was clear,

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Jan. 10 except some remains of diffused cloud in the horizon. At 11½ the stars were shining: not a breath of wind.

226 Jan. 11 9 Fine, with a little haze, especially near the horizon: wind hardly perceptible, N.W. by W. Great changes since yesterday: e & n are invisible, f has increased: a, b, considerably developed: spots c, d, e, are new.

Towards 11 A.M. the sky became wholly covered with diffused clouds, which however allowed the sun to be seen at noon. The wind shifted to E.S.E.

1½ The group a, b, is larger than it was this morning: a line of penumbra is forming S. of this group.

The sun became wholly invisible towards 2½ P.M. & did not show itself again the rest of the day. At sunset the sky was red again in the west, but less of it than yesterday. At 7½ P.M. some stars could be seen about the zenith, but only under clouds. At 9 P.M. & at 11 P.M. all the sky was dark & overcast: not a breath of wind. The magnetic needle did not deviate far today. Cloudy till near morning.

227 Jan. 12 9½ No clouds at 6 A.M.: at 7¼ A.M. black clouds rapidly showed themselves in masses in the S.W. & W. flying before a strong wind &

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Jan. 12 soon covered the sky: the sun was visible 2
at sunrise & afterwards disappeared. The
dome of cirrus was soon driven off by
the violence of the wind, & the sky became
very clear with some rapidly moving
cirrus. The magnetic needle at 7¼ A.M.
was at 4' 15" W.: after 8 A.M. it rapidly
retrograded towards the E. & at 8½ A.M.
it was only 0' 30" W. Important changes
since yesterday: f is scarcely visible:
h has disappeared: but the group a, b,
has increased; spot p & all the semicircle
to the west has developed since yesterday;
the small spot c is a little smaller
than yesterday; e, d, has more spots: k,
n, m, are new spots.

1½ The small spot q has appeared since
11 A.M.: sky perfectly clear, not a cloud,
wind W., very strong.

4 No change: the magnetic needle has been at 11' 15" today.

9¾ From the horizon to about 45° attitude 2
the sky is covered with thick diffused
clouds, especially at the S., and even the
stars about the zenith are a little hazy:
in the N. horizon a great band seeming a
little luminous, & above it a wider band of black
cloud melting gradually into the sky above.
Not a breath of wind.

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228 Jan. 13 3 1/3 Towards morning the sky was pretty clear, but a little before sunrise it became wholly cloudy & the magnetic needle retrograded a little towards the E.: the sky continued more or less cloudy till towards 3 P.M.; then cleared off, & I got a good view at 3 1/2 P.M. Changes since yesterday: g has disappeared: group e, d, has only three spots: g can no longer be seen: k is hardly visible: c has disappeared: group a, f, b, is smaller: the single spot z is new.

4 1/2 No change.

Magnetic disturbance towards 9 [P.M.]: (see obs.) [in some other memorandum.] A little earlier I had thought I saw a somewhat reddish light among the diffused clouds in the N. horizon; but it was only slightly visible: probably an aurora, for the magnetic needle varied to the E. & at 11 1/2 P.M. almost all the sky was overcast, wind N.: during the day it was S.W. Cloudy the rest of the night with pretty strong wind.

229 Jan. 14 2 1/2 Cloudy, wind N.W., rather strong: towards 1 P.M. it began to clear off a little, & at 2 the sun could be somewhat seen. Group b, a, f, is somewhat exaggerated in the sketch: its spots are a little too large: k has disappeared, & s, t, are new.

4 No change in the spots. The vane points N., while the clouds move from S. to N.

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230 Jan. 15 10½ Fine, clear; wind W.N.W., light. Group b, a, is smaller & has fewer umbrae; e is also smaller: d has vanished: m is no longer in sight; but the two spots r have enlarged; p also is larger, as is s likewise: the small spot x was not visible yesterday, v and the two spots w are new.

3 No change. Directly after sunset the sky became cloudy & remained partly cloudy all night, wholly so towards morning.

Jan. 16 Cloudy all day with snow towards night.

Jan. 17 It snowed part of the day & the sun was invisible. (Aurora at Aosta.)

231 Jan. 18 10 Fine, clear, wind S.W. by W., rather strong. Since Jan. 15 spots e, u, a, v, x, z, have gone off or vanished: but spots t, v, m, u, e, k, f, g, h, c, d, are new. Faculae near v. From 11 A.M. to noon it was almost everywhere cloudy. At 1 P.M. it was clear; wind N., stronger: large cumuli passing.

1⅚ Spot w had not been seen this morning. The magnetic needle made a great excursion towards 3 P.M.: it reached 20' W. at 9½ P.M.

232 Jan. 19 9½ Hazy, wind S.W.: b, p, r, have disappeared; s has diminished; so have e, k; f has vanished, but the small spot y is new: the central group is consequently diminished, the western

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Jan. 19 group a little increased: t is more developed: n is now a group of three spots. On the whole, the spotted surface is diminished. Towards noon the sun wholly disappeared, & was hidden the rest of the day. At night, the wind shifted to the E., & the magnetic needle made an excursion to the E. of several minutes; then, after an hour, retrograded towards the W.

Jan. 20 Cloudy, wind N.W. by W., very light.

233 " 2 Rain all the morning, & cloudy afterwards; but towards noon it began to clear up: [the sun] seen pretty often the rest of the day: till midnight there were cumuli, but later the sky was clear of clouds: wind W. Spot w vanished: group k has lost two spots: k is smaller: so is g, but has a small penumbra to the south: the two small spots y are new. The western group also shows change: t is divided into several spots: n is perhaps larger: the two spots q are new. (Aurora at Paris.)

234 Jan. 21 9½ Fine, clear; wind S.W. The two spots q are obliterated: so is y: k has two spots: spot c is larger & separated into two: the western group is increased; there are more spots: & close to the western limb a group of two spots r, u, has appeared. Faculae noted. No change at 3¾ & at 4 P.M.

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235 Jan. 22 8 Fine, sky clear, wind S. W.

Jan. 23 } No time to make a sketch or to observe the
Jan. 24 } sun, which however might have been seen.
There were clouds all day and on the night
of Jan. 24 the wind was violent.

236 Jan. 25 4½ As it was late in the day, there may
have been some spots, smaller than those
on the sketch, which were not seen.
Wind W., strong; large cumuli.

237 Jan. 26 3½ Wind W., strong. Clear & cold all day.
Saw the spots in detail in the large
Cambridge telescope, & examined the
spots with the spectroscope. The spot e
showed a strong black line parallel to the
spectrum; so did spot o: while spots c &
a showed double parallel lines. Drew
the flames & protuberances on the limb
in the region of group a, b, c, (see drawing)
[among the drawings of protuberances.]

238 Jan. 28 3 5/6 Snow began to fall at sunrise & continued
till towards 10 A.M., when it began to
clear off. The sun was visible at times
towards 2 P.M. & at 3 1/6 P.M. it was in
full view: wind W., scarcely perceptible.
Since yesterday v has gone off the
visible hemisphere; groups a, b, c, are
fainter: e, f, are in view: the two spots d &
the important group k, h, g, m, have appeared.

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Jan. 28

Faculae near k. [See note to No. 222. Here also there seems to be a missing sketch, made Jan. 27.] [Note April 18, 1873. Mr. Trouvelot moved from Medford to Cambridge about Jan. 20, 1872. It seems likely from the notes above that he moved on Jan. 23 & 24. Sketches No. 236, 237, 238, were made at his house in Cambridge. There is a sketch (No. 239) dated Jan. 27, 1872, made with the telescope bought from G. M. Searle by Harvard College Observatory, which was ordinarily used by Mr. Trouvelot at the Observatory, after his removal to Cambridge, to continue his series of sketches. This telescope has an inverting eye-piece, but as the sheet was turned over (to make the sketch, after the places of the spots had been obtained by projection,) from side to side, instead of from top to bottom, as before, there is no change in the character of the sketches made with the new as compared with those made with the old instrument, except that the scale is larger, and that an indication of position is usually given by an arrow marked either on the back or front of the sketches. After Feb. 25, 1872, the sheet was not turned over after the projection. From Jan. 27 to Feb. 4 inclusive, Mr. Trouvelot's original notes are partly in English, but these English notes are entered here as well as the translation of those in French, for the sake of completeness. The barometer readings which often occur will be marked B. which are probably half an inch too low until July 20, 1873]

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239 Jan. 27 11 7/12 Sky covered partly with cirro-stratus; wind W. B29 5/20 Middle spot (of 1) shows two parallel lines [in the spectroscope.] Spot 5 shows bright, dark, & penumbral lines [as represented in a sketch on the original.]

Towards 1 P.M. the sky was almost all cloudy, and at 3 P.M. the sun could no longer be seen at all. All the evening and night were cloudy, the moon invisible.

4 1/2 No change [in the weather or in the sun? The notes on this sketch are mainly written so that, to read them, what is evidently the top of the sketch is held lowest.] Since yesterday m has disappeared, but group c is considerably larger, & spots f, e, are new: v will soon go off. (+ Aurora at Houston, Texas. Auroras with this mark + are from the "New York Meteorology, 1850–1863, second series".)

240 Jan. 29 3 5/12 Snow storm from 10 A.M. till now. Sky clearing up, wind N.W., pretty heavy. B29 50/100. Group of spots d invisible. After sunset the sky was perfectly clear and the stars very bright. At 7 P.M. a feeble aurora without streamers was visible, above a narrow dark segment. At 9 P.M. no trace of aurora remained.

241 Jan. 30 11 1/6 Fine weather, clear. Much change since yesterday. The group g, m, K, h, has more

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Jan. 30 spots: group e, f, has 7 spots instead of 4: c has 6 spots instead of 3: a remains about the same; also r: but west of this last spot 9 new spots have made their appearance: these are s, t, u: v also is new. Aurora visible at 8 P.M.; still visible at 10 P.M.: quite a bright light behind a very dark segment, but no streamers are visible. (Aurora at Valpeglino.)

242 Jan. 31 10¾ B 29 12/20. Wind N.W., light. Fine weather, clear. The group e, f, is larger than yesterday: c, b, a, which formed two groups yesterday, are now united, the total area occupied by spots being larger: on the group u, s, r, there is some little change, but the amount occupied by spots is about of the same area: the large group m, g, h, k, is a little increased: v is invisible: x is a new spot. After sunset the sky was somewhat covered with light stratus, but soon after the sky cleared off, except near the horizon, which remained vaporous to 15° or 20°. About 9 P.M. this vapor lowered & then the appearance of an aurora was visible. At 10 P.M. it was still visible: it consisted of a nebulous light above a dark segment, but no streamers or wavy motion were visible.

243 Feb. 1 12⅔ Wind W. B 29 16/20. Fine & clear weather. The group e, f, occupies a larger space: the spots seem to have separated from close proximity. The

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Feb. 1 group a, b, c, also occupies a larger space and has larger spots. The group u, t, is diminished: the two small spots s are vanished; x has two spots; y, z, w, are new spots.

244 Feb. 2 11 5/6 Fine and clear weather, wind W., light. B 29 17/20 B (at 8 1/2) 29 17/20. B (at 7 1/3 P.M.) 30. Since yesterday some changes have taken place: the spot m of the large group has 3 smaller spots more developed, but the spot between q & k is much smaller; z is developed into a group of 4 small spots; y is also increased; on the group e, f, spots have disappeared & the area occupied by spots is smaller: so it is on the group c, b, a, which is also considerably less: w & u, t, are nearing the limb: x has already disappeared: on the preceding [should be following, apparently,] side the two double groups d & n have made their appearance since yesterday, d occupying the same place as the faculae seen yesterday. Sky perfectly clear at 11 P.M. (+Aurora, Salem, O.) (Aurora at Modena)

Feb. 3 Cloudy from morning, wind N. W.: at 10 1/6 A.M. it began to snow, and the storm kept increasing & continued all day with a strong east wind. At 10 56/60 B 29 17/20 At 11 48/60 B 29 16/20 High wind all night.

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245 Feb. 4 11 B $29\frac{7}{20}$ wind N.W., strong. This morning the storm was not over yet & snow was still falling, but at intervals through the opening of clouds the sun could be seen. Changes have taken place since the 2d.: the spots w, a, u, t, have passed to the other hemisphere: z has now only one spot instead of four: x also has lost two spots: between c & b four little spots have closed: e, f, remain about the same. The large group m, q, h, k, is considerably diminished: n has 2 or 3 little spots more than day before yesterday: d is about the same: p & r are new. By $8\frac{1}{2}$ P.M. a strong light, carmine red, with a little vermilion mixture, was showing itself in the S. about 20° to 25° [of altitude?]. This light began at the S.E. horizon, passing thence in an arc of a circle through the place just described to the S.W. horizon, but its color was distinct only towards the S., and faded out in both directions, E. & W.: the breadth of this light was 6° to 8°. As yet there was no appearance of aurora in the N., but soon the pale tint peculiar to periods of aurora showed itself: then mists slowly gathered in the N. horizon, and at the end of half an hour formed a very high & not well defined segment. At $8\frac{2}{3}$ P.M. two short streamers issued from the

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red light in the S.S.E. Towards 9 P.M. two or three undefined streamers appeared above the northeastern mists. At 10 P.M. rather fine streamers issued from the segment, but not well defined, nor rising above 65° to 70°. At 10½ P.M. the reddish light in the S. exactly resembled in form and position the whitish light in the N., and seemed like a copy of it: was it the northern auroral light refracted over to the southern mists? At 11¼ P.M. the aurora was much diminished: the red tint was nearly gone; and so was the whitish light in the North. (M. Tremeschini, who observed this aurora at Paris, suggests that there may be a connection between the disappearance of the tail of Encke's Comet and the strange peculiarities of the aurora of Feb. 4: see Bulletin Hebdomadaire de l'Association Scientifique de France 18 fevrier 1872. The aurora was observed almost everywhere in Europe; in Asiatic Turkey, at Bombay in Hindostan, in Egypt [?] in Nubia at Khartum & Gondokoro, at St. Denys à l'Ile de la Réunion, in the southern hemisphere, at the Cape of Good Hope, where at the time of the aurora an aurora australis was seen. Magnetic disturbance on the French &

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Feb. 4 Italian telegraph wires: the direction of the currents was generally from W. to E.: great snow whirlwind at St. Pierre & Miquelon. The magnetic needle at Montpellier during the aurora deviated strongly to the W.: difference of maximum & minimum amplitude 50' 42" towards the W. Same day at Paris the mean position of the needle for the day was 17° 35' N.W. & during the aurora it reached, at its greatest deviation, 18° 57' N.W.: difference 1° 22'.)

246 Feb. 5 11 3/4 Fine & clear; wind W.N.W., light. B 30 3/20. At 2 P.M. the sky was a little tinged with cloudiness in places; at 3 P.M. cirro-stratii were numerous; at 7 P.M., sky free from clouds & clear. At 9 2/3 P.M. there was a faint aurora without streamers but the dark segment, which was low, was remarkably dark. (Aurora at Rome & at Moncalieri.)

Feb. 6 Sky wholly overcast, fog. At 8 2/3 B 29 17/20 At 11 3/4, overcast, foggy. B 29 13/20. (Aurora at Moncalieri.)

247 Feb. 6 3 7/12 The sky began to clear off at 1 P.M. & at 2 P.M., the sun could be seen, and was visible till evening, though it was occasionally hidden by the numerous cirro-stratus clouds. At 4 1/4 P.M. B 29 17/20. Towards night the sky became wholly overcast & at 10 P.M. a few stars near the zenith could just be seen. A little later the wind blew with tempestuous violence from the S. and so continued till day.

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248 Feb. 7 11 Fine & clear: wind W.? At $8\frac{22}{60}$ A.M., B $30\frac{7}{20}$; at $10\frac{2}{3}$ A.M. B $29\frac{17}{20}$. No protuberances seen on the limb. Spot e has disappeared; group w, y, is considerably longer; v has disappeared; while the two spots d are more open: group x, w, x, has larger spots, & group m, l, k, is still smaller. At $6\frac{1}{3}$ P.M. saw a pale & much diffused light tapering from the horizon about the place where the sun had set to a point some 45° of altitude, but with no definite outline; probably zodiacal light. At $7\frac{2}{3}$ P.M. there was some pale auroral light behind a dark segment only a few degrees in altitude. The phenomenon was very little noticeable, but was clearly recognized. At $8\frac{3}{4}$ P.M. no trace of it could be seen.

249 Feb. 8 $10\frac{3}{4}$ Many cumuli & cirro-cumuli: at $8\frac{1}{2}$ A.M. the vane pointed N., the lower clouds came from the S.E., the upper clouds from the W.N.W.; B $30\frac{1}{20}$. At $12\frac{56}{60}$ P.M. B $29\frac{19}{20}$. (Aurora at Aosta & Genoa.)

Feb. 9 Cloudy, wind N.E. At $8\frac{42}{60}$ A.M. B $30\frac{16}{20}$. At $2\frac{1}{12}$ P.M. B $30\frac{6}{20}$ At 2 P.M. the sun was visible for some minutes but only under thick clouds through which the spots could not be seen. Rest of the day overcast. At 11 P.M. some stars near the zenith could be seen, but they were blurred. Wind rather strong in the night. (Large oscillations of the magnetic needle,

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Feb. 9 in inclination, at Rome, Paris, Florence, Constantinople. Aurora at Geneva.)

Feb. 10 Wind N.E., rather strong. At $8\frac{23}{60}$ B $29\frac{12}{20}$; at $12\frac{43}{60}$ P.M. B $29\frac{12}{20}$. Continuous clouds all day, with strong N.E. wind, till $5\frac{1}{2}$ P.M. Sun seen for a quarter of an hour at sunset, among yellow clouds. At 9 P.M. the sky was still wholly covered. (+ Aurora at Orono, Me: Mendon, Mass.; Milford, Del.; Fort Wayne, Ind.; Salem, O.; Embarrass, Wis.)

Feb. 11 Cloudy all day. (+ Aurora at Orono & Waterville, Me. splendid; Copper Falls, Mich.; Embarrass, Wis.; Brilliant, Missouri; Deer Lodge City, Montana.)

250 Feb. 12 $10\frac{1}{2}$ Morning clear, cirri forming from and after 9 A.M. Wind N.E., very light. At $8\frac{7}{12}$ A.M. B $29\frac{11}{20}$: at $1\frac{1}{3}$ P.M. B $29\frac{11}{20}$ wind S.W. Night clear. (Aurora in Italy?)

251 Feb. 13 $11\frac{5}{12}$ Clear. At $8\frac{7}{12}$ A.M. B $29\frac{11}{20}$; at $11\frac{5}{12}$ B $29\frac{11}{20}$. Wind E. Cumuli gathering, cirri forming; long band of cirri from the N. towards the sun. At $1\frac{17}{60}$ P.M. B 29.00, growing cloudier: towards 3 P.M. the clouds had covered all the sky. At 8 P.M. sky all cloudy, wind N.E. by E. At $10\frac{2}{3}$: Wind pretty strong & rising. Sky clear in the S., with stars; cloudy on horizon W., N., & E. At midnight, sky wholly overcast. Towards 1 A.M. the rain began & lasted till day. (At New York a thunderstorm this night, with hail enough to break glass & wound some people: see Herald,

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	1872		
	Feb. 13		Feb. 15, evening edition. In Minnesota there was a severe snow hurricane. [On the back the image of the sun is seen as it appears after refraction through one lens only, & consequently inverted.]
252	Feb. 14	$3\frac{5}{6}$	Foul weather, sky overcast all the morning, sun invisible; wind S.S.E., moderate. At $8\frac{5}{6}$ A.M. B $28\frac{17}{20}$; at $11\frac{48}{60}$ B $28\frac{33}{40}$. Towards 2 P.M. it cleared up a little & the sun showed itself some moments, then a little sleet fell & the clouds lasted for half an hour. At $3\frac{5}{12}$ P.M. there were large blue patches, & many cumuli moving before the rather strong west wind. At $4\frac{1}{4}$ P.M. the sky was quite clear. (+Aurora at Alpena, Mich.)
253	Feb. 15	11	Fine & cold, wind W., rather fresh. At $8\frac{7}{12}$ B $29\frac{1}{40}$ at $1\frac{1}{12}$ B $28\frac{19}{20}$. Spot s is at 43° S. Some detached cumuli passing. At 4 P.M., sky almost all overcast: up to $6\frac{1}{2}$ P.M. it remained so; at $7\frac{1}{2}$ P.M., quite clear. Prof. Winlock says he saw a faint aurora towards midnight.
254	Feb. 16	$2\frac{1}{4}$	Fine & clear, wind N.W. by W. moderate. At $8\frac{7}{12}$ A.M. B $29\frac{2}{20}$ at $2\frac{37}{60}$ P.M. B $29\frac{2}{20}$. Magnificent flames well defined & very high. (+Aurora at Mariches, N.Y., Conticook, N.H., Gardiner, Me., Waterville Mass.)
255	Feb. 17	9	Cirri beginning to extend; wind W. At $8\frac{3}{4}$ A.M. B $29\frac{6}{20}$; at $4\frac{37}{60}$ B $29\frac{7\frac{1}{2}}{20}$; at $8\frac{7}{60}$ P.M. B $29\frac{8\frac{1}{2}}{20}$; wind North. (At Paris at midnight of the 17 the magnetic needle was at 17° 37' W. & at 8 A.M. it was 18° 36' 18" Difference 1° 4' 1" [?])

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256 Feb. 18 4½ Fine, with some cirri, wind N. At 5 P.M. B 29 10/20
Towards 10 P.M. there was a faint auroral light
with a dark segment.

257 Feb. 19 8⅓ Fine, calm, wind N.W., very light. At 8 16/60 A.
M. B 29 12/20. At 9 P.M. an aurora without
streamers; it was a light above a dark
segment well seen in spite of moonlight.
(At Paris between midnight & 8 A.M. of the 19th, the
magnetic needle changed from 17° 34'.7 to 18° 35'.6.
difference 1° 0'.9)

258 Feb. 20 9 Fine, wind W., very light. At 8 50/60 A.M. B 29 12/24
at 1⅔ P.M. B 29 10/20: at 8 42/60 P.M. B 29 8/20. Spot
y observed & sketched with the large equatorial. Its
interior was full of fibres going in all
directions, these fibres being dark red, color
hardly visible. Part of them connected the
outer edges of the penumbra. From the inner
border of the penumbra to the extremity of
the fibrous layer there seemed to be a
great thickness as if there were a considerable
layer under the photosphere. Towards 10 P.M.
there was a faint aurora; undefined light in the N.
(Magnetic disturbance at Leghorn morning of the 20th.)

259 Feb. 21 9¼ Cloudy before sunrise, upon which it began
to clear up, with large cumuli passing,
especially westwards: wind at earth's surface
W.: now nearly clear. At 1 5/6 P.M. B 29 2/20.
Sky became constantly more overcast, & at

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Feb. 21 night the whole sky was uniformly cloudy, the moon just visible, but hardly any stars. About midnight the wind rose & blew hard & at 1 A.M. the sky was clear & the moon unusually bright. At 8 47/60 A.M. B 29 4/20

260 Feb. 22 11 1/4 Rather fine, with passing clouds. Wind N.N.W. cold [probably].

261 Feb. 23 11 1/2 Morning fine, wind N.N.W., rather brisk. About 10 1/2 A.M. numerous cumuli came on, soon extending throughout the sky. Towards 1 P.M. they had mostly dispersed & the sky was again clear, with some scattered & thin cirri. At 9 A.M. B 29 9/20. At 1 1/6 P.M. B 29 8/20. [Note to sketch in corner.] In this spot the faculae advanced in two places certainly upon the penumbra: I could trace them outside advancing upon the spot.

262 Feb. 24 11 1/4 Rather fine, with large cumuli passing, at times almost covering the sky. Wind S.W. by W., moderate. Towards 4 P.M. it began growing cloudy: at 10 P.M. wholly cloudy. At 8 1/3 A.M. B 29 4/20, at 1 P.M., B 29 3/20. Full moon.

Feb. 25 Cloudy, rain in the forenoon, sun invisible all day: towards 5 P.M. the sky became black to windward, wind N.W., and a clap of thunder, or something like it, was heard. Towards 11 P.M. the wind rose soon blew with the force of a tempest, so continuing all night. It began to clear up when the

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1872
Feb. 25 wind rose & at midnight it was fine moonlight: moon full. Up to the present time the sun has been sketched as it appears in the sky [by making the sketch on the opposite side of the paper from that on which the projection was made,] and consequently without reversal [the sheet being so turned over as to effect this in all cases.]

263 Feb. 26 10 5/12 Drawn as the spots appear when projected, & without being turned over: [right & left being reversed by projection but not top & bottom.] Fine & clear: wind N.N.W., strong; air unsteady: no good view to be had of the spots or the flames, which last however are not numerous; the wind blew all last night as violently. At 8½ A.M. B 29 5/20 At 1¼ P.M. B 29 5/20. Moon 2 days past full. (Aurora at Mondovì.)

264 Feb. 27 11½ Fine, clear, cold: wind still N.N.W., very violent. At 8 5/6 A.M. B 29 4/20: at 12 ¼ P.M. B 29 4/20. After noon rather numerous cirro-cumuli covered the sky, dispersing towards night. At 7 5/6 P.M. an aurora was visible: only a rather strong light, no streamers: still visible at 9 P.M., but no traces to be seen of it at 9¾ P.M., the moon then rising. Zodiacal light at 7¾ P.M. very diffuse & undefined, but pretty bright

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1872
Feb. 27 at the horizon & rising to the neighborhood of the Pleiades. At 8 P.M. B $29\frac{4}{20}$ still. Night fine, calm: wind stopped about 9 P.M. At $10\frac{1}{2}$ P.M. it began to cloud up: at $11\frac{1}{3}$ P.M. the wind became strong again. (Rain of sand at Cosenza during the great barometric depression of February. Aurora at Genoa, Alexandria, Valpeglino.) Moon 3 days past full.

265 Feb. 28 $9\frac{5}{12}$ Fine, clear, cold, wind N.N.W., strong: some cirri forming. At $9\frac{11}{12}$ A.M. B $29\frac{4}{20}$ Umbrae of spots f & g very black: interior of spot n dark red: interior of triple umbra of spot k, h, red. At $1\frac{7}{12}$ P.M. B $29\frac{3}{20}$. At $8\frac{5}{6}$ P.M. B $29\frac{5}{20}$. Moon 4 days past full. At 9 P.M. zodiacal light can be traced almost as far as the Pleiades but has no such definite boundary as is figured in books on astronomy.

266 Feb. 29 $10\frac{2}{3}$ Morning clear but numerous cirri are gathering. Wind N.N.W. pretty strong, falling off at about 1 P.M. Moon 5 days past full. At $8\frac{1}{3}$ A.M. B $29\frac{6}{20}$: at $12\frac{48}{60}$ P.M. B $29\frac{5\frac{1}{2}}{20}$. (Paris magnetic observations Feb. 29: At 8 A.M. 17° 33'.2 65° 42'.0: at 3 P.M. 17° 38'.8 65° 41'.2: at midnight 17° 33'.3 65° 39'.8)

267 March 1 $9\frac{1}{6}$ Fair, with scattered cirro-stratus, especially N.E. to S.E.: wind N.N.W., strong & cold. At $8\frac{3}{4}$ A.M.

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1872
March 1

B $29\frac{7}{20}$: at $12\frac{3}{4}$ P.M. B $29\frac{8}{20}$. Faculae about spot c radiate from it as if under the influence of a repulsive force acting in straight lines. Faculae are seemingly the matter of the photosphere displaced by the force which produces the spots; and the closing of the spots is accomplished rather by the return of this displaced matter when the force which removed it diminishes than by the coming together of the edges of the spots. This is illustrated by the sketches made Feb. 28 & March 1 of spot k, l; and Feb. 29 & March 1 of spot n. Moon 6 days past full. At 9 P.M. a pretty bright aurora without streamers, & with a low & very dark segment. At $9\frac{5}{12}$ P.M. aurora more extensive & brighter, segment higher. Wind none at nightfall, pretty strong upon the appearance of the aurora. The arched appearance peculiar to this aurora was soon lost & a greenish mist rose nearly to the upper limit of the light, forming an immense segment bordered by a pale & much diffused light. (The Traveller of March 2 says "Early last evening a steady, white, bright aurora appeared in the N., & about midnight brilliant red streamers in the E. & E.S.E. This morning at 3 o'clock in the N.E., there was a very bright red streamer, though the moon was also brilliant". Aurora seen

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1872
March 1 — on March 1 in Scotland, Sweden, Russia & Italy.
Paris magnetic observations March 1: 8 A.M. 17° 34'.3, 65° 41'.2: noon 17° 40'.5, 65° 41'.2: midnight 17° 35'.6; 65° 40'.5.)

March 2 — Wholly overcast, sun not seen at rising: wind N.N.W., rather strong. At $8\frac{34}{60}$ A.M. B $29\frac{9}{20}$; at $1\frac{1}{2}$ P.M. B $29\frac{4\frac{1}{2}}{20}$. Towards $3\frac{1}{3}$ P.M. a little sleet: at 4 P.M. the sleet became snow (snowstorm at Washington): towards 8 P.M. wind strong, snowing. (Paris magnetic observations March 2: 8 A.M. 17° 43'.1, 65° 43'.5; noon 17° 45'.9, 65° 43'.8: midnight 17° 34'.8, 65° 41'.8. Patches of auroral light seen at Paris. Aurora at Stockholm.) Moon's last quarter.

268 March 3 $9\frac{7}{12}$ — Cloudy, sun seen dimly under clouds: wind N.N.W., rather strong: at $9\frac{18}{60}$ A.M. B $29\frac{4}{20}$: at 10 A.M. it cleared up. Very clear all day after 11 A.M. At $5\frac{6}{60}$ P.M. B $29\frac{6}{20}$. At 8 P.M. sky hazy, cirrostrati numerous. Zodiacal light plainly seen through the haze. At 10 P.M. clear, stars bright. Moon 1 day past last quarter. (Zodiacal light very brilliant in Italy. Paris magnetic observations: 8 A.M. 17° 31'.7, 65° 44'.2: 3 P.M. 17° 39'.9, 65° 44'.4; midnight 17° 33'.9; large oscillations.)

269 March 4 — At $8\frac{1}{2}$ A.M. sun hardly seen through thick haze & cirro-stratii. At $8\frac{23}{60}$ A.M. B $29\frac{6}{20}$: wind very moderate. At $1\frac{1}{3}$ P.M. B $29\frac{3}{20}$: wind moderate S.W.: at 3 P.M. wind S.W., rather strong: at 4 P.M. snowing: at 10 P.M. wind strong, snowing; wind

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March 4 tempestuous all night: snow ceased & it cleared off about 11 A.M. March 5. Moon 2 days past last quarter, in conjunction with Saturn. (Aurora at Moncalieri. Splendid zodiacal light in Italy. Paris magnetic observations: 8 A.M. 17° 30.'6, 65° 41.'7: 3 P.M. 17° 40.'5, 65° 39.'4; midnight 17° 32.'4, 65° 39.'6.)

270 March 5 $12\frac{5}{12}$ Clear: coldest day of the season: 4 below zero in the morning: wind W., strong. At $8\frac{42}{60}$ A.M. B $29\frac{4}{20}$. At 9 P.M. faint aurora, no streamers, but pretty bright light over dark segment. Wind still tempestuous. Spots n, p, q disappear today. Moon 3 days past last quarter. (Aurora at Hernösand. Aurora in Italy. Splendid zodiacal light in Italy. Paris magnetic observations: 8 A.M. 17° 32.'5, 65° 39.'4 noon, 17° 38.'0, 65° 40.'5; midnight 17° 31.'7, 65° 41.'4)

271 March 6 $3\frac{7}{12}$ Cloudy all the morning, very cold; one of the coldest days of the season: wind S.W. by W., strong. At $8\frac{3}{4}$ A.M. B $29\frac{1}{20}$. At 3 P.M. it began to clear off, & the sun was seen occasionally: weather not quite so cold. At 8 P.M. quite clear. At 10 P.M. faint aurora, no streamers, with dark segment: calm. At $10\frac{1}{2}$ P.M. aurora still visible. Spots g, f, one of those at b, q, p, n, have disappeared since yesterday: a is double today. Moon 4 days past last quarter: in perigee and in conjunction with Venus. (Aurora at Messina, Sicily. Paris magnetic

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March 6 observations: 8 A.M., 17° 30.6, 65° 41.0; 9 A.M. 31.3, 41.4; noon 38.1, 40.8; 3 P.M. 36.6, 41.8; 6 P.M., 34.3, 41.3; 9 P.M., 32.1, 41.8; midnight 34.5, 41.1)

272 March 7 9 Fine, quite calm, wind S.W. by W., light: warm for the season. At 8½ A.M. B 29 9/20. Wind now rising, blowing pretty strong: temperature falling. The two spots at a are obliterated; small group c has appeared. At noon, the wind had somewhat gone down. Towards 4 P.M. large cirro-cumuli covered the sky. At 8 P.M., calm, still cloudy; a few stars seen. Moon 5 days past last quarter. (Splendid zodiacal light [this seems to be a quotation from the Paris or Moncalieri bulletins]. Paris magnetic observations: 8 A.M. 17° 29.8, 65° 44.0; noon 37.4, 41.0; 9 P.M. 31.2, 41.7. Aurora at 11 P.M. Thurso, Moncalieri, Genoa, Kasaranda, London.)

273 March 8 8½ Fine, clear, calm: wind W.S.W., light. At 8 12/60 A.M. B 29 8/20. Group c tends to development: a is a new group, as is d: f is a small new spot, just visible: g could not be seen at all; probably it is too close to the limb to appear on the projection. At 8 P.M. auroral light on the horizon; no dark sky below; no streamers: light rather bright. At 8½ P.M. some streamers from the horizon. The zodiacal light still visible. At 11½ P.M. aurora still visible; no streamers. Moon 6 days past last quarter: in conjunction with Mercury.

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March 8 (Paris magnetic observations: 8 A.M. 17° 31'.0, 65° 40'.5; noon, 39'.3, 41'.3; midnight, 32'.0, 40'.9. Aurora at Moncalieri, in England & in Scotland.)

274 March 9. 8 5/6 Cloudy, sun seen through clouds at times. Since yesterday spots a & d have been obliterated, and almost all of group c also: & on the contrary is developing some spots. At 8 37/60 A.M. B 29 10/20, calm, wind W.N.W., light. At 11 A.M. wholly overcast, wind shifted to E. At 10 P.M. it had been cloudy all day & was then wholly overcast: much light above Boston, probably gas light on clouds. Moon new. (Paris magnetic observations: 8 A.M. 17° 30'.9, 65° 42'.0; noon, 41'.1, 42'.2; midnight, 33'.3, 40'.9. Brilliant aurora at Thurso, Moncalieri, Genoa.)

March 10 Rain all day; wind in forenoon E.: S.S.E. in afternoon. Sun not seen at all. About 10 P.M. wind rose & shifted to W., when the sky cleared up rapidly. Moon 1 day old, in conjunction with Mars: Mercury in conjunction with the sun. (Paris magnetic observations: 8 A.M. 17° 28'.3, 65° 41'.6; noon, 41'.2, 40'.6; midnight, 32'.4, 40'.9.)

275 March 11 8 2/3 Fine, clear, wind, W.N.W., light. Many faculae on the E. side of the sun, only one small group on the W. side. Since March 9, spot b has disappeared & f has lost a spot. At noon the wind shifted to N. At 8 5/12 A.M. B 29 6/20: at 2 7/12 P.M. B 29 10/20; cloudy; no change on sun.

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March 11 Sky wholly overcast at 10 P.M., but auroral light pretty plainly seen on northern horizon. Moon 2 days old. (Paris magnetic observations; 8 A.M. 17° 30′.1, 65° 41′.8; noon 45′.3, 39′.9; midnight 31′.3, 40′.6. Rain of sand in southern Italy, probably brought by the strong northerly winds of the latter part of February.)

March 12 Snowing rather hard; wind N., strong. At 9 A.M. B 29 10/20: at 11 P.M. 29 10/20. About 8 P.M. it began to clear up & at 10 P.M. it was quite clear. Moon 3 days old. (Paris magnetic observations: 8 A.M., 17° 28′.8, 65° 40′.7; noon 43′.4, 39′.9; midnight, 30′.1, 40′.9)

276 March 13 11 1/4 Fine, clear; wind N.E., very light. Group f has lost 2 small spots: spot a is new. At 11 1/12 A. M. B 29 14/20. About 1 P.M. cirri began to spread, and towards night it was wholly cloudy. At 8½ P.M. no stars visible; calm. Moon 4 days old. (Paris magnetic observations: 8 A.M. 17° 28′.6, 65° 40′.8; noon, 39′.1, 41′.1; midnight 32′.8, 41′.1.) [Sketch of dimensions of a spectrum on back of this sheet.]

277 March 14 8 3/4 Half the sky covered with cirro-strati; wind S., very light. At 8½ A.M. B 29 11/20. About 10 A.M. it cleared up entirely. At 9 P.M. I was observing the moon, sky remarkably clear; when cirri gathered in less than ten minutes so as to cover the sky and entirely hide the moon. Moon 5 days old. (Paris magnetic observations: 8 A.M. 17° 32′.6, 65° 42′.8; noon, 44′.6, 41′.3; 6 P.M. 27′.5, 41′.0; midnight, 32′.4, 41′.7.)

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278 March 15 $9\frac{5}{6}$ Some four inches of snow fell last night & this morning. Snow suddenly stopped about 9½ A.M. & the sun could soon be seen, wind rising at the same time, blowing rather hard from the N.W.; great cumuli rapidly passing, often covering the sun. At 8½ A.M. B $29\frac{2}{10}$; at $9\frac{5}{6}$ A.M. B $29\frac{3}{10}$; at 1¼ P.M. $29\frac{5}{20}$; at $6\frac{5}{12}$ P.M. B $29\frac{9}{20}$. At 11½ P.M. faint aurora, sky dark below, no streamers; night very clear. Moon 6 days old. (Aurora in Sweden. Paris magnetic observations; 8 A.M., 17°32'.0, 65°41'.0; noon 39'.1, 40'.6; 9 P.M., 28'.8, 41'.7; midnight 35'.2, 40'.4)

279 March 16 $8\frac{3}{4}$ Fine, clear, cloudless, wind N.W., light. B $29\frac{12}{20}$. At 8 P.M. B $29\frac{10}{20}$; night very clear & very calm. Moon's first quarter. (Aurora in Italy. Paris magnetic observations; 8 A.M. 17°30'.8, 65°41'.4; 3 P.M., 43'.6, 40'.8; midnight 30'.1, 40'.9.)

March 17 Sky cloudy, sun somewhat visible, but spots could not be seen; later it was still more cloudy & there was some little snow in the afternoon; wind S.W., light. At 10 A.M. B $29\frac{5}{20}$: at 6 P.M. B $29\frac{3}{20}$. (Paris magnetic observations: 8 A.M. 17°29'.0, 65°41'.9; noon, 40'.5, 39'.8; 9 P.M., 32'.7, 40'.6; midnight 33'.8, 40'.2.)

280 March 18 $8\frac{3}{4}$ Fine, clear; wind S.W. by W., rather strong: at $8\frac{5}{12}$ A.M. B $29\frac{3}{20}$; magnetic needle too far east for the time of day. Spot a has disappeared: group d developed; c has another small spot; g, e, & group f, are new.

$12\frac{1}{2}$ Since morning many small spots have formed in groups f & d; small spot h not seen at $8\frac{3}{4}$ A.M. View very good, faculae well seen, also the grain of the sun, which resembles the dotted appearance of an egg. Moon 2 days past first

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March 18 quarter, in apogee, & in conjunction with Jupiter. (Aurora in Italy. Paris magnetic observations: 8 A.M. 17° 36'.7, 65° 42'.8; noon 39'.6, 42'.8; midnight 29'.2, 41'.3.)

281 March 19 11 Overcast by morning; but between 11 A.M. & noon the sun showed itself through the clouds at times: wind W.S.W., light. At 8 5/6 A.M. B 29 1/20. Spot k is obliterated, f much smaller; group d smaller, and so also group c; g has now but one spot; k, n, m, v, r, t, & s are new spots. The place of the small barely visible group r, though not far wrong, is not accurate on account of the clouds. At 12 1/6 P.M. B 29; at 5 1/2 P.M. B 29 2/20. Moon 3 days past first quarter, in conjunction with Uranus. (Brilliant aurora at Thurso. Earthquake at Cavalla. Paris magnetic observations: 8 A.M. 17° 28'.8, 65° 42'.5; noon, 39'.1, 39'.7; midnight 26'.8, 41'.7.)

282 March 20 8 2/3 Clear, fine, wind W., rather strong. At 8 1/3 A.M. B 29 6/20; at 12 1/4 P.M. B 29 5 1/2/20; at 6 1/4 P.M., B 29 6/20. About 10 A.M. it became wholly cloudy, the wind became violent & the horizon was all hazy & so to speak lost in dust. Wind harder still at 2 P.M.; regular equinoctial gale from the N.W.: towards night wind fallen off, sky clear: at 9 P.M. wind stronger again, sky still a little cloudy. Moon 4 days past first quarter.

(Paris magnetic observations: 8 A.M. 17° 28'.3, —; noon 17° 42'.3, 65° 41'.4; 9 P.M., 25'.8, 41'.4; midnight 31'.6, 41'.4.)

283 March 21 9 Fine, clear, cold; wind rather strong. Group f has lost a spot: k is a little larger: groups c & n have developed

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March 21 many small spots; m is larger; x is a new group. At $8\frac{5}{6}$ A.M. B $29\frac{7}{20}$; at $5\frac{5}{6}$ P.M. B $29\frac{8}{20}$. At 9 P.M. fine, wind gone down. At 10 P.M. an aurora could be seen though it was moonlight; the aurora had no streamers or dark sky. Moon 5 days past first quarter. (Paris magnetic observations; 8 A.M. 17° 39.7, 65° 43.2; 3 P.M. 38.4, 41.3; midnight, 33.0, 42.2.)

284 March 22 $8\frac{5}{6}$ Fine, clear: wind N.W., rather strong. At $8\frac{7}{12}$ A.M. B $29\frac{10\frac{1}{2}}{20}$; at $12\frac{54}{60}$ P.M. B $29\frac{11\frac{1}{2}}{20}$. Cirri gathering about 10 P.M. Moon 6 days past first quarter. (Paris magnetic observations: 8 A.M. 17° 25.2, 65° 42.1; 3 P.M., 46.0, 40.8; midnight, 25.2, 44.8.)

285 March 23 $10\frac{1}{4}$ Cloudy & misty, particularly in the W.; wind W., scarcely perceptible. At $8\frac{18}{60}$ A.M. B $29\frac{10}{20}$. About $7\frac{2}{3}$ A.M. the sun was visible some time & I looked at it with my telescope, seeing groups x & z, spots e, m: the group c much smaller: g, k, f, d, not seen: group z very visible. About 10 A.M. the sun showed itself at times: f, v, n, & one spot of g disappeared: d, g, s, e, k, smaller; group c much smaller; w & b are new. At $1\frac{18}{60}$ P.M. B $29\frac{7\frac{1}{2}}{20}$. It began to snow about 2 P.M.; snow continued falling till about 8 P.M., when the moon was somewhat visible under the clouds. Moon 7 days past first quarter. (Paris magnetic observations: 8 A.M. 17° 26.5, 65° 42.6; noon, 44.8, 41.9; 9 P.M., 28.3, 42.8; midnight, 29.8, —.)

286 March 24 $10\frac{1}{4}$ Fine, clear: wind N.W. by W., strong. B $29\frac{8}{19}$. Spot x smaller: k & d obliterated; group c, y, a little smaller w scarcely visible. At $1\frac{5}{12}$ P.M. B $29\frac{9}{10}$. Moon full.

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March 24 Mercury & Mars in conjunction. (Aurora at Venice. Paris magnetic observations: 8 A.M., 17°26'.5, 65°42'.8; noon, 42'.8, 41'.9; 9 P.M., 26'.9, 40'.6; midnight, 31'.2, 40'.7.)

287 March 25 9 1/6 Fine, clear, calm; wind N., very light. At 8 5/6 A.M. B 29 18/20. Spot e, g, hardly visible; group c almost obliterated: m increased; group z much larger: i has two spots; h & d are new spots. Moon 1 day past full: Mercury in Perigee. (Paris magnetic observations; 8 A.M., 17°23'.4, 65°43'.2; 3 P.M. 41'.7, 41'.2; midnight 28'.0, 42'.2.)

288 March 26 11 Cloudy, wind S.S.E. About 11 A.M. the sun was seen a short time under clouds; the large spots were plainly seen, but small ones may have escaped observation: o, x, k seemed smaller; m seemed to have disappeared & to have been replaced by a small new spot a little to the right, unless m has moved to n. Cloudy rest of day & night. (Aurora at Mondovì, Italy. Paris magnetic observations: 8 A.M., 17°27'.5, 65°41'.1; 3 P.M., 44'.7, 40'.0; midnight, 27'.0, 42'.2.)

March 27 Snow, wind N.; snow stopped at noon. At 9 A.M. B 29 12/20; at noon, B 29 11 1/2 / 20. Moon 2 days past full.

289 " " 1 Wind NE. sun dimly seen under clouds. (Aurora at Genoa, Alexandria, Valpeglino. Paris magnetic observations; 8 A.M., 17°36'.6, 65°41'.6; 3 P.M. 40'.1, 40'.2; midnight 31'.6, 40'.8.)

290 " " 5 1/4 At 4 P.M. the west was clear; at 6 P.M. blue sky everywhere. Moon 3 days past full. (Faint aurora at St. Petersburg.) At 5 P.M. B 29.55. [Notes of March 27 on 3 sheets, Nos. 288, 289, 290: repetitions omitted here. Note of aurora March 28 also entered on No. 290, probably by accident: omitted here.]

291 March 28 8 3/4 Fine, clear, calm, wind N., light. At 8 1/2 A.M.

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March 28 B 29.55; stationary all day. Magnetic needle farther E. than usual all day. Some zodiacal light at 8 P.M., reaching the Pleiades. Fine aurora at 9 P.M., streamers beginning in the N.E., & extending throughout [the auroral region?] in less than a minute; red light in the N.E. instead of, as usual, the N.W. At 10¼ P.M. aurora still visible, but northern sky mostly covered by large black strato-cumulus clouds. (Paris magnetic observations: 8 A.M., 17° 25.7', 65° 41.1'; noon, 45.1', 42.3'; 9 P.M., 30.5', 42.0'; midnight 33.5', 40.8'.)

292 March 29 9 A little sleet last night: morning overcast, clearing up a little about 8 A.M.; wind N.W., very light. At 8¾ A.M. B 29 $\frac{8\frac{1}{2}}{20}$. Small spot h disappeared, m exactly on the limb. Wholly overcast again at 10 A.M.; rain from 3 P.M. till evening. Quite clear & very calm at 9 P.M. Moon 5 days past full. (Brilliant aurora at Thurso. Paris magnetic observations: 8 A.M. 17° 31.1', 65° 44.5'; noon, 44.0', 43.3'; 6 P.M., 27.5', 40.8'; midnight, 29.2', 42.3'.)

293 March 30 8⅔ Fine, calm, wind very light. At 8½ A.M. B 29 $\frac{12}{20}$. Spots k, x, n, disappeared; g has lost a spot; group a, z, considerably smaller; group b changed; f seems smaller; h is a new spot. Towards 3 P.M. cirrus clouds rapidly spread & it was somewhat overcast. At 7 P.M. only a few stars near the zenith could be seen, horizon clouded all round. At 10½ P.M. sky as before: only a few stars visible near the zenith. Moon's twenty-first day, or moon 6 days past full. At 7 P.M. the

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March 30 clouds were remarkably arranged: five beds of dark clouds, separated by four beds of less dark clouds, radiated from a point a little over that where the sun had set towards the north, curving slightly, as in sketch on back of sheet. (Paris magnetic observations: 8 A.M. 17°24'.4, 65°42'.7; noon, 41'.5, 42'.9; midnight, 32'.1, 42'.1.)

March 31 Four inches snow by morning: very fine snow continued falling till noon: afterwards very fine freezing rain, coating the ground & trees with ice: rain stopped towards evening, wind light, E. (Paris magnetic observations; 7 A.M., 17°26'.5, 65°42'.1; 3 P.M., 38'.8, 40'.4; midnight, 31'.4, 40'.2.)

2944 April 1 10⅓ Cloudy still, but clouds gathered into cumuli with blue patches: hardly any wind, but clouds move from south to north. At 9 A.M. B 29 8/20: at 1 7/12 P.M. B 29 9/20; at 7 3/4 P.M. B 29 12/20; at 9½ P.M. B 29 13/20. Spot e has disappeared, so also the two small spots at z, and spot g. Group g [probably b is meant] is considerably smaller; f also is smaller; c has lost a spot: group p and spots q & n are new. Between 10 A.M. & noon it was rather clear but afterwards grew cloudy again, as in the March showers. Wind rose & grew pretty strong from the west. About noon the northern clouds had a singular pale appearance like that of the mists

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April 1 seen during auroras, and seemed to be arranged in some places like auroral streamers. Aurora suspected. The magnetic needle oscillated sufficiently to be supposed to be undergoing a disturbance: between 9 A.M. & 1 P.M. it moved 7' westwards. At 9½ P.M. it was at 17°45' W. but no aurora was seen. The zodiacal light was plainly visible as far as that part of the northern sky which had continued clouded throughout. Moon 23 days old & in perigee; also in conjunction with Saturn. (Paris magnetic observations; 7 A.M. 17°27'.1, 65° 40'.4; 3 P.M., 39'.8, 40'.5; midnight, 32'.4, 39'.4)

295 April 2 8¾ Cloudy, sun seen under continuous clouds; wind N.W., strong. At 8 7/12 A.M. B 29 7/20; at 1¼ P.M. B 29 9/20. Groups p & b are smaller. About 11 A.M. the sun appeared, the clouds being dissipated. Group e has appeared. At 9 1/3 P.M. a slight aurora was visible; the sky was clear: at 10½ it was wholly overcast; a light still visible on the northern horizon; the magnetic needle still moving west; at 9½ P.M. it was at 22' W. A little snow during the night. Moon 2 days past last quarter. (Paris magnetic observations; 7 A.M. 17° 28'.1, 65°41'.3; 3 P.M., 39'.2, 40'.0; 9 P.M., 29'.2, 39'.3; midnight, 31'.2, 40'.0)

296 April 3 8 7/12 Cloudy at first, now clear in parts. Wind W., very light. At 8 23/60 A.M. B 29 9/10. Weather

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April 3 continued fine all day, but there were many cumuli. About 8½ P.M. a faint aurora was seen. At 10½ P.M. it was rather bright, but was simply an undefined light. At 11½ P.M. some rather fine streamers appeared, first in the N.E. and thence towards the W., from behind a continuous cloud, black as ink, which covered the northern sky as high as the Great Bear, a lowly gathering. Moon 3 days past last quarter.
(Paris magnetic observations; 7 A.M., 17° 27.5, 65° 39.9; noon 40.1, 39.6; 9 P.M. 25.2, 41.4.)

297 April 4 9/6 Fine & clear, wind N., light. At 8 5/6 A.M. B 29.50 Zodiacal light visible. Moon 4 days past last quarter. Venus in aphelion. (Paris magnetic observations: 7 A.M., 17° 32.9, 65° 40.1; noon, 40.0, 41.2; midnight 31.6, 40.9)

298 April 5 8 3/4 Fine, clear, wind N.W., light. At 8 34/60 A.M. B 29 12/24.
p has disappeared; two new spots at g: group e much increased; k is new.
About 10 A.M. numerous cirrus clouds gathered; at 11¼ A.M. it had become difficult to see the sun; after noon the sky became clear again; about 6 P.M. the wind shifted to the E.; the dipping needle oscillated some minutes; the declination needle was still moving west at 9 P.M. instead of returning eastwards; at that time there was a faint aurora. Zodiacal light visible.

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April 5 Moon 5 days past last quarter & in conjunction with Venus. Large flames at the point on the sun's limb marked B in the sketch. (Paris magnetic observations; 7 A.M., 17°27'.3, 65°40'.7; noon, 37'.1, 40'.4; midnight, 31'.7, 40'.7)

299 April 6 10 Morning cloudy, but sun occasionally visible under clouds at 10 A.M. At 9½ A.M. B 29 11/20 Spot d farther from c than yesterday: not much change elsewhere; f is just going off the limb, but Spot a has come on during the night. Afternoon very fine. About 8 P.M. zodiacal light conspicuous, & attended by some peculiar appearances. It was very wide, at least 45°, but not high above the horizon. Its light had so much resemblance to that of the aurora that some connection between them might be suspected. Besides, it seemed to have some undefined & very diffuse streamers. The view of Jupiter was very good till 9 P.M., growing worse afterwards; belts hardly visible at 11 P.M. On the disappearance of the zodiacal light, dark mists took its place, extending upwards from the horizon 25° or 30°. No auroral light visible: the magnetic needle however moved W. until 11 P.M. Moon 6 days past last quarter. (Paris magnetic observations; 7 A.M., 17°27'.0, 65°41'.7; noon, 39'.7, 41'.3; 9 P.M., 30'.3, 40'.7; midnight, 32'.5, 40'.2)

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April 7 — Wholly cloudy, wind S., light. At 11½ A.M. B 29 14/20. Light rain from noon through the day and following night. Magnetic needle had not begun to return to the east in the evening. New moon. (Paris magnetic observations: 7 A.M., 17°27'.5, 65°41'.8; noon, 39'.7, 40'.4; midnight, 31'.1, 40'.4)

April 8 — Wholly cloudy day and following night, no rain: wind N.E., light. At 9 A.M. B 29 10/20; at 1 7/12 P.M. B 29 10/20. Moon 1 day old. (Paris magnetic observations: 7 A.M., 17°26'.4, 65°40'.6; noon, 40'.6, 40'.6; 9 P.M., 26'.8, 39'.1; midnight, 34'.4, 39'.9.)

April 9 — Very heavy rain; wind S., light. Magnetic needle has not varied since last evening. At 9 A.M. B 29 9/10. Rain all day, thick fog from 4 P.M. lasting through the next night, with rain, bright lightning & heavy thunder towards morning. Wind at 4 P.M. N.W., very light. Magnetic disturbance 1½ to 6 P.M.: needle changing 6'; dipping needle half a minute less than before. Moon 2 days old. (Paris magnetic observations; 7 A.M., 17°30'.4, 65°39'.9; noon, 40'.7, 39'.6; midnight, 31'.2, 40'.5.)

April 10 — Fog continued thick; magnetic needle far to the W.; at 9 A.M. B 29 0½/20: wind N. About 10 A.M. the sky began to clear off; wind shifted to W.

301 — 11/6 — Since April 6 almost all the spots have changed; c, d, h, g, f, k, have disappeared; group e is smaller; m is nearing the limb; spots k, q, y, a, are new. At 1/3 P.M. B 29 1½/20; at 8 P.M. B 29 6/20. Aurora by 8 P.M., still visible at midnight, clouds gathering during aurora; pulsating motion from the south to the zenith; corona near ν & ξ Urs. Maj.

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April 10 About 4 A.M. April 11 a violent wind rose. Moon 3 days old. Jupiter & Saturn in quadrature with Sun. (Aurora at Thurso & Stockholm, & Hernosand. Great magnetic disturbance at Rome & Paris. Paris magnetic observations; 7 A.M. 17° 27'.5, 16(?)40'.8; 3 P.M., 46'.7, 36'.5; midnight, 28'.9, 42'.4.)

302 April 11 9 1/6 Cloudy with blue patches among cumuli: wind W., strong. At 8½ A.M. B 29 2/20: at 1 P.M. B 29 10/20, wind N.W. Moon 4 days old. (Aurora in Cambridge, U.S., northern Europe, & in Australia between 7½ P.M. & 10 P.M. Electric currents on telegraph line between Paris & St. Etienne. Paris magnetic observations: 7 A.M., 17° 30'.8, 65° 44'.2; 3 P.M., 40'.1, 44'.5; 9 P.M., 26'.3, 44'.9; midnight, 31'.4, 45'.2.)

303 April 12 8 11/12 Fine, clear, calm, wind N.W., light. At 8 3/4 A.M. B 29 11 1/2/20. Group k has lost a spot: q has two new spots: a is large & f & e are new: spot k very much cut up by a large facula which covers it & seems to be upheaved by force from within, which tears it open in many places: it seems to be forming. The chief spot at q has a facula extending into its umbra: chief spot at d is nearly round & has no penumbra: b is composed of 3 spots, c of many: g must be a fine large spot: it is covered by brilliant faculae which divide it from north to south: the faculae round spots b, c, g, lie in general N.E. & S.W. At 11½ A.M. wind S.W.: at 6½ P.M. B 29 13/20. About 1 P.M. cirri collected & the

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April 12 afternoon thick undefined clouds covered the sky: evening wholly cloudy. Moon 5 days old. (Paris magnetic observations: 7 A.M., 17°27'.9, 65°43'.3; noon, 41'.0, 43'.1; midnight 27'.7, 41'.8)
[Sun's north, south, east, & west, and aperture of diaphragm, marked on drawing.]

April 13 Cloudy, some rain: wind W., very light. At 9 1/6 A.M. B
304 11 2/3 29 8/20. Began to clear up at 10 A.M. to windward, in the W.; clear at 11 1/2 A.M. All the spots smaller; one small group, h, is new; m has come on. The western protuberances begin at 85° & reach to 120°. At 3 5/6 P.M. B 29 16/20. About 4 P.M. the wind shifted to S.W. Conjunction of Sun & Neptune. Moon 6 days old. (Paris magnetic observations: 8 A.M., 17°30'.2, 65°41'.2; 3 P.M., 37'.9, 40'.0; midnight, 30'.3, 41'.2.)

305 April 14 9 1/2 Cloudy, promising to clear up; wind W., rather strong. At 9 1/6 A.M. B 29 7/20. At 10 A.M. wind shifted to N.W., & it clouded up again: April weather. Group e smaller so also k, q, g; b has joined c which is accordingly larger: h a little larger. Large cumuli passing all day: Sun sometimes seen between them. Cleared up at night. At 10 P.M. faint auroral light, not extinguished by the moon. Moon 7 days old. (Paris magnetic observations: 7 A.M., 17°27'.5, 65°41'.2; 3 P.M., 41'.0, 41'.8; midnight 31'.0, 42'.8.)

306 April 15 9 5/12 Fine, clear; wind fresh from the N. At 9 5/12 A.M. B 29 8/20; at 1 5/12 P.M. B 29 7/20, wind nearly W., about W.N.W.: cirrus nearly everywhere in sky. At 4 1/2 P.M. cloudy, wind shifted to S.E. About 10 P.M. light rain, changing to snow during the night. A round bright facula at the north pole & 2 or 3 in the N.W.: 3 revolutions, flame at 127° following side.

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April 15 Moon's first quarter & apogee: moon in conjunction with Jupiter & Uranus. (Very destructive storm at Zanzibar, Madras, etc.?? Aurora at Sèvres, France, & at Thüso: brilliant: aurora in Australia and magnetic disturbance. Paris magnetic observations; 7 A.M., 17° 28.5', 65° 42.5'; 3 P.M., 48.5', 41.7'; 9 P.M. 28.9', 44.8'; midnight 32.2', 41.3'.)

307 April 16 5 1/3 Cloudy: at 8 1/4 A.M. some snow, melting as it fell; wind N.N.E, light: B 29 4/20. At 10 1/6 A.M. B 29 4/20; at 1 2/3 P.M. B 29 5/20; at 6 2/3 P.M. B 29 8/20: alternate snow & rain; snowing very hard between noon & 1 P.M. Clearing up at 5 P.M., wind shifting to N. and blowing hard. At sunset sky clear in parts with large cumuli passing. At sunset the clouds near the horizon were lighted from below & had an orange tint. In more than 20 places among them, were small bands showing prismatic colors, where however the ~~most~~ prevalent color, occupying at least half the space, was green. The drawing is not very exact, as only the larger spots could be taken by projection: the others were sketched with the equatorial. The evening was fine, with a few clouds: sky clear at 10 P.M. Between 8 & 11 P.M. there was a faint aurora without streamers or arch.

(Paris magnetic observations: 7 A.M., 17° 34.7'; 3 P.M. 17° 43.7', 65° 43.3'; midnight, 17° 21.1'.)

308 April 17 8 1/4 Fine, calm, wind a little W. of N. At 8 1/12 A.M. B 29 12/20. Since yesterday groups a, b, f, d, have appeared: groups e & k are perhaps a little smaller. At 10 A.M. cirrus was gathering & the sky was covered

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April 17 with light white haze. At 12¾ P.M. B 29 11/20: at 9⅓ P.M. B 29 10/20: wind W.N.W., imperceptible; sky covered with cirrus. (Paris magnetic observations: 7 A.M., 17°26'.2; noon, 17°40'.7, 65°45'.3; 9 P.M., 28'.1, 42'.1; midnight 31'.4, 42'.8.)

309 April 18 8⅓ Fine, wind W., light. At 8¼ A.M. B 29 8½/20. Group L is smaller, so are a & e, & b & m: r is larger: d has moved further on. At 10¾ A.M. B 29 7¾/20, wind E.S.E., horizon cloudy all round. At 5 5/12 P.M. B 29 4/20, wind S., rather strong: at 8¾ P.M. B 29 4/20, wind S., hardly perceptible, sky almost wholly covered with cirrostratus clouds in long bands from the eastern to the western horizon, but moving northwards before the light S. wind. Very faint light in the N.; probably an aurora. (Tornado this evening in South Carolina; 62 houses overthrown in a village, a thousand fruit trees torn up. Paris magnetic observations: 7 A.M. 17°28'.1; noon, 17°43'.9, 65°42'.7; midnight, 17°30'.0.)

310 April 19 8 5/12 Cloudy, sun occasionally visible: at 8¼ A.M. B 29 2/20, wind N.E., light. Group e is new. About 9 A.M. it cleared up a little. At 10¾ A.M. B 29 2¼/20, wind N.E. by N. After noon wind S.E. by S., sky rather clear all day, though hazy. Brilliant & extensive zodiacal light, resembling a faint aurora: faint auroral light suspected between 8 & 10 P.M., but moonlight made this uncertain. Moon 4 days past first quarter. (Paris magnetic observations: 7 A.M. 17°30'.1, 65°42'.8; noon, 43'.9, 42'.6; 9 P.M. 32'.4, 42'.5; midnight, 17°36'.1.)

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311 April 20 $8\frac{7}{12}$ Fine, with cirrostratus clouds; wind S., very light: at $8\frac{1}{3}$ A.M. B $29\frac{8}{20}$. Since yesterday h & a have disappeared; b, m, group s, & c, are a little smaller: f is no longer visible: but n, r, & especially group d are larger, considerably. At $1\frac{1}{2}$ P.M. B $29\frac{8\frac{1}{2}}{20}$. At $2\frac{1}{2}$ P.M. wind shifted to S.E. B $29\frac{8\frac{1}{2}}{20}$, cumuli many & large. At 5 P.M. B $29\frac{9}{20}$, wind S.; upper clouds come from the N.; threatening weather. About $6\frac{1}{2}$ P.M. two distant thunderclaps. Night partly cloudy. (Paris magnetic observations: 7 A.M., 17° 31'.2; noon, 17° 45'.5, 65° 41'.8; midnight, 31'.6, 43'.3.)

312 April 21 $9\frac{3}{4}$ Fine, with light white haze covering the sky, wind W. S. W., light. At $9\frac{5}{6}$ A.M. B $29\frac{10\frac{1}{2}}{20}$. Group s further diminished, b disappeared, n smaller, d a little larger; x, w, v, are new: r is filling up with a regular cataract (see separate drawing and notes); contrary to statements of Dawes & Secchi, spot d is followed, not preceded, by a tail. At $11\frac{1}{4}$ A.M. wind shifted to S.S.E. After 1 P.M. vane points E.S.E., clouds move from the west; warm & rather clear. Night calm, clear: observed Jupiter. Faint aurora suspected 8 to 9 P.M., but moon too bright to make sure. (Paris magnetic observations: 7 A.M., 17° 29'.6, 65° 40'.6; noon, 41'.0, 41'.5; midnight, 29'.0, 42'.6.)

313 April 22 5 Sun shone early; clouding up rapidly at 8 A.M. with cumuli: about 11 A.M. slight rain: sky continued cloudy till 4 P.M., with a little rain at times: towards 5 P.M. the sun showed itself a short time. Wind in the morning W. S. W., rather fresh; at 5 P.M. it was W. At 8 A.M. B $29\frac{6}{20}$; at 5 P.M., B $29\frac{5}{20}$. Spots m, u,

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April 22 s, c, y, obliterated: groups n, d, smaller. (Paris magnetic observations: 7 A.M., 17° 30'.9, 65° 42'.1; 3 P.M., 17° 45'.4, 65° 40'.8; midnight 31'.5, 40'.8.)

314 April 23 9 Fine, clear, some cumuli, wind N.W. by W., fresh. At 9½ A.M. B 29 8/20. At 3 P.M. spot r continues to fill up: at 6 P.M. B 29 9½/20; wind shifted to W.: at 9½ P.M. B 29 11/20; clear. (Paris magnetic observations: 7 A.M. 17° 28'.8, 65° 43'.8; noon 42'.0, 42'.2; 9 P.M. 30'.8, dipping needle oscillating too much to be read, but entered 38'.6; midnight, 32'.7, 31'.1.)

315 April 24 10 5/6 Cloudy last part of previous night: morning cloudy with a little rain: about 10½ A.M. promising to clear off & sun occasionally seen for a moment; wind rather fresh, W.S.W. At 12 3/4 P.M. B 29 8/20: at 8½ P.M. B 29 9/20; at 5 3/4 P.M. B 29 7½/20. (Paris magnetic observations: 1 A.M., 17° 27'.5, 65° 33'.2; 3 P.M. 43'.6, 41'.5; midnight, 27'.1, 43'.3.)

316 April 25 8 2/3 Horizon cloudy & hazy all round, wind W.S.W., hardly perceptible: at 8 5/6 A.M. B 29 11/20. Groups w, d, x, n, much smaller. At 12½ P.M. sky growing more overcast, wind shifted to E.S.E.; a few drops of rain.

317 April 26 8 5/6 Cloudy and hazy, sun somewhat visible; wind S.S.W., light. At 8 7/12 A.M. B 29 4½/20, many cirrocumuli covering the sky: at 1 P.M. B 29 2/20, wind W., warm. At 6 P.M. B 29 1/20. Towards night-wind rose & blew violently from a little S. of W. At 10 5/12 aurora without streamers, but sky very black below arch.

318 April 27 8 2/3 Fine, with cirro-strati: wind N.W., rather fresh. At 8¼ A.M. B 29 5½/20. Spots at y formed since yesterday; group w larger; group d much larger.

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April 27 — At noon the two spots z seen coming on. At 12½ P.M. B 29$\frac{6}{20}$: at 6 P.M. B29$\frac{6}{20}$. Sky overcast last part of night.

319 April 28 $8\frac{5}{12}$ Fine, clear, wind N., strong: at 8¼ A.M. B 29.50. Spots at x & y obliterated, z gone off. At 4⅝ P.M. B 29.45. At 5 P.M. spot a seen: not seen this morning: about 9½ P.M. faint auroral light.

320 April 29 $8\frac{2}{3}$ Very fine, calm, wind N.N.W., fresh. At 8½ A.M. B 29$\frac{12}{20}$: at 1 P.M. B29$\frac{12}{20}$, wind N.N.E.: at 2¼ P.M. wind E.S.E.: at midnight B 29.80.

321 April 30 $9\frac{11}{12}$ Horizon cloudy & hazy all round, wind E.S.E., very light: at 8$\frac{36}{60}$ A.M. B 29.82: at 6 P.M. B29.75 wind S., rather fresh. Group b not seen this morning; about noon it had two spots; at 6 P.M. it had the three spots marked on the sketch.

322 May 1 $8\frac{11}{12}$ Fine, with some cirri, wind S.S.W, light. At 8¾ A.M. B29.70. Groups z & a larger, w & v smaller; one spot less in small group b; c & d have just come on. At 12¾ P.M. B 29.67. (Paris magnetic observations; 7 A.M., 17° 29'.2, 65° 42'.5; noon 89'.5, 41'.9; 9 P.M., 32'.0, 42'.1; midnight, 33'.4, 42'.6.)

323 May 2 $5\frac{1}{6}$ Cloudy, wind S.W. At 8⅚ A.M. B29.40: a little rain about noon & previous: clouds lasted till 4 P.M.; then somewhat less cloudy, and the sun appeared occasionally but always under clouds. Position of groups a & z obtained by projection, the rest sketched with the equatorial with less precision than could be wished. Line of apparent motion of sun taken from yesterday's sketch. (Paris magnetic observations: 7 A.M., 17° 25'.5, 65° 43'.6; noon, 39'.7, 41'.0; midnight, 33'.3, 40'.9.)

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324	May 3	4½	Cloudy & rainy part of the day. Small group w & its faculae no longer seen: the two chief spots of group a much separated: group z perhaps a little smaller: so also c: e, f, are new. (Aurora, by meteorological record of Harvard College Observatory. Paris magnetic observations: 7 A.M., 17°25.1, 65°40.4; noon, 41.0, 40.0; midnight, 29.2, 41.0.)
325	May 4	10	Morning rainy, clearing up about 8 A.M.: sun seen at 9⅔ A.M. At 8⅔ A.M. B 29.80; wind S.S.W.; at 9½ A.M. distant thunder in the N. Group a has fewer spots; z, b, have more; g is new. (Paris magnetic observations: 7 A.M. 17°26.0, 65°42.1; noon, 40.5, 41.0; midnight 32.7, 42.1.)
326	May 5	11⅚	Fine, sky full of cumuli; wind N., strong. Groups b, z, d, f, are smaller; g, h, are two large spots. (Paris magnetic observations: 7 A.M., 17°27.3, 65°43.0; 3 P.M., 42.2, 41.5; midnight 32.9, 41.7.)
327	May 6	9 7/12	Cloudy; sun shone out for a few moments about 9½ P.M., afterwards disappearing again at once: wind N., fresh. Almost all the spots are smaller; b, z, & especially a, have lost much in area. After half an hour of clearer weather, clouds again came on: wind shifted to E. about 11 A.M.: at 2 P.M., wind N.E.: at 3½ P.M. wind S.E.: at 6 P.M. wind E.: B 29.90. (Paris magnetic observations: 7 A.M., 17°26.5, 65°43.3; noon, 39.9, 40.9; midnight, 31.2, 41.4.)
328	May 7	8¾	Fine, clear; wind N. At 8½ A.M. B 29.90: at 1 P.M., wind N.E. (Paris magnetic observations: 7 A.M. 17°26.3, 65°42.1; 3 P.M., 42.5, 39.8; midnight, 32.8, 42.1.)
329	May 8	8⅔	Cloudy, but sun seen pretty well: wind E., hardly perceptible. At 8½ A.M. B 29.90: atmosphere smoky & hazy.

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330 May 9 $9\frac{3}{4}$ Morning cloudy and somewhat rainy, wind E. by E., imperceptible: upper current from the W.: at $8\frac{2}{3}$ A.M. B 29.96: sky cleared off a little at about 9 A.M.: air very hazy. At $12\frac{2}{3}$ P.M. B 29.85; wind S. W., sultry. Hazy: sun scarcely visible under thick smoky haze. At $5\frac{3}{4}$ P.M. B 29.75: very cloudy, hazy, & sultry, all night. (Paris magnetic observations: 7 A.M., 17°25.9, 65°42.9; noon, 43.6, 40.2; midnight, 28.8, 41.6.)

331 May 10 $8\frac{1}{2}$ Hazy at sunrise, soon clearer; wind rose from the W. about 8 A.M., with heavy gusts. At $8\frac{1}{3}$ A.M. B 29.85. Spot p not seen in the morning, added to sketch at 3 P.M.: exact position doubtful. [Protuberance sketched near preceding point marked too high. (Paris magnetic observations: 7 A.M., 17°30.5, 65°43.5; 3 P.M., 40.6, 40.6; 9 P.M., 29.0, 42.2; midnight, 31.2, 41.9.)

332 May 11 $8\frac{3}{4}$ Cloudy, with rain about 5 A.M., continuing cloudy, sun occasionally seen; wind E., light: at $8\frac{1}{3}$ A.M. B 29.72: after noon wholly cloudy, clouds thicker everywhere towards evening; very thick weather following night. (Paris magnetic observations: 7 A.M., 17°28.7, 65°43.6; noon, 39.1, 42.3; midnight, 31.2, 41.5.) [Note of position of protuberance at foot of sheet.]

333 May 12 $4\frac{1}{12}$ Wholly cloudy, morning foggy: sun somewhat visible about 10 A.M., no change on its surface. At 1 P.M. no projection could be obtained, but the spots were seen separately, but not well enough to see f, n, m: at $1\frac{1}{3}$ P.M. B 29.80; wind S. W., in gusts. (Paris magnetic observations: 7 A.M., 17°27.1, 65°42.6; noon, 39.0, 42.7; midnight, 29.5, 41.4.)

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334 May 13 $2\frac{2}{3}$ Sun shone brightly on rising, but it soon became wholly cloudy, so continuing till 2 P.M., from which time the sun could be seen, but the air was full of whitish haze: evening cloudy: wind N.E. morning, E. evening: calm. Spots generally smaller, especially h: see drawing in album: the important group a is coming on. (Paris magnetic observations: 7 A.M., 17°27'.0, 6°41'.7; 3 P.M. 40'.4, 40'.0; 9 P.M., 29'.0, 40'.4; midnight, 27'.3, 40'.0.)

335 May 14 $8\frac{3}{4}$ Morning at first cloudy, clear at 7 A.M.: wind N.E., light. At $8\frac{1}{2}$ A.M. B 29.55. (Paris magnetic observations: 7 A.M., 17°27'.3, 6°41'.4; noon, 39'.4, 39'.7; midnight, 30'.6, 38'.9.)

336 May 15 $8\frac{11}{12}$ Clear at sunrise, cloudy directly afterwards: wind S., very light: at $8\frac{1}{2}$ A.M. B 29.65. Groups g, h, are somewhat smaller: the 2 small spots at p are invisible today: k is a small new group, m is new. (Paris magnetic observations: 7 A.M., 17°28'.3, 6°40'.9; 3 P.M., 39'.9, 39'.5; midnight, 31'.4, 40'.6.)

337 May 16 $8\frac{5}{12}$ Fine, clear, wind N., rather strong: at $8\frac{1}{4}$ A.M. B 29.50: at $12\frac{5}{6}$ P.M. B 29.42: afternoon and evening cloudy.

338 May 17 $8\frac{2}{3}$ Fine, wind N.N.E.: at $8\frac{1}{2}$ A.M. B 29.45. Spot g has gone off, but groups a & b considerably larger, and spots at n & p have appeared since yesterday: cloudy towards evening & many cirro-cumulus clouds the following night.

339 May 18 $8\frac{1}{2}$ Fine, wind W., very light; at $8\frac{1}{4}$ A.M. B 29.40. The group a on the sketch is too near group b; it should be farther towards the

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May 18 left, so that its preceding spots should occupy the positions of the small crosses marked on the sketch. The penumbra of the chief spot of group b is too large in the sketch. At 5 P.M. B 29.30; sky covered with smoky haze: same weather in the evening.

May 19 Cloudy by morning, sun invisible: began raining at 10 A.M.; wind S., with clouds & rain all day.

340 May 20 8 2/3 Fine, clear, wind light. Spot m has disappeared group b is smaller, & more divided & farther from b; c, d, e, f, g, h, are new spots.

341 May 21 4 1/4 Morning cloudy with a little rain: about 2 P.M. the sun became somewhat visible. At 6 P.M. B 29.25.

342 May 22 8 3/4 Fine, calm, wind E., light; whitish haze: at 8 1/2 A.M. B 29.50; many cirrostrati in the afternoon, wholly cloudy at sunset.

May 23 Rain began in the latter part of the previous night; cloudy or rainy all day. {[Error: aurora recorded May 24, not May 23.] Aurora, by meteorological record Harvard C. Observatory}

343 May 24 8 1/2 Fine: at 12 M. cloudy, wind S.E: at 8 1/4 A.M. B 29.30: cloudy the rest of the day, but cleared off about 10 P.M. At 9 P.M. streamers of a rather fine aurora seen issuing from behind a cloud in the N.W. & reaching Polaris. (Tornado in St. Charles Parish, Alexandria, Mississippi: very destructive to trees, churches, etc.

May 25 Cloudy with showers: heavy thundershower about 10 1/2 A.M. At 8 2/3 A.M. B 29.25: at 12 11/12 P.M. B 29.20: during

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3344 May 25 4 2/3 the thundershower the lightning struck the earth in the neighborhood; wind E.: at noon, wind S.; about 4½ P.M. it suddenly cleared up & the sun came out. Since yesterday spots of groups a & c have gone off, but p is larger, & s, n, r, have appeared. (Terrible tornado Morgan County, South Missouri, on Saturday evening: houses destroyed, people killed, rain in torrents, etc.)

3345 May 26 9 1/4 Morning cloudy, sun seen under a continuous curtain of cirrus clouds about 9 A.M.: wind N.N.W., light. Groups p, h, somewhat smaller, n larger, d, w, disappeared; s, u, are new. About the time yesterday when the sky suddenly cleared off at 4½ P.M. spot t was coming upon the visible hemisphere: b is now going off. At 9 1/3 A.M. B 29.40,

3346 May 27 8 Fine: wind S.S.E., light. At 8 A.M. B 29.35, cloudy after noon: a little rain following night.

347 May 28 3 1/12 Morning cloudy, wind E.S.E.: wind shifted to S. about noon, & the sun was occasionally seen. At 8 2/3 A.M. B 29.25: between 3 & 5 P.M. the sun was rather bright: about 5 P.M. a distant thunderclap was heard. Faint aurora without streamers between 8½ & 9½ P.M.

3348 May 29 8 5/6 Fine: at 8½ A.M. B 29.40; wind W.N.W.: many cumuli almost all the afternoon, and some thunder rumbling at a distance.

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349 May 30 $8\frac{11}{12}$ Fine & clear: wind W.N.W., very light: at 9 A.M. B 29.55: at 2 P.M. wind had shifted to E.S.E., sky wholly overcast: at 3 P.M. it rained: at 5 P.M. B 29.50: rain all the following night.

May 31 Morning rainy: toward 3 P.M., wind shifted from E. to N. & it cleared off a little. [There seems to be a rough sketch of this date on back of No. 348.]

350 June 1 $8\frac{5}{12}$ Fine, clear, calm. At $8\frac{1}{2}$ A.M. B 29.45: cloudy towards evening, a little rain about 9 P.M. & clouds later. Spots n & r are smaller.

351 June 2 $9\frac{1}{6}$ Fine, clear, wind N.W.: at $8\frac{5}{6}$ A.M. B 29.40. Spots f, m, k, have disappeared, v & n smaller, also group q. Some light showers of very fine rain in the afternoon.

352 June 3 $8\frac{5}{6}$ Fine, calm, wind N., light; frequent cumuli: B 29.50. Spots are decreasing. Aurora between 9 P.M. & midnight: some rather fine streamers, arch low. Sky wholly overcast in the latter part of the following night. Conjunction of Mercury & moon.

353 June 4 $6\frac{1}{2}$ [Time of sketch seems to be $6\frac{1}{2}$ A.M.; notes of this date both on No. 352 & 353.] Almost wholly cloudy: sun seen occasionally for a few moments: wind S., light. At 9 A.M. B 29.35. No new spots, & n, v, have gone off. About 4 P.M. a fine & gentle rain set in, wind still S.: at 6 P.M. the rain increased and continued without intermission through the night. Conjunction of Venus & moon.

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June 5 [Notes of this date on Nos. 352 & 353.] Heavy rain all day, continued from yesterday without intermission. Wind at first S.E.; afternoon N.E., very strong, in gusts; tempestuous. At 8½ A.M. B 28.92. Rain [following] night. Conjunction of Jupiter & Neptune: conjunction of Mars & moon: new moon.

354 June 6 {7½ P.M.} [Notes of this date on Nos. 353 & 354.] Morning rainy: rain soon ceased: wind N.E. all day: at 8½ A.M. B 29.10: at 10 A.M. B 29.20: at 7 P.M. B 29.30: towards 11 A.M. it promised to clear up, but afterwards clouded over again, remaining cloudy till 6 P.M. after which the sun was occasionally seen. Sketch made at 7½ P.M. with a telescope which had a terrestrial eye-piece, so that the image is inverted with respect to the other sketches. Faint aurora 9 P.M. to midnight. (Violent rain in Illinois, overflow of rivers and great loss of property.)

355 June 7 9¾ Partly cloudy with numerous cirro-stratus clouds. At 8½ A.M. B 29.40: wind N., light. At 1 P.M. wind E., cloudy: at 6 P.M., wholly cloudy, with mist: fine rain following night. (Tornado in Ohio: Dayton almost destroyed, buildings & churches overthrown.)

June 8 Rain & fog: day very dark. At 8¾ A.M. B 29.20: at 1½ P.M. B 29.12. Rain & fog rest of the day: following night cloudy.

June 9 {5 P.M.} Cloudy till 11 A.M. to noon; afterwards clearer; quite clear about 2 P.M. Sketch made with terrestrial eye-piece [see No. 354. Drawings of June 7 & 9 both on No. 355.]

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356 June 10 $11\frac{3}{4}$ Almost wholly cloudy; sun came out a little about 11 A.M.: at $8\frac{3}{4}$ A.M. B 29.20: at noon B 29.17. Magnetic disturbance now [at time of sketch]: needle 12' E. of usual position.

357 June 11 $8\frac{1}{2}$ Fine; wind W.: some large cumuli. At $8\frac{1}{4}$ A.M. B 29.20.

358 June 12 $9\frac{1}{2}$ Cloudy previous night & this morning; nearly free from clouds now. B 29.35: wind light. The spots are smaller. Thunderstorm at about 5 P.M., continuing till 10 to 11 P.M.: lightning struck the earth repeatedly: two women were killed at Waltham.

359 June 13 $9\frac{1}{4}$ Clear at first, growing cloudy by 8 A.M. or thereabout, and the sun soon disappeared. The spots continue to diminish.

360 June 14 $8\frac{1}{2}$ Somewhat overcast, many cirri; wind W., light. At $8\frac{1}{2}$ A.M. B 29.15. Thunderstorm in the afternoon, rain lasting through the day & a good part of the night.

361 June 15 $8\frac{5}{12}$ Fine, except some cumulo-stratus clouds: wind light, W.: at $8\frac{1}{4}$ A.M. B 29.25. Cloudy afternoon and following night.

362 June 16 $\{7\frac{1}{2}$ P.M.$\}$ Sketch made at sunset with terrestrial eye-piece. [See Nos. 354 & 355.] Cloudy, but the sun came out a little in the morning. At $8\frac{1}{4}$ A.M. B 29.40: wind N., light. Spots same as those of June 15 & 17.

363 June 17 $9\frac{1}{12}$ Sky covered with cirrus cloud. At $9\frac{1}{6}$ A.M. B 29.60: wind E., very light.

364 June 18 $8\frac{1}{4}$ Fine clear, calm, wind W., light. At $8\frac{1}{12}$ A.M., B 29.70.

365 June 19 $8\frac{11}{12}$ Cloudy: wind light.

366 June 20 $8\frac{1}{3}$ Cloudy; a little rain at 6 A.M.: many cirro-stratus clouds: sun visible from time to time. At $8\frac{1}{4}$ A.M. B 29.65: wind E., light.

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367 June 21 8 11/12 Fine, clear: wind S.W., light. At 8½ A.M. B29.60. Lightning on the horizon in the evening.

368 June 22 8½ Rather fine: somewhat overcast with cirrus cloud: wind light. At 8⅓ A.M. B29.45: at 1 P.M., wind E.

369 June 23 12 Morning cloudy; afterwards the sun showed itself at times under nearly continuous cirro-stratus cloud: wind S.E., light. B29.50. Clouded over entirely about 5 P.M., with fog: weather still thicker evening & following night.

370 June 24 12 5/12 Yesterday's fog continued: no wind, vane pointing E.: at 10 A.M. signs of clearing up: at 12⅓ P.M. it cleared up & the sun was seen: spot c has recently come on. At 1 P.M. B29.45. About 5 P.M. it clouded up again entirely and the fog came on again & lasted all the following night. (Heavy storms in England; trees & houses overthrown.)

June 25 Cloudy, thick fog on all sides: wind E.

371 10½ At 8¼ A.M. B29.47: entirely cloudy: about 10⅓ A.M. the sun just seen under thick continuous clouds: rain afternoon & following night.

June 26 Cloudy & overcast: at 8⅙ A.M. B29.50: cloudy the rest of the day.

372 June 27 10 11/12 Morning cloudy; began to clear off about 10 A.M.: at 8⅔ A.M. B29.60: wind light. Spots g & h have appeared since the 25th, & group d is a little more developed.

373 June 28 9 11/12 Morning cloudy: cleared off about 9 A.M.

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June 28 — At 8¼ A.M. B 29.55: wind light. Thunderstorm about 4 P.M.

374 June 29 8 1/6 — Fine, clear, hot, wind S.S.W., light. B 29.50. Groups c & g are larger. A little rain about 10 P.M.

375 June 30 4 3/4 — Fine, clear, hot; some large cumuli in the afternoon: wind gentle.

376 July 1 8 1/3 — Fine, but many cirro-stratus clouds: wind S.S.W.: B 29.40: at 1½ P.M. B 29.25: towards evening wholly cloudy: sunset orange yellow.

377 July 2 9 — Fine, hot: wind N.N.W., fresh: at 8½ A.M. B 29.25. About 2½ P.M. a black storm-cloud spread over the sky with extraordinary swiftness: it seemed that the storm was about to break out, when the clouds dispersed as rapidly as they had gathered, and the sun came out again. Wholly cloudy following night.

378 July 3 10 — Morning cloudy: about 9½ A.M. cleared up rapidly: at 9 A.M. B 29.45: wind E., fresh: at 8 A.M., wind S.S.W. Groups of spots smaller than on yesterday: about 8½ A.M. a few drops of rain. At 1 P.M. B 29.35.

July 4 — Morning fine, with burning sun: but about 2 P.M. a heavy thunderstorm came on: it began with mixed hail & rain, the largest hailstones reaching 2½ centimetres [in diameter?], and many of them having tubercular accretions upon one side only. The hail did not last over ten minutes and was followed by very heavy rain, lasting till evening. During the storms, the lightning struck the earth 3 times. [After the first hour of the storm, rain not very heavy.]

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379 July 5 8 5/6 Sky partly covered with cumulus & cirro-stratus clouds. At 8½ A.M. B 29.33 : wind light : group k is considerably larger.

380 July 6 8¼ Sky clear : wind N.N.W., fresh : B 29.48 : spot k larger than yesterday.

381 July 7 12 Fine, clear : rather fine aurora in the evening, streamers reaching the pole-star. (Aurora, magnetic disturbance, and currents on the telegraph wires, at Brest. Explosion on the eastern limb of the sun observed in the afternoon at Rome, by Secchi: it began at 3½ P.M. & lasted to 6 5/6 P.M. Roman time : a magnetic storm began at Greenwich at 5 P.M. the same day, lasting till the evening of July 9, and attended by aurora for part of the time it lasted.) Probably the explosion was observed over the spot y, for which see sketch of July 8.

382 July 8 8 7/12 Fine, clear; wind N.W., moderate : at 8⅓ A.M. B 29.65. Group k further developed & other groups have appeared, as x, w, z, a, y, u. About 4 P.M. thunder-shower with much rain, lasting till evening.

383 July 9 8½ Fine : some cirrus cloud : wind light, S.S.W. : at 8⅓ A.M. B 29.70. Spots of group y too far from limb in the sketch.

384 July 10 8 7/12 Many strato-cumulus clouds, and cirrus clouds; wind rather strong & fresh, S.S.W. : at 8½ A.M. B 29.55. Group u, but no other spot, shows in the spectroscope a black spot on the spectrum

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July 10 each side of the dark line C. At 5½ P.M. B 29.40: sky wholly overcast; some drops of rain. Clouds & rain increasing. Thunder & lightning about 6½ P.M.: lightning remarkably ramified, and seen in the form of a five-pointed star, as in the annexed sketch. (Severe storm at Philadelphia.)

385 July 11 8¾ Partly cloudy, promising to clear off: wind W., hardly perceptible: at 8¼ A.M. B 29.30. Spots smaller than yesterday: spot k will go off the limb about 2 P.M. About 2 P.M. there was a heavy shower for ten minutes, & it cleared up afterwards.

386 July 12 8⅔ Much of the sky covered by uniform & continuous cloud: wind hardly perceptible. At 8 5/12 A.M. B 29.35.

387 July 13 8 5/12 Fine, clear, fresh: wind N., fresh: at 8½ A.M. B 29.55. Sketch of July 14 on back of No. 386.

386 July 14 6½ P.M. Cloudy much of the day, with occasional openings among the cirro-cumulus clouds which covered the sky: wind N.W., fresh. Sketch taken with terrestrial eye-piece. Spot z smaller, c obliterated: groups b-f, y smaller, also d & u: spotted area on the whole diminished.

388 July 15 9 1/12 Much cirrus cloud wind S.W., light. At 9½ A.M. B 29.43 (Observer ill till July 19. (Aurora noted in meteorological record of Harvard College Observatory at 9¼ P.M. July 16.)

389 July 19 11¼

390 July 20 9 7/12 Wholly cloudy after noon. (Aurora seen in Newfoundland, and working of transatlantic telegraph prevented.)

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391	July 21	10 1/3	Much of the sky overcast in the morning: sun seen with much difficulty: clearer about noon, cloudy again towards evening: night cloudy with rain towards morning.
392	July 22	3 1/2	Morning rainy: rain ceased about 9 A.M., & it cleared up a little: at 8½ A.M. B 29.47: rain again about noon, clearing off about 2 P.M., and remaining clear till evening.
393	July 23	8 7/12	Fine, fresh: some stratus & fracto-cumulus clouds: wind N.W.: at 8½ A.M. B 30.00; rain following night.
394	July 24	6 ½ P.M.	Rain previous night, morning cloudy: cleared off about 3 P.M., wind E.
395	July 25	8 2/3	Rather fine & fresh: more than one third of the sky covered by fracto-cumulus & cirrus clouds: wind N.W., moderate: at 8½ A.M. B 30.05: cloudy all following night.
396	July 26		Morning rainy: wind S.W., light: heavy rain after noon: wind S.E., violent: cloudy rest of day & following night: sun not seen at all.
397	July 27	8 2/3	Fine: some fracto-cumulus: wind N., fresh. Fine aurora between 8½ P.M. & midnight. First there was an unusually bright twilight in the west, resembling zodiacal light, but not in the form of a cone, and easily seen to be auroral. Afterwards an arch, 45° to 50° at its highest point, and touching the horizon a little north of the east & west points, was formed, and rather fine

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July 27 streamers appeared later: red light, at first, as usual, in the W.: spectrum diffuse, green line.

398 July 28 11½ Fine, almost cloudless; wind W., moderate. Groups n & s larger: although the sky seems very clear the seeing is very bad, & it would seem that an aurora is going on, for that has the same effect on the seeing. The double line marked + on the sketch represents nothing that could be seen on the sun as a spot or facula, but in that region the spectroscope showed a spot darker than line C. This spot lay upon line C in almost its whole extent, but at the place where a cross line is drawn upon the sketch it was at least two or three times as wide as line C. It covered the spectrum on the side of the prolongation of this black line.

399 July 29 9¼ Last part of previous night cloudy; morning cloudy till 8½ A.M., then clearer: wind W.S.W., moderate: B 30.05; group p on the limb; changes in groups n & s: u is new: storm with thunder & lightning about 11½ P.M. (At 9½ A.M. Chacornac saw what he calls a Crateriform flame, representing an ignited volcanic opening, near spot t: the flame was bluish. This agrees with the singular phenomenon observed by me yesterday. See No. 398.)

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400 July 30 9¼ Fine; some cumuli; wind fresh, rather strong: At 9¼ A.M. B 29.90. About 9 P.M. a faint aurora appeared behind clouds on the horizon, with some streamers: last part of the night cloudy.

401 July 31 9⅙ Sky almost entirely covered with pallio-cumulus cloud: wind N.W.W., hardly perceptible: B 30.03

402 Aug. 1 9⅙ Fine: wind W.S.W., light. B 30.00.

403 Aug. 2 11¼ Cloudy, sun scarcely visible: wind S., light: B 30.03. Spots at s & n have disappeared: a & z are new: group t contracting: distant storm about 8 P.M., with thunder & lightning: cloudy all following night.

Aug. 3 Cloudy all day; a little rain after noon: sun wholly invisible. (Aurora at Lothin & Cracow: see "Nature".)

Aug. 4 Cloudy; sun somewhat visible about noon: spots seem about as many, but smaller: magnificent aurora between 9 P.M. & midnight. (Aurora at Emden.)

404 Aug. 5 8 3/11 Fine; wind S.S.E. B 30.30.

405 Aug. 6 8 2/3 About half the sky covered with cloud: much cirrus cloud: wind S.W., light: B 30.25: groups u, w, b contracted.

406 Aug. 7 9 Much cirrus cloud: wind W.S.W.: B 30.23: afternoon very hot.

407 Aug. 8 8 11/12 Fine, sky nearly clear: wind S.W., moderate: hot: B 30.24. Magnificent aurora between 9 P.M. & 1 or 2 A.M. next morning: streamers reaching the zenith; corona about 11 P.M.: about 1 A.M. the streamers from the E. & the W., especially the latter, ran parallel up to about 65° altitude and then joined by bending at the top,

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	1872 Aug. 8		so as to form two long colonnades joined by semicircles at the top. The streamers occupied at least two thirds of the horizon; there were none in the S. on the horizon, but very bright ones appeared some 40° or 45° higher up. Several shooting stars: one, very large, about 1 A.M., crossed the Great Bear in the midst of the aurora: its path was decidedly curved, and its color, at first white, changed under the aurora first to reddish & then to greenish blue. (Aurora seen at Angers, France.)
408	Aug. 9	9½	Fine: some haze: wind light: B 30.20: spots u, t, have disappeared: x more visible: w has lost a spot: b has disappeared: group d, e, much increased: h has appeared: faint aurora about 10 P.M. (Aurora morning of Aug. 9 at Greenwich, Emden, Thurso.)
409	Aug. 10	9 7/12	Fine: wind S. W., rather strong: B 30.10: the spots generally smaller than yesterday. Cloudy evening & following night.
410	Aug. 11	1½	Much cirro-cumulus cloud: hot: wind S.: distant thunderstorm after 4 P.M.; a little rain: night cloudy.
411	Aug. 12	12 2/3	Cloudy morning, wind S. S. W.: about 12½ the sun came out for a few moments: all the groups smaller, especially c, d: wind at 12½ P.M. S. S. E.: At noon B 30.10: rain towards evening lasting through the following night.
412	Aug. 13		Sun seen with the equatorial, not long enough for a projection: the sketch does not give the exact places of the spots: heavy rain early, afterwards cloudy nearly all day: wind S. W.: B 30.05: group q larger, c more contracted: groups m, n, have appeared since yesterday. Rain with thunder and lightning in the evening.

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413 Aug. 14 11 1/6 Overcast, and weather thick till 11 A.M., when the sun could be seen under thick cloud. B 30.02 : wind S.W. : hot. About 1 P.M. the wind shifted to N.W., and soon after to N.E., and mists occupied all the sky: about 6 P.M. a very severe thunderstorm broke out from this mist: the lightning struck several times, & burned the wires of the telegraphic apparatus of the Observatory: storm passed off & came back a little after midnight: lightning struck again twice near my house: at this moment I had my spectacles in my hand, and I felt a sensation like the prick of a needle in one of my fingers: the storm came back again in the last part of the night. (Aurora at Greenwich, England.)

414 Aug. 15 9 11/12 Much of the sky covered with numerous pallio-cirrus and facto-cumulus clouds: wind S.W., scarcely any. B 30.03 ; distant thunder this morning. Storm with thunder, lightning, & rain, between 4 & 6 P.M., following night cloudy. (Secchi thought an aurora was visible at 10 A.M., when there was a magnetic disturbance and an arch of cirrus cloud with filamentous jets like solar protuberances: see "Nature", Oct. 17, 1872, pp. 492, 493. Aurora in different localities in England; and at Stettin.)

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415 Aug. 16 $11\frac{1}{6}$ Morning cloudy: wind N.W.: B30.20: sun somewhat visible at $11\frac{1}{6}$ A.M.: at 10 A.M. magnetic disturbance; needle osallated some minutes of arc: storm with rain about 3 P.M.; storm with lightning, thunder, & rain about midnight.

416 Aug. 17 $3\frac{11}{12}$ Morning cloudy, wind S.: heavy rain 9 to 11 A.M.: about 3 P.M. wind shifted to W. & it cleared off. At 4 P.M. B30.00. Spots z, s, t, u, could be seen only with the equatorial: they were not projected & their place on the sketch is not exact: c & f have disappeared.

417 Aug. 18 $10\frac{2}{3}$ Fine; half the sky covered by cirro-cumulus clouds. Wind S.S.W., very light. B 30.18.

418 Aug. 19 $11\frac{1}{12}$ Shower in the morning, afterwards cloudy till 10 A.M.: wind S.W.: B 30.20.

419 Aug. 20 $8\frac{7}{12}$ Fine; one third of sky clouded: wind S.W., very light. B 30.32. Wind E. afternoon.

420 Aug. 21 1 Cloudy all day, sun slightly visible at about 1 P.M. only: wind E.: B30.20. Spots p & z do not appear on the sketch, but they may very probably have been rendered invisible by the thickness of the clouds.

Aug. 22 Morning cloudy, wind S.S.W.: sun seen for a few moments: at $8\frac{1}{2}$ A.M. B 30.00: about 11 A.M.

421 $11\frac{1}{12}$ sun seen under thick clouds separated by a few pale blue openings: at 11 A.M. B 29.95. Between 2 & 6 P.M. storm with lightning, thunder, & much rain.

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422	Aug. 23	8 7/12	Clear, fine: wind moderate: B 29.88; groups n, z, m, invisible. Brilliant twilight between 8 & 9 P.M.: I thought an aurora would follow, but could not make sure of any. The spectrum of the light in the N.W. was continuous, & I did not see the auroral green line.
423	Aug. 24	8 2/3	Fine & calm, wind N., very light: B 30.08: v is smaller, x & y are new, group s is larger. About 8½ P.M. aurora with streamers: Sky growing cloudy.
424	Aug. 25	8 2/3	Many cirro-cumuli: wind S.W., light: B 30.16. Between 8 & 9 P.M. there was a singular aurora. The northern sky was covered with rather black clouds, rising not over 45° from the horizon, and interspersed with large blue patches: the rest of the sky was clear. Ever since nightfall I had noticed light in the north, but it was not distinct enough to warrant my attributing it to an aurora. About 8¼ P.M. I observed a narrow band of apparently cirro-cumulus cloud reaching from a point some 15° or 20° above the eastern horizon to the same height above the western horizon: this cloud was strongly illuminated: soon after, some streamers, at no time more than three, appeared in the west, their upper ends joining the cloud: no streamers in the north, where the light continued to be faint. The western streamers, when first seen, passed over Arcturus & near the zenith a little south of Vega: they soon moved

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Aug. 25 southwards rather rapidly to [limit left flank.] The clouds soon disappeared, & afterwards the streamers. In the cloud were two or three singular interruptions, where the ordinary color of the sky appeared, scarcely illuminated: one was nearly at right angles to the direction of the band, the others more inclined: the clouds in the zenith changed their forms rapidly & were tumultuous. (Aurora at Thurso, the north of Scotland, Hernösand, Lisbon: sudden barometric fall in Scandinavia: unusual whirlwind in Ireland, observed at 5 P.M.: see "Nature", Oct 31, 1872, page 541. Fron, of the Meteorological Bureau of Paris, attributes auroras to squalls or barometric fluctuations.)

425 Aug. 26 8 5/6 Cloudy to a great extent, wind W. S. W., moderate: B 30.03: v has disappeared, x is on the limb, y, s, have grown smaller. (Aurora, of the fourth class in Olmsted's classification, reported at Sèvres, France; at Stockholm.)

426 Aug. 27 4 1/6 Cloudy all the morning, with a little rain: wind S. W., light: at 8½ A.M. B 29.88: at 12 2/3 P.M. B 29.78: about 3 P.M. the sky cleared off: the wind had shifted to the N. W., blowing rather steadily: many cumuli: B 29.78: group x gone off, s smaller: t a little larger.

427 Aug. 28 9 1/6 Cloudy to a great extent: wind N., fresh: B 30.00: sky much overcast till about 5 P.M.: afterwards clear.

428 Aug. 29 8 1/2 Fine, wind E. & E.: B 30.05: towards evening it grew cloudy, & about 9 P.M. began raining: rain soon became very heavy, & so continued all following night: wind still E., strong.

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	Aug. 30		Storm of last night continued, but the rain was not so heavy: it lasted till about noon or somewhat earlier, when it showed signs of clearing off: wind shifted to N.E. & blew hard: at 2 P.M. sky still much overcast, but no rain: at 9 1/12 A.M. B 29.55: at 12 1/2 P.M. B 29.45.
429		3 1/2	Sketch does not give the exact position of the spots: t, y, s, b, obliterated.
430	Aug. 31	8 5/12	Fine, cool, wind W., moderate. B 29.63. Group q obliterated since yesterday. (Aurora, by meteorological record of Harvard College Observatory.)
431	Sept. 1	9 5/6	Fine, wind N.W., strong: B 29.85: group c larger, g smaller.
432	Sept. 2	2	Cloudy all the morning, with a little rain: wind S.W.: B 29.86: sketch made with terrestrial eye-piece. (Magnetic disturbance at Lisbon.)
433	Sept. 3	8 7/12	Fine, cool, wind N.W., strong: At 8 1/2 A.M. B 29.90: group k considerably developed since yesterday afternoon: d, e are a & f. Faint aurora between 8 & 9 P.M. (Violent rain at Bombay: see "Nature", Oct. 31, 1872, page 554. Magnetic disturbance at Lisbon.)
434	Sept. 4	8 2/3	Fine; wind N.N.W., fresh: B 29.95: groups c, a, obliterated: faint aurora between 9 & 11 P.M.
435	Sept. 5	10 11/12	Morning cloudy, a little clearer about 10 1/2 A.M.; no wind: at 8 2/3 A.M. B 29.95: cloudy all [following] night.
436	Sept. 6	9 1/12	Morning cloudy, some clear spaces now: wind W.S.W., hardly perceptible: B 29.97: groups m & c have developed. About 10 P.M. it clouded up: wind shifted to E. & a heavy fog came on: cloudy the rest of the night. Faint aurora about 8 P.M., disappearing in a quarter of an hour.

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437 Sept. 7 10½ Cloudy, sun somewhat visible at about 10 A.M. under thick cloud: wind S.S.W., light: B 30.05: almost all the spots smaller, except m, which is larger: p is new.

438 Sept. 8 9⅓ Fine, hot: wind S.W., light: B 29.95.

Sept. 9 Sun came out a little in the morning, but was hidden all the rest of the day: wind N.E.: B 30.15. About 2 P.M. a few drops of rain: at sunset it cleared off a little. About 8 P.M. a rather fine aurora with streamers appeared among clouds. (Severe storm at Martinique, West Indies: ships submerged.)

439 Sept. 10 8 7/12 Much of the sky cloudy, wind E., very light: B 30.27. (At St. Kitts, West Indies, schooners, barks, etc., submerged.)

Sept. 11 Cloudy all day, some drops of rain in the morning: wind S.S.E., light: at 8½ A.M. B 30.35: at 11 A.M., B 30.25.

440 Sept. 12 11⅔ Wholly cloudy; signs of clearing off about 11½ A.M.: wind S.S.E.: at 8½ A.M. B 30.25: at 11¾ A.M. B 30.20: spots d, m, f, have disappeared, but a has appeared & n is larger.

441 Sept. 13 8 1/12 Part of the sky covered with cumuli: wind S.S.W., fresh: B 30.10: at 8 5/6 A.M. the sky was almost wholly overcast. About 3 P.M. rain began falling, & continued till 8 P.M.; following night cloudy throughout.

442 Sept. 14 9½ Cloudy, beginning to clear off: wind N., moderate: B 30.10: spots g, c, have disappeared: group n much smaller, so also n. Afternoon cloudy throughout.

Sept. 15 Cloudy all day, rain beginning about 1 P.M. & lasting the rest of the day & all the following night: wind E.

Sept. 16 Rain nearly all day, falling during the

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	Sept. 16		afternoon in heavy showers: wind N.E., rather strong: at 9 A.M. B 29.97: in the afternoon singular muffled sounds like distant rumbling: in the evening distant lightning & thunder.
	Sept. 17		Cloudy all day, morning rainy: wind N.E.: B 29.97: (magnetic disturbance at Lisbon.)
443	Sept. 18	3 2/3	Cloudy all the morning: wind E.: B 29.95: about 1 P.M. the sun came out for a moment, but immediately went in again, and a sudden thunderstorm with very heavy rain came on, lasting not over 20 minutes: at 3 3/4 P.M. wind S.W.: B 29.90.
444	Sept. 19	4 1/2	Telescope with terrestrial eye-piece. About 10 A.M. B 29.80: overcast since morning, much rain, thunderstorm about 7 1/2 P.M.: wind S.W.
445	Sept. 20		Fine, wind light: B 29.73.
446	Sept. 21	8 3/4	Fine: B 29.95: (magnetic disturbance at Lisbon.)
447	Sept. 22		Fine, calm, wind S.W.: B 30.00: hot: cloudy all [following] night.
448	Sept. 23	8 3/4	Much cirro-cumulus & stratus cloud: hardly any wind: B 30.22: thunderstorm with little rain after noon.
449	Sept. 24	8 2/3	Wind very light: B 30.35: a little fog: cloudy all [following] night. (Destructive hurricane at Louisville: houses & churches destroyed: fearful storm of wind & rain swept over Eastern Iowa.)
450	Sept. 25	12	Morning wholly cloudy: about 11 1/2 A.M. cleared off with wind S., moderate: at 8 3/4 A.M. B 30.30: (terrible rain storm at Aberdeen, Scotland.)
	Sept. 26		Cloudy all day. (Heavy storm in England.)

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Sept. 27 Morning & evening rainy: cloudy all day & much of following night. At 9 A.M. B 29.85: at 6 P.M. B 29.95: (Storm in England continued.)

451 Sept. 28 8½ Fine, calm: B 30.05: (aurora, by meteorological record of Harvard College Observatory.)

452 Sept. 29 12⅚ Many clouds this morning, but the sun was often seen: wholly cloudy after 4 P.M. (Furious gale on Lake Ontario all last night & today. At Milwaukee a severe N.E. wind & heavy rain set in last night & did not abate till noon today. At Detroit the most furious gale of the season set in last night & continued today with unabated fury from the W. S. W. A terrible storm swept over the village of Osceola, Arkansas, yesterday about noon, uprooting trees, sweeping away fences, demolishing houses, etc. Three churches & several residences were destroyed: two persons killed: crops ruined along the line of the tornado. Magnetic disturbance at Lisbon.)

453 Sept. 30 10⅚ Wholly overcast previous night & till 10 A.M., then cleared off rapidly: wind S., light: B 29.95.

454 Oct. 1 5¼ B 29.83: cloudy all day, sun coming out only a little before sunset: spots sketched with the little equatorial with the naked eye [no shade glass?].

455 Oct. 2 8⅔ Fine, clear, wind N.N.W., strong: B 29.78: about 3 P.M. magnetic disturbance, which I observed at South Boston with the Coast Survey instruments: about 7 P.M. there was a rather fine aurora without streamers:

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	Oct. 2		while observing it with the telescope or with the naked eye, sudden flashes appeared occasionally, but it could not be precisely seen whence they came: they were very like heat lightning.
456	Oct. 3	8 5/6	Clouds numerous, afternoon cloudy with a little rain: evening clear till 9 P.M., then suddenly cloudy with a little rain: lightning in the S.E. horizon: at 9 P.M. B 29.70.
457	Oct. 4	9 1/12	Fine, clear; wind N.W., fresh: B 29.90: from a to z are faculae seemingly arranged perpendicular to line C.
458	Oct. 5		Fine, clear, calm: B 30.30: about 4 P.M. it clouded over entirely & so continued all the following night.
459	Oct. 6	11 5/12	Three quarters of the sky covered by cirro-cumulus & stratus clouds: wind S.: faculae seen at place marked A on sketch, crossing the dark line C and appearing of the same form & color as the prominences: B 30.25: at 7 P.M. B 30.20: (aurora in England.)
460	Oct. 7	9	Sky almost wholly covered with cirro-stratus clouds: wind S.E.: B 30.15: towards evening wholly cloudy: rain began at 7 P.M. & lasted all following night.
	Oct. 8		Rainy: at 9 A.M. B 29.90: sun first seen a little before sunset, at 5 P.M.: spots d, g, b, a, z, visible & little changed: large faculae on the following limb: spots sketched with small telescope with terrestrial eye piece; consequently their position is not very accurate, but their number is right, unless some were too small to be seen: sky clear for an hour after sunset; cloudy again about 7 1/2 P.M.
461		5 1/12	

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462 Oct. 9 8 3/4 Magnificent sky, wind W.N.W.: B30.10: (aurora, by meteorological record of Harvard College Observatory.)

463 Oct. 10 8 11/12 Fine, sky cloudless: B29.90: spot m not drawn or seen till noon, seeing very bad: two rather fine prominences, one in arborescent form, the other seemingly detached from the surface of the sun; but there were one or two slight scarcely visible bands apparently directed towards the prominence, & presumably connected with it by non-luminous matter. About 8 P.M. it clouded up entirely: the wind blew hard for not over an hour: following night cloudy.

464 Oct. 11 9 1/3 Morning somewhat cloudy, but no clouds about 9 1/2 A.M.: B29.98: wind W.N.W., fresh. The prominence of yesterday near z is still visible & scarcely altered since then, though the sun's rotation makes it look lower: sky partly cloudy all day: (storms in England on the Channel.)

465 Oct. 12 8 11/12 Fine, calm; frost last night: B30.20: (storm on the British Channel: very destructive typhoon at Manilla.)

Oct. 13 Cloudy all day; rain began about 2 P.M. & lasted till evening & into the following night.

466 Oct. 14 12 Cloudy all the morning, a few drops of rain: about 10 A.M.: at 10 A.M. B29.54: about 11 A.M. signs of clearing off: blue patches at noon. Spots b, g, h, have disappeared. About 6 1/2 P.M. there appeared in the N.W. a red luminous cloud: I examined it repeatedly with the spectroscope

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without seeing any lines: ten minutes later, streamers started from this cloud, and then I saw the usual auroral spectrum and also a fine red line. The magnetic declination needle deviated to the east by [amount left blank.] At 10 P.M. the red light, which had disappeared, came out again, and there were long streamers which rose to the zenith. (Magnetic disturbance at Southampton, England, from 9½ A.M. to 1 P.M. & from 10⅓ P.M. to midnight and later. At Stonyhurst Observatory, England, the magnetic storm began at 10½ P.M. & lasted to 11 P.M. Oct. 18: there was a slight pause in the storm in the afternoon of Oct. 16.)

467 Oct. 15 8 5/6 Magnificent sky; wind W., fresh: B 29.80: groups f, I, s, considerably larger: two spots t, u, have appeared. The principal umbra of group f has red clouds in its interior: and the spectroscope shows brilliant faculae round it which cross the dark line C & even extend upon each side of this line upon the spectrum, but not beyond the line due to the chromosphere: they must accordingly be brighter than the general surface of the chromosphere. Spot f has a very distinct spiral structure. (Magnetic disturbance & currents on the telegraphic wires in England from 9½ A.M. to 1 P.M. & from 7 to 9 12 P.M. See "Nature"

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Oct. 15 Oct. 31, 1872, page 554. Magnetic storm of Oct. 14 to 18, earth currents, & sun spots. The magnetic storms in England reached their maximum today. Currents on the telegraphic wires in England.)

468 Oct. 16 12 2/3 Cloudy almost all the morning; a little rain about 10 A.M.: wind S.S.E., violent. B 29.85: group s smaller, also groups m, Z: t is not visible: group f also smaller, and is less distinctly spiral.

469 Oct. 17 8 5/6 Sky remarkably clear; wind N.W., light: B 30.45: unusual change in the atmospheric pressure, six tenths of an inch since yesterday: many groups of spots have appeared, v, w, x, y: u, z, s, are larger. Evening & following night cloudy. (Currents on telegraph wires in England.)

Oct. 18 Cloudy all day, with a little rain. (Storms in England; great tempest at New Orleans; currents on telegraph wires at Southampton, England, from 11 1/3 A.M. to 12 3/4 P.M. & from 2 1/6 P.M. to 9 P.M.)

470 Oct. 19 9 3/4 Sky almost wholly covered by cumuli: B 29.95: wind N.W.: since Oct. 17, groups f, e, n, are considerably smaller: s is just going off the limb; groups v, w, u, y, are obliterated. (Currents on telegraph wires in England.)

471 Oct. 20 2 5/12 Fine, clear, strong west wind. B 30.05.

472 Oct. 21 8 47/60 Calm; sky pearly blue, without clouds: B 30.20: moon 5 days past full.

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1173 Oct. 22 9½ Much cirrus cloud: wind S.W.: B 30.25: (rain throughout England.)

Oct. 23 Cloudy: sun seen after 10 A.M. from time to time under clouds consisting of very thick cirrus, but not well enough to be sketched by projection. The spots seen with the equatorial seemed the same as on Oct. 22, except that spots m, r, were not seen: afternoon cloudy with a little rain, evening rainy.

1174 Oct. 24 11 1/12 Cloudy till 10 A.M.; then cleared off quickly, wind N.N.E., fresh: B 30.60: the chief spot of group c has the usual form of closing spots, [as in sketch in the original text:] following night cloudy with some openings among the clouds: light seen between 8 P.M. & midnight, which I took to be auroral: magnetic disturbance. This day at 11 3/4 A.M., while observing the sun with the spectroscope at 36° on the following side [36° from the S.? point towards the following point] I saw something singular, unless it was the effect of an illusion: at this place there were only a few very slight prominences. Ordinarily, by placing the slit tangent to the sun's limb, the chromosphere can be seen: and by moving the slit, taking care to move it slowly, upon the disk, rays are seen shooting the whole length of the spectrum

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∥ parallel to it. All this is a customary experience: but to-day, just before these rays should have occupied the spectrum, a light shot out obliquely to the spectrum, making an angle with the slit of about 40° to 45°, ∥ inclined from the north pole towards the equator. This light was much less brilliant than that of the rays due to the sun. I supposed it an illusion, but upon repeatedly bringing the slit upon the sun so as to see the parallel rays, I came upon the oblique ray as before: after 4 or 5 of these trials, all with the same result, I examined other parts of the sun in the same way, but found no trace of the phenomenon: and on returning to the place first examined, to make quite certain of the facts, I no longer saw anything unusual. There was nothing remarkable, as a spot or faculae, at this place upon the sun answering to that of the ray; but on the side towards which the ray sloped, there was a rather high prominence: this was at 54°: however, its visible portion was not high enough to have intersected the ray in case that had been prolonged. The first impression that I had was the image of the eclipse of Aug. 29, 1867, as depicted in Secchi's work "The Sun" as seen by Capt. Bullock at Marseilles. The next day a large spot

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Oct.24 was visible in just the same place where I saw the oblique ray today. The spectroscope, which had not been disturbed, showed this spot in just the same place. 47

475 Oct.25 8 5/6 Sky whitish & partly covered with cirrus cloud, but with signs of clearing off: wind N.E., light: B 30.46: it is remarkable that spot n is just in the place where I noticed the oblique ray yesterday: group c,e, is much smaller; g, k, are invisible: spots n,p, are new. After noon it clouded up completely: following night calm, with light rain: magnetic disturbance till about noon. 47 48

Oct.26 Rainy, entirely overcast, wind N.E., light: B 30.05: at noon B 29.73: rain all day & all following night. 48

Oct.27 Cloudy, with signs of clearing off about 10 or 11 A.M., but only for a short time. Wind at first W.: soon shifted to N.E.: sky clouded over again entirely, with rain. Cloudy all following night. (Frightful hurricane through province of Syracuse, Sicily the 27th of October: buildings blown down; 32 persons buried under ruins.)

476 Oct.28 11 1/6 Morning cloudy: cleared up about 10 A.M.: wind N., rather strong: B 30.30: aurora at 8 1/2 P.M.: no streamers: arch & fine light: the magnetic declination needle had been agitated all day.

477 Oct.29 10 1/6 Fine; but the air, though transparent, is much disturbed, & the seeing is bad: B 30.60: group f is larger: faint aurora between 9 & 10 P.M.

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478	Oct. 30	9 5/6	Fine: wind N: B 30.60: seeing excellent: (aurora borealis at Thurso.)
479	Nov. 1	3 1/2	Cloudy till time of sketch; wind N.W., strong: at 8½ A.M. B 29.75: at 12 M. B 29.70: small spots g, f, u, c, a, have disappeared: f has now only one spot: rather fine protuberances at 21° & 68° following side of sun: aurora between 10 & 11 P.M., faint: no streamers: (auroral light at Paris: aurora at Harnosand.)
480	Nov. 2	8 5/6	Fine; wind W.: atmosphere very unsteady: B 29.88: magnetic declination needle agitated about 7 P.M.
	Nov. 3		Cloudy & rainy all day & following night.
481	Nov. 4	10 5/6	Cloudy to a great extent: wind N.: B 30.22: magnetic needle agitated at 9 A.M.
482	Nov. 5	10 3/4	Calm & fine: wind W., hardly perceptible: B 30.40: all the spots remain: group a considerably larger: d, c, e, are spots which have been formed or have come on since yesterday. Magnetic needle agitated. A little before sunset it clouded up entirely: half an hour after sunset there was on the western horizon a segment of a circle formed of dark clouds, then a clearer space above; then a dark arch of cloud concentric with the segment: none of the curves being perfect circles. From the upper arch diverged bands of darker cloud like streamers. The arches & radiating bands had their centre below the horizon, about the place of the sun, which had set half an hour before. At this time the magnetic needle was remarkably steady, oscillating hardly 2/10

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Nov. 5 slowly at irregular intervals. (News from Milan of Nov. 6 states that on Nov. 5 the town of Palozzolo near the city of Brescia, province of Brescia, was visited by a terrible hurricane; half the buildings were destroyed, 32 persons killed by the falling wall, & thousands of persons made homeless.)

Nov. 6 Cloudy all day.

483 Nov. 7 3 1/6 Cloudy & rainy all the morning; still raining a few minutes before 3 P.M., when suddenly it cleared off with a violent west wind. At 9 A.M. B 29.35: at noon B 29.40. 48

484 Nov. 8 10 7/12 Fine: wind W., strong: B 29.30.

485 Nov. 9 9 3/4 Fine: wind W.S.W., fresh: B 29.83: group x larger, w & z smaller.

486 Nov. 10 9 1/2 No clouds: wind N.N.W., fresh: B 30.15: group z smaller & closing up: w & x larger. Aurora between 7 & 9 P.M.: at 8 P.M. bright arch, no appearance of streamers: magnetic declination needle had moved E. to 16 0: about 10 1/2 P.M. the aurora shot out pale streamers to the zenith, but these streamers were shaped more like irregular cirrus clouds than like [ordinary] streamers.

487 Nov. 11 8 3/4 Cirrus & undefined clouds fast gathering: wind N.W., very light: B 30.30: the rest of the day almost wholly cloudy: following night wholly cloudy. 49

488 Nov. 12 10 7/12 Rainy at daybreak: wholly cloudy between 9 & 10 A.M.: about 10 1/2 A.M. the sun came out just five minutes: group x smaller: spots a, d, gone off the visible hemisphere: group

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Nov. 12 z smaller, b larger; d has appeared. At 8½ A.M. B 30.10: wind very light S.E.: at 12 5/12 P.M. B 30.00: at 4½ P.M. B 29.90: about 5 P.M. it began to rain, the wind rose and blew very hard much of the following night: the sky, however, became clear about 11 P.M.: (heavy storm at Bangor, Maine, from 11 P.M. all the rest of the night: schooner driven ashore; house destroyed.)

489 Nov. 13 11 7/12 Since [morning?] cloudy to a great extent: many cirri: sun seen with difficulty through clouds: wind S.W.: about 10 A.M. the wind shifted to N.W., & the sky cleared off a little: at 8½ A.M. B 30.10: group c has four more spots: e & f have also appeared since yesterday: group x, which was smaller yesterday has grown since then: w is just going off the limb: about 9 P.M. it cleared off fast: at 1/3 A.M. following day it clouded up entirely & so continued till daylight: aurora without streamers between 9 P.M. & 2 A.M.: (terrible storm this night on the coast of Russia: twelve ships lost at Stralsund & the town inundated.)

Nov. 14 Cloudy & rainy all day. In the morning B 29.90: wind E.

490 Nov. 15 8 3/4 Fine, no clouds, wind W.: B 29.65: (on the German coast, the storm, accompanied by rain & snow, has lasted some days: the inundation extends over all the coast: storm as heavy on the English coast: many ships & 50 lives lost.)

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491 Nov. 16 9½ Fine, wind W., hardly any: B 30.10: groups d, c, e, a little smaller; y has disappeared: group f considerably larger, & group k has appeared: magnetic declination needle oscillates over 20 divisions: inclination great below the horizontal line.

492 Nov. 17 9⅔ About 6⅚ A.M. wholly cloudy, but about 8 A.M. cleared off fast: at 6 A.M. strong wind in squalls: at 9 A.M. quite clear, horizon hazy, seeing bad in the telescope: group x exactly on the limb & can hardly be seen: many prominences above & near it: small spot b no longer visible: group c smaller, so also f & e: k more developed, group m formed: two great spots are coming on at k. (Ship Calabria, which sailed from Jersey City Nov. 13, met a terrible hurricane Nov. 17 about midnight.)

493 Nov. 18 11¾ Cloudy all the morning, sun now just visible through thick continuous cirrus cloud: wind W.S.W., light: at 8½ A.M. B 30.45: probably there are spots not represented on the sketch, as the seeing is so bad. (Steamship Europa, for Glasgow, met a terrible hurricane.)

494 Nov. 19 9 11/12 Clear, calm, wind W.S.W.: B 30.07: group p larger: e & f smaller: at 4½ P.M. B 30.00: (Steamship Baltic met very heavy squalls Nov. 17, becoming a gale Nov. 19, when the ship Assyria was met in a sinking condition.)

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Nov. 20 Morning cloudy: sun came out occasionally in the afternoon, but I was in Boston.

495 Nov. 21 10½ Clear, calm, wind W.: B 30.30: group h much larger, so also g: f, e, & one spot of group d, obliterated: c has disappeared.

496 Nov. 22 9⅙ No clouds, but smoky haze 30° high all round the horizon: wind S.S.W., light: about 9⅓ A.M. the magnetic inclination needle dipped its scale at least ¾ below the horizontal line, as in annexed sketch [in original:] after a few minutes it had risen a little above the horizontal line. The two large groups of spots are closing up. About noon it clouded up entirely, with light rain after 3 P.M. till evening. Following night rainy with a little snow towards morning. (Storms today on the English coast.)

497 Nov. 23 10¼ Haze from the horizon to about 45° of altitude: light clouds elsewhere: wind N.W., light: B 29.97: Spots m & d have disappeared.

498 Nov. 24 10⅓ Cloudy with nearly continuous cirrus: sun hard to see: wind W. S.W., light: B 30.25.

499 Nov. 25 8⅚ Much cirro-cumulus & stratus cloud: wind S.W.: B 30.00: at 4½ P.M. B 29.85: weather thick & threatening all day: magnetic disturbance of inclination needle, its north end dipping. Evening calm: stars visible near the zenith, horizon overcast. (Storm continued today in the Channel.)

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Nov. 26 Cloudy: wind N. W.: B 30.15: at 4 2/3 P.M. wind N.N.E.: B 30.05: a sprinkling of snow in the evening. All the prominences drawn on the back of No. 499 belong to the date of Nov. 27.

500 Nov. 27 9 1/6 Fine, sky clear, Wind N. W.: B 30.10: group g has disappeared, h is a little smaller, n a little larger; the great group s is new: 20 are to be seen. Near spot n is a protuberance with long parallel oblique filaments rising 185020 miles. Meteoric shower from nightfall to midnight. Near 1000 meteors were counted by two observers, one looking east, the other west; but their number constantly diminished, so that most were seen at the beginning of the observations. Point of radiation near γ Andromedae. Meteors generally small & without trains; many of their paths were curved, & two were undulating. Aurora. Prominences of Nov. 28 on the back of No. 500.

501 Nov. 28 10 1/4 B 30.27; wind W.: fine & clear: about noon some cirrus cloud gathered: at 10 A.M. magnetic needle oscillated 30 divisions: after sunset it clouded up entirely. (Aurora at Paris.)

Nov. 29 Wholly cloudy with light rain: wind S.E., strong: snow after noon: cleared up about 8 P.M. (Violent hurricane at St. John, New Brunswick, in the night of Nov. 29 & 30: terrific rain storm.)

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502 Nov. 30 $8\frac{11}{12}$ Fine: wind W. S. W., strong: B 29.60; wind very strong, since yesterday, during the night: magnetic inclination needle dipping: weather very cold; strong wind all following night. (Terrible hurricane at St. John, New Brunswick. Aurora at Paris.)

503 Dec. 1 $10\frac{26}{60}$ Fine, but with some hardly visible cirrus clouds. Wind S. W., still strong. Magnetic inclination needle dips still more, 1°30', than yesterday; the declination needle oscillates very little. Groups v, u, larger; s little changed; k has disappeared, x & y are hardly visible. Clouded over entirely after noon, & so continued into the night following, when it snowed a little.

504 Dec. 2 $9\frac{12}{60}$ Sky still overcast this morning, but about 8 A. M. it cleared off rapidly: nearly clear now. B 29.85: wind S. W.: magnetic inclination needle still dips, now about 1'. Groups o, v, u, smaller: spot z new: near group u the spectroscope shows faculae brighter than the sun, since they appear in a brilliant range on line C: these clouds extend between the two chief spots & even over the penumbrae of the group; also nearly to the small spot x: on this side they are larger & brighter. It is remarkable that yesterday, when the spots of this group were more open, these faculae were not to be seen: they only appear now that the spots are closing up. Wholly cloudy about 1 P. M.: B 29.80.

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505 Dec. 3 9 Fine, wind W., strong: some cumuli: B29.75: magnetic declination needle oscillating 15 divisions: inclination needle again in its usual position. Group w much smaller & changed: at 4 P.M. B 29.90: magnetic inclination needle oscillating since 11 A.M.

506 Dec. 4 9 Fine, only a few strato-cumuli: wind W.: B30.05: groups v, w, a little smaller, perhaps z also: spots a, b, are new.

Dec. 5 Morning clear, clouded up about 9 A.M.: snow after noon. Observer ill.

Dec. 6 Sun came out in the morning, afterwards it clouded up: cleared off again about 11 A.M. & so continued the rest of the day. Observer ill. 50

507 Dec. 7 11 Sketched by eye with telescope with erecting eyepiece. Sky covered with hazy cirrus clouds. (Aurora, by meteorological record of Harvard College Observatory.) [This aurora only suspected.]

Dec. 8 Cloudy: sun came out only a little in the morning beneath thick haze. Observer ill. (Squall & storm at Vannes.)

Dec. 9 Morning cloudy: melting snow after 11 A.M.: sun invisible: observer ill: terribly violent west wind beginning after night-fall & lasting all night: (terrible hurricanes and storms in England, with lightning & thunder; much property destroyed: wind W.) 50

Dec. 10 Observer ill. At 11 A.M. the wind was as violent as ever; the sky wholly cloudy,

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Dec. 10 but the sun was occasionally seen through clouds. Clear at noon: one rather large spot has appeared: wind continued as before. (Violent gale at Paris, France, with pouring rain: same in England: squall & rain at Angers.)

Dec. 11 Observer ill. Fine. (Aurora at Perugia, 6 A.M.: magnetic disturbance.)

Dec. 12 Observer ill. Cloudy: a few snowflakes about noon. On the back of No. 507 is a protractor drawn to show how the sun stands on the spectroscope slit. The S. point, marked Sud, is uppermost.

508 Dec. 13 10½ Sketched by projection, with small telescope & erecting eye-piece. Weather fine.

Dec. 14 (Magnetic disturbance at Paris & Rome.)

Dec. 15 & 16 [No record. Observer ill.]

Dec. 17 Fine. (Magnetic disturbance at Paris.)

Dec. 18 Cloudy, snowing all day after about 10 A.M.: wind N.: spot a, which was near the limb yesterday must have disappeared today. (Snow in England & gale on the Channel.)

509 Dec. 19 10¼ Fine: B 30.35: magnetic declination needle agitated: wind W.: clouded up towards night & so continued throughout the night.

Dec. 20 Wind blowing a gale about 3 or 4 A.M.: fine close snow, like sleet, falling: about 8 A.M. the snow changed to rain & the wind went down: B 29.97: wind E.: at 3 P.M. B 29.80: rain all day. About 11 A.M. magnetic inclination needle slightly agitated: declination needle very steady, hardly moving 1 division

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510 Dec. 21 Morning cloudy, afternoon clear: wholly cloudy after 7 P.M. Sketch shows roughly the apparent places of the Spots. 51

511 Dec. 22 $10\frac{5}{6}$ Fine: about 6 A.M. the wind rose & blew hard from the west: B 30.05: large magnetic disturbance: the declination needle oscillated at $10\frac{1}{3}$ A.M. over an angle of 13 divisions: at $12\frac{1}{4}$ P.M. over one of 27 divisions: the north end elevated: wind, still very strong, shifted to N.W.: clouded up in the evening.

Dec. 23 Wholly cloudy, snowing: wind S.E.: B 30.05: magnetic declination needle oscillates very far: inclination decreases: at noon B 29.90: wind S.; the snow has stopped: at 2 P.M. the movement of the magnetic needle has stopped: wind S.W.; snowing hard: after sunset wind shifted to W. & it cleared off.

512 Dec. 24 $9\frac{1}{3}$ Cloudy: the sun could be seen at the time of the sketch, but only under clouds: wind W., light: B 30.25: magnetic declination needle oscillates over an angle of 36 divisions. 51

513 Dec. 25 $9\frac{1}{4}$ Cloudy with C.S. [cirro-strati?] to a great extent: wind N.W., light: B 30.45: magnetic needle moves over 36 divisions: spot e has moved far towards the pole: clear after noon.

Dec. 26 Cloudy with a little snow: B 30.08: spot c must have disappeared this day: abundant snow all the day & evening: wind N.N.E.

Dec. 27 About 8 A.M. the sun came near coming out,

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514 Dec. 27 4 but it clouded over again entirely & even snowed a little about 10 A.M.: wind N.N.W.: B 29.60: magnetic inclination needle oscillating gently: declination needle oscillating much less today than for the three previous days; about 4 P.M. the sun came out in a blue strip in the western horizon: B 29.65; spot [e?] after moving towards the pole for two days has come back towards the equator & is now about where it would have been in the ordinary course of events; so it must have a proper motion forward, since from the 24th to the 25th it moved towards the pole on the same meridian, & must accordingly have retrograded as it moved towards the pole. Spots a, b, c, d, h, g, have appeared since the 25th. Aurora with streamers about 11 P.M.

515 Dec. 28 8 5/6 Very fine: calm; wind W.: B 29.95: at this time there was a magnetic disturbance; the declination needle was unsteady & oscillated irregularly: at 12 2/0 P.M. the inclination needle oscillated rather vigorously: spots must have been developed near spot c of Dec. 25th, since there are very large cloudy protuberances on the preceding limb.

Dec. 29 Cloudy, but the sun was visible under the clouds from 9 to 11 A.M.: spots f, g, a, b, were seen at 11 A.M.: B 30.30: wind W.: cleared off directly after sunset.

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516 Dec. 30 9 32/60 Fine & clear: wind N.W.: B 30.45: magnetic declination needle oscillating over 50 divisions: inclination needle elevated 1" of arc: a spot is obliterated. 51

Dec. 31 Cloudy with snow all day: wind N.W.: at 9 A.M. B 30.25: in the afternoon the magnetic declination needle remained farther east, than usual: at 5 P.M. it stood at 117°: inclination much less than the normal amount, 1°20": at 11 P.M. it was very clear. 51

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517 Jan. 1 9 Clear, no clouds: wind S.W., light: B 30.35: spots f & g smaller: d & k obliterated: groups a, b, & h, are larger.

518 Jan. 2 4 Cloudy almost all day: sun came out a little after noon among numerous cirro-cumulus clouds: B 30.45: the sun was seen only a few moments & imperfectly, so that the spots were probably not all sketched: k is new.

Jan. 3 Cloudy with rain & mist all day: thawing: B 29.45: wind N.W.

519 Jan. 4 9¼ No clouds: wind W.: B 29.45.

Jan. 5 Cloudy: B 30.17: wind N.: a little sleet about 1 P.M.

520 Jan. 6 9¼ Clear: wind W., very strong: B 29.90: spots a, f, have disappeared: group b much smaller: small spots n, m, p, are new.

521 Jan. 7 9⅓ Wind W.: B 30.45: clear, calm: g has disappeared, n is no longer visible; m is larger: s & r are new. The magnetic needle, which at 1 P.M. was moving W. as usual had moved east at 2¼ P.M. to a point beyond its maximum of the morning. About 5 P.M. there was a brilliant aurora: it was composed of two bright arches & of many streamers; the eastern & western streamers were red, but showed no red line in the spectroscope: at 7 5/4 P.M. the magnetic declination needle was oscillating between 135 & 165, so that the deviation was towards the east: at midnight the aurora was as bright as ever & occupied all the sky, south as well as north.

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Jan. 7 (In northern Iowa "terrible gale of wind commenced this evening": it still continued on Jan. 9; snow storm, etc. Terrible cyclone Jan. 7 at Ile de la Reunion.)

Jan. 8 Cloudy: at 9 A.M. B 30.25: about 9½ A.M. it was snowing; wind N.; about 1 P.M. it looked a little clearer, then clouded up again entirely: at 5 P.M. B 30.00.

522 Jan. 9 9½ At 7½ A.M. still wholly cloudy: at 7⅔ A.M. wholly clear, wind W.: B 29.25: spots b, d, s, have disappeared: group m smaller, do is p, & its one remaining spot has a proper motion forward. m also has a proper motion: s is new: at 9½ A.M. group t seen on the sun's limb: no protuberances on that part of the limb.

523 Jan. 10 9⅙ Clear, wind S.S.W.: B 30.10: magnetic declination needle oscillating over 62 divisions of the scale.

524 Jan. 11 9⅙ Clear, wind W.: B 30.18: magnetic declination needle oscillating over 44 divisions.

525 Jan. 12 9⅚ Clear, wind W.: B 30.40: magnetic declination needle oscillating 24 divisions: spots v & u are new: magnetic inclination needle oscillating slightly and rising.

Jan. 13 Cloudy, a little snow about 10 A.M.: magnetic disturbance of inclination needle, north end rising: declination needle nearly stationary. At 9 A.M. B 30.48: wind N.W.

526 Jan. 14 9 1/12 Clear, some strato-cumulus clouds: wind W., light: B 30.00: s has disappeared: x is considerably

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Jan. 14 smaller: w & x are new. Cloudy towards evening & following night. (Great snow storms in Minnesota from evening of Jan. 14 to evening of Jan. 16.)

Jan. 15 Cloudy all day, wind N.: at 9 A.M. B 30.70: at 5 P.M. B 30.75.

527 Jan. 16 3 5/6 Cloudy; wind N.: at 9 A.M. B 30.35: fine rain, freezing: fog: shower about noon: then sun came out among large cumuli: at 3½ P.M. B 30.15: following night clear: spots k, v, have disappeared: z, a, y, are new: magnetic needle quiet.

Jan. 17 Rain, fog all day: wind S.E.: at 9 A.M. B 29.75: western sky red at sunset: following night cloudy: magnetic needle quiet.

Jan. 18 Cloudy: a few drops of fine rain: wind E. N.E., rather strong. B 30.00: magnetic inclination needle rising: declination needle oscillating 15 divisions: rain, snow, sleet, the rest of the day: thunderclap at 6 5/12 P.M.

528 Jan. 19 3 37/60 Cloudy in the morning & till 3¼ P.M.: then clear: at 3 37/60 P.M. B 29.85; wind W., strong. Since Jan. 16 spots y, z, w, have disappeared: groups t, a, z, smaller. Faint auroral light between 9 & 10 P.M. (Very violent storm at Paris, France, with thunder & lightning: earth struck in many places.)

529 Jan. 20 9 1/12 Much cirro-stratus cloud: wind S.S.W., light: B 30.10: at 8¾ A.M. magnetic declination needle oscillating over 37 divisions. Spot u a little smaller, d no longer visible: b, c, are new. Wholly cloudy after 3 P.M. At 4 P.M. B 30.00.

530 Jan. 21 10 Sky much covered by cirro-cumuli: wind S.S.W.:

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Jan. 21 rain & snow afternoon & following night: sketch made at home [presumably with Mr. Trowbt's telescope with terrestrial eye-piece, but the preceding point is marked to the left as in the other sketches.]

531 Jan. 22 Sun sketched at home with my telescope [see note to No. 530 in brackets] at 8½ A.M.: extensively cloudy: wind W. 53

532 Jan. 23 9⅓ Clear, wind N.W.: B [not given]: b smaller; a, c, e, are new: large faculae near groups a, c, e, d, & the limb: the spectroscope shows the faculae near the spots at e brighter than the photosphere & appearing as bright lines on the line C of the spectrum. Cloudy after 2 P.M.: snow all the following night, with strong wind: magnetic declination needle nearly stationary. 53

Jan. 24 Snowing, wind E.N.E., strong. At noon B 29.80: at 8¾ A.M. magnetic declination needle nearly stationary: at 5 P.M. it was still moving eastward, being at 113 instead of 125 or 130 as usual: it had not retrograded after noon as usual; at 11 P.M. it was cloudy but in the northern horizon there was a dark segment of sky as black as ink, but no light could be seen. (Snow hurricane in central Illinois, beginning Jan. 22, in the night: began at & near Chicago in the morning of Jan. 23 & continued with great violence into the following night. Heavy snow storm in Eastern Wisconsin.) 53

533 Jan. 25 9½ Partly cloudy in the E., clearing up with a west

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Jan. 25 wind: magnetic inclination needle much elevated: spot u must have disappeared yesterday evening: group a considerably larger: d is smaller: g & f are new spots. Very faint auroral light about 11 P.M.

534 Jan. 26 9 5/6 Extensively cloudy: B 30.20: after 2 P.M. cleared off entirely. The wind W.: this sketch is perhaps incomplete, as there were thick masses of cloud at the time when it was taken.

Jan. 27 Snow storm morning till night: wind N.N.E.: B 29.80.

535 Jan. 28 9 Much cirrus cloud: wind W.: m, which is the same as group k, has increased: f & c have disappeared: the spectroscope shows bright faculae round m: sky covered all day with thick cirrus cloud; sun often wholly hidden: following night cloudy, wind very strong.

536 Jan. 29 10 5/12 Clear, cold: wind S.W., very strong: at 8 3/4 A.M. magnetic needle oscillating over 22 divisions. The spectroscope shows bright faculae round k & a: m has disappeared, groups a & k are considerably larger: at 12 2/3 P.M. magnetic needle oscillating over 38 divisions: B 30.25 [probably at time of sketch.]

537 Jan. 30 9 1/4 Clear, very cold, wind W., light: magnetic declination needle oscillating over 26 divisions: inclination needle's north end has been rising some days & rose still more last night: a seems a little smaller; m, n, are new spots: group a is rapidly closing up; the spectroscope shows none of the bright faculae about it which were seen yesterday. About 11 A.M. cirrus cloud gathered fast, and afternoon was wholly cloudy.

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538 Jan. 31 $9\frac{1}{12}$ Clear, calm, wind W. S. W., light: group a smaller, g smaller, e considerably larger, k obliterated: p, r are new spots. At 3 P.M. group g was developing spots, & a large protuberance appeared on the following [side.] Immediately after sunset cirrus clouds occupied the sky rapidly, at 6 P.M. the sky was wholly cloudy & so continued all the following night.

539 Feb. 1 $10\frac{2}{3}$ Almost wholly cloudy, sun sometimes appearing under thick cirrus clouds: sky a little clearer after noon but soon cloudy again, so remaining for part of the night following. (Terrible snow storm with wind in England; much property lost; first snow of the winter: wind furious: many ships lost: storm extended over the English & Irish coast: storm heaviest in the evening.)

540 Feb. 2 $10\frac{1}{6}$ Clear, calm, wind W.: magnetic needle oscillating over 60 divisions: oscillations irregularly increasing & diminishing.

Feb. 3 Sun came out for a few minutes at sunrise; rest of day wholly cloudy: wind S. W.

Feb. 4 Morning & part of afternoon cloudy: clear after 2 P.M. but being absent, I did not observe the sun.

541 Feb. 5 $9\frac{5}{6}$ Morning cloudy, cleared off about $9\frac{1}{2}$ A.M.: wind N.N.W.: B 30.05: since Feb. 2, e, g, & group k have disappeared: r is a little developed & s has appeared.

542 Feb. 6 9 Clear, calm, wind W. S. W.: B 30.22: magnetic declination needle oscillating over 40 divisions.

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543 Feb. 7 9 Wholly cloudy with undefined & cirrus clouds: wind S.: fog: however the sun can be seen. After 10 A.M. wholly cloudy: fog: wind N.E.: cloudy & thick weather the rest of the day. Spots l, n, have disappeared; all the others are a little smaller: rain in the evening.

544 Feb. 8 8 11/12 Clear, some cumulus cloud, calm, wind W.: r & p still smaller: u is a new group: high & wide turnip-shaped protuberance at 182° following side: many jaculae following side: magnetic declination needle nearly stationary.

545 Feb. 9 9 2/3 Much light cirrus cloud: wind N.W.: B29,70: p & r smaller: x, v, w, no longer appear: y is new. Magnetic disturbance lasting all day: deviation E.: strong wind after sunset.

546 Feb. 10 9 1/4 Clear, very cold, wind N.W., very strong: B 30.00: seeing very bad: at 2 1/2 P.M. group z larger: group u shows jaculae which reverse line C where they meet it.

Feb. 11 Wholly cloudy, a little snow, wind S.S.W.: cloudy till evening, then showing some rather large clear spaces among cumulus clouds.

547 Feb. 12 11 1/2 Sketch made with my telescope by eye merely [not a projection]: sky covered with nearly continuous cirrus cloud, not very thick, as the sun is constantly seen under it, & sometimes very well: mild: group u [as sketched] should be nearer the centre: wholly cloudy after noon; following night cloudy with very strong wind.

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548 Feb. 13 9 7/12 Sketched with my telescope merely by eye without a projection: it must be remembered that this instrument enlarges the spots. Morning overcast, many & large cumulus clouds at time of sketch: group w smaller & closing up: z also closing up: wind strong.

549 Feb. 14 9 27/60 Rather clear, but a good deal of cirrus cloud: wind N.: magnetic declination needle far to the west: at 9 A.M. it marked 11 ; at least 10 divisions beyond its mean place at that time. With my telescope this morning group w seemed to me certainly smaller. Sketches made with my telescope & with that at the Observatory cannot be compared with regard to the size of spots, but only for their position. Cirrus cloud fast gathering & thickening, sun still seen, but with difficulty: invisible a[fte]r 3 P.M.: wind shifted a little to the east: somewhat clear in the evening.

550 Feb. 15 9 1/6 Sky blue & calm, but a little hazy: wind E.: no clouds, but seeing very bad & sky whitish except in the west: spot a still in sight: group w fast closing: large facula, curved at the end & looking spiral, coming sidewise upon the eastern spot of group w: b is somewhat developed, d is a new pore [small spot]: y larger than yesterday: the spectroscope directed to the faculæ which are invading the chief spot of group w shows line C cut by bright points. Few protuberances & none remarkable: spot e is on the limb: at 12 2/3 P.M. spot a still in plain sight: group d developing, w closing up.

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Feb. 16 Morning wholly cloudy, snowing about 10 A.M. & snow growing heavier afternoon & evening: about 10 P.M. wind became rather strong.

551 Feb. 17 $2\frac{5}{12}$ Cloudy all the morning, wind N., strong. About 1 P.M. cleared off rapidly, wind N., & at 2 P.M. no clouds. Seeing excellent; the smallest details of the disk visible: the "rice grains" well marked: groups u, v, x, very much smaller; y smaller: a & b larger: f, g, h, k, m, n, p, are very small spots, all new but most of them are visible only because the seeing is uncommonly good today: c & e are obliterated.

552 Feb. 18 $9\frac{1}{12}$ Fine, calm, wind N.: sky not very clear; haze about the horizon: all the groups closing up & somewhat smaller. The prominence of yesterday has less of an eruptive appearance [prominence sketched on back of No. 551: that sketched on back of No. 552 is on the same part of the limb.] After noon cirrus clouds came on: wholly cloudy at sunset.

553 Feb. 19 $10\frac{7}{12}$ Cloudy, wind S. W.: spots sketched with difficulty: it had to be done a little at a time as the sun came out only for a very short time now & then between 10 & 11 A.M.: groups a, b, smaller: sun did not reappear: about 3 P.M. fine rain & thick fog. (Aurora at St. Petersburg.)

554 Feb. 20 $9\frac{1}{12}$ Clear, no clouds, wind W. N. W. Spot c shows a red veil over more than half its umbra, on the side of b: groups d, c, b, k, m, f, are larger:

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Feb. 20 k is a new group. Between 7 & 9 P.M. rather fine aurora, with arch: streamers faint. (Magnetic disturbance at Forence, Italy.)

Feb. 21 Wholly cloudy, wind N.W.: magnetic declination needle at 9 A.M. oscillating over 42 divisions: about 11 A.M. wind shifted to N.E.: about noon snow for some minutes: at 12½ P.M. wind E.: about 3½ P.M. snowing thick in large flakes; wind N.N.E., strong. (Brilliant aurora at [St.] Petersburg, Europe, also at Thurso; magnetic disturbance at Florence, Italy.)

555 Feb. 22 9 5/12 Clear, fine: wind W.N.W., strong. Cold: at least 4 inches of snow fallen yesterday. Groups u, v, y, have disappeared: group c, b, smaller: n no longer visible; small group z new, also the two very small pores a, x: pore z no longer visible: seeing not very good. At noon seeing bad: group g, x, developing and now combined into one group. 55

556 Feb. 23 9¼ Clear, cold: wind W.: d is no longer visible: f smaller: a was not seen: k, g,) perhaps m are larger; e & k are new groups. 55

557 Feb. 24 9 5/12 Morning clear, but about 9 A.M. cirrus cloud rapidly gathered: sky wholly covered at 9 7/12 A.M., but clouds not yet thick enough to hide the sun entirely. Group b is near the limb & its first spot will disappear today: group m seems smaller: at 9 A.M. the magnetic declination needle was oscillating over 37 divisions. 56

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Feb. 24 About noon it was quite clear again: r is a small group detected at 3 P.M.: groups k, e, n, are larger than they were yesterday: at 3 P.M. the preceding spot of group w [presumably b] had not yet reached the limb: all three were seen: faint aurora between 7 & 8 P.M. At 11 P.M. wholly cloudy, so continuing all the following night till sunrise. (Very heavy snowstorm in England, beginning Feb. 23 at night & continuing Feb. 24. Aurora at Thurso, Haparanda & Stockholm.)

558 Feb. 25 9 5/12 Cloudy till 8 A.M.: then clearing off rapidly, wind W.: groups q, x, & m, & z, a little smaller. Group y larger; small new group w; groups on the following side are developed. Prominence sketched on back above group b, which has disappeared.

559 Feb. 26 9 1/6 Fine, clear, wind N.: spot k no longer visible: so also group m & w: r & z smaller. Faint aurora light at 11 3/4 P.M.

Feb. 27 Cloudy all day: sun occasionally seen under clouds which were too thick to allow the spots to be seen: wind E.: snow in the evening. (Heavy snowstorm today in the north of France.)

560 Feb. 29 10 1/2 Morning cloudy with a little snow about 9 A.M.: at 10 1/2 A.M. some openings among the clouds: groups n, g, have disappeared: r, z are no longer visible: e, n, f, k, t, a little smaller: a & b are new: some snow repeatedly during the day: cloudy all following night.

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March 1 Cloudy, wind N.E. (Aurora seen at Concord, Mass., about midnight, by meteorological record of Harvard College Observatory.) [The date of this aurora, which rests on hearsay evidence only, may be wrong.]

561 March 2 9 2/3 Morning clear, wind N.: about 11 A.M. cirrus cloud rapidly gathered & at noon there was a great halo round the sun, its diameter being about half the sun's altitude at noon. Wholly cloudy towards evening.

March 3 Wind N.: wholly cloudy: snowing rather hard: storm continued heavy all day & following night, with very strong wind.

562 March 4 9 13/60 Cloudy, but the sun showed itself a little through the clouds: wind N.N.W., strong. Spots g, b, invisible: group e, f, n, considerably smaller & reduced to n only: k also has almost wholly disappeared: group d larger: a is divided: group e new. It continued to clear up & after sunset was quite clear. Spot b was seen at 3 P.M.: also the 7 dots near n.

[After this date Mr. Trowbridge used the Kept Equatorial in making his drawings, as described in note of June 12, 1873, at the end of this volume. The drawings are hereafter all 5 inches in diameter, & the notes contain measurements of the spotted area which, as they would not be easily obtained by copying, are omitted for the present in this copy.]

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563 March 5 $9\frac{5}{12}$ Fine & calm, wind W.: seeing indifferent: group d larger, also a & e & c: group b has more spots.

564 March 6 $9\frac{7}{12}$ Clear & calm, wind W.: seeing bad. Group d less irregular about the margin: the umbræ are larger & the group has a spiral appearance: a smaller, e larger: groups m, s, p, t, developed since yesterday: at $4\frac{1}{2}$ P.M. the seeing was better: I then saw k & spot n, which has just come over the limb: the sketch makes group d too large, and all the other groups are a little too large; this is due to the bad seeing of the morning, since the spots look larger when they are badly defined.

565 March 7 $9\frac{1}{2}$ Much cirro-cumulus & cirro-stratus cloud, wind W. & W.: group n still visible, but will soon disappear: k no longer visible, d little changed: s larger: p obliterated: a smaller: t a little larger: groups e & b are perhaps a little larger: v is new: at 4 P.M. spot n is just on the limb.

566 March 8 $9\frac{5}{12}$ No clouds, but yellowish haze rising rather high all round the horizon: wind E.: seeing tolerable: at 264° following side there is a large protuberance rapidly changing in form: group d little changed: s larger; a smaller: so also t & perhaps e: w is new: spot x seen at 2 P.M. in the place where it stands on the sketch: at 2 P.M. cirro-stratus & cumulus cloud coming on: at 3 P.M. wholly cloudy: at sunset, clear: following night alternately cloudy & clear.

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567 March 9 $10\frac{28}{60}$ Sun visible at sunrise, wholly cloudy soon after, with a few drops of rain: then clear and cloudy again with a few flakes of snow: March weather. At $10\frac{1}{2}$ A.M. rather thick cirrus cloud almost everywhere; wind W.S.W., blowing very hard: at 10 A.M. a fine eruptive protuberance was seen at 264° near spot y: it seemed by its filamentous appearance to be about a spot, but at $10\frac{1}{2}$ A.M. the seeing was too poor to show it: m and the first spot j d are on the limb: I will pass it in the course of the day: s has lost its small spots, a is smaller, t has disappeared, e, f, j are smaller, v a little larger: groups k & h are new: b about the same: z, q, y, z are new. Sky quite clear again in the afternoon: some cumuli about 11 P.M.

568 March 10 $4\frac{1}{6}$ Wholly cloudy, with snow by $6\frac{2}{3}$ A.M.: snow falling thicker & thicker, till nothing could be seen a hundred steps away: did not stop till 2 P.M.: wind N.E.: at 2 P.M. it shifted to W.N.W., & the sun was indistinctly seen beneath thick undefined clouds: at 4 P.M. there were hardly any clouds. Groups m, d, have disappeared: e, c, are smaller: f no longer visible: w, v, g, obliterated: k, b, z, v, a little smaller: the pores at n are new: group y today shows the spots that were below the

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March 10 protuberance seen on the limb yesterday. Aurora about 7½ P.M. consisting of two diffused arches with greenish streamers: no trace of it at 9 P.M.

(Cyclone March 10 & 11 in the N.W. of Europe, latitude of the Hebrides.)

569 March 11 $9\frac{37}{60}$ Extensively cloudy; much cirrus clouds, wind S.E.; rather strong: group k no longer visible, b a little smaller, r, t, hardly visible: one spot of c larger, n hardly visible: spot w has appeared. At 11 A.M. wholly cloudy, wind violent: at 2 P.M. raining rather hard, wind still violent. During the following night it cleared off & the wind went down.

570 March 12 $9\frac{1}{4}$ Only some cirrus cloud in the sky, which is however not very blue & looks whitish: seeing very bad: groups k, a, have disappeared, s is still on the limb, but very hard to see when the definition is so bad: e & c may still exist, but I could not see them: group b smaller, t & w not visible: groups b, y, larger. Calm, wind W., hardly perceptible: spot f seen at 3 P.M.

571 March 13 $9\frac{7}{60}$ Partly cloudy: clouds partly cirrus: clouds moving from the N.W.: wind W.: spots c, s, f, r, no longer visible: groups v, b, smaller: two very small groups, d, e, have appeared since yesterday: a protuberance diminishing, indicating very rapid change: facular or ridges entering on the sort of tail of spot y, very visible in the spectroscope & looking like protuberances.

572 March 14 $9\frac{7}{12}$ Morning clear, numerous cumuli gathering

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March 14 about 10 A.M. & covering much of the sky: groups v, b, e, w, z, less than yesterday; d somewhat larger: group c is new & will soon pass off the limb: bright faculae about group y no longer seen: two gray spots, darker than the shadows between the "rice grains," seen, one near each pole, marked + on the sketch [one such mark only made out July 8, 1873, date of this copy.] These spots not seen by direct observation but only by projection: h is a group of three small spots with very little umbra, occupying the place of the shadow seen this morning: it is now 2½ P.M.: [the second + marks probably replaced by h:] wind in the morning N.W., strong: afternoon it went down & the sky was quite blue. 573 571

March 15 Cloudy all day with a little snow & rain, [following] night. Perhaps the sun might have been seen through the clouds, but I was not at the Observatory.

573 March 16 10 27/60 Clouded up entirely with heavy cumuli, then cleared up a few moments later: wind W., strong. Spots c, u, e, g, h, d, x, obliterated: group y smaller. Wind violent: about 3 P.M. a few snowflakes in sunshine: true March weather (Cyclone on north coast of Africa March 16 & 17.) 571

574 March 17 9/6 Wind still strong, somewhat less violent. Sky blue but half covered with cumuli, detached, &

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March 17 moving very rapidly; wind N.W.: groups v, b have disappeared: so has a: y smaller & closing up, w smaller: group c is new. Wind continued strong all day; sky very clear.

575 March 18 $9\frac{26}{60}$ Wind W.S.W.: sky everywhere covered with very light pearly or whitish haze which entirely obliterates the blue: spot z obliterated, w smaller, group y continuing to contract: cirrus cloud becoming thicker, covering all the sky: sun nearly hidden at 2 P.M.: at 3 P.M. wholly cloudy; wind S.: a little rain following night, beginning about 9 P.M.

576 March 19 $10\frac{13}{60}$ Cloudy, but sun seen under thick cirrus cloud: wind W.: group y still smaller than yesterday: c not seen, though at the time when I sketched the sun it was rather conspicuous: spots a, b, are new: sky cleared up somewhat after noon: stars visible, but under cloud, in the evening.

March 20 Morning wholly cloudy, wind E., light fog: about 11 A.M. snowing very hard already: so continued without interruption till evening. Sleet & rain much of following night.

577 March 21 $9\frac{1}{2}$ Morning cloudy till 8 A.M., then increasing signs of clearing off: sun occasionally seen between the numerous cumuli, which moved rapidly before the rather strong W.S.W. wind: a there is today a group of several spots: b also has an additional spot: c & d are

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March 21 new groups: w is obliterated group y has almost lost its surrounding spots; those on the sketch were seen by direct observation, not by projection; the principal spot remains but is smaller; the lesser spots are now only pores. Heavy clouds all day; sun occasionally seen between them: about 5 P.M. it grew cloudier and the wind increased: about 2½ P.M. there was a snow squall.

578 March 22 9 1/3 Morning clear: about 10½ A.M. cloudy to a great extent: spot y has reached the limb: d is smaller; a, b, c, larger; the small barely visible group f is new. Clouds increasing; some snowflakes about noon: almost continuously wholly cloudy for the rest of the day: partly clear in the evening: rather fine aurora seen among heavy clouds in the north: the light seemed very bright about 10 P.M. 581

579 March 23 9 1/3 Much cirrus cloud, wind W.S.W.: group y has disappeared; so also group d: the shape of spot f is changed; the spot seems closing up: cloudy all day: clear about 10 P.M.: about midnight aurora without streamers & at the same time the wind rose & blew very hard in squalls lasting only a few minutes: this violent wind lasted not over half an hour. 582

580 March 24 9 8/60 Extensively cloudy with continuous cirrus cloud, except in the N.W.: wind N.W.:

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March 24 all the groups seem a little smaller; f has disappeared: spots e, d, are new; magnetic declination needle at 9 A.M. oscillating over 14 divisions of the scale; sky at noon same as at 9 A.M.: afternoon clearer, calm: evening partly cloudy: between 10 & 11 P.M. auroral light, rather bright, seen in an opening among Stratus clouds in the north.

March 25 Wholly cloudy: a little snow at 9 A.M.: wind N.E.: continued wholly cloudy all day: some drops of very fine rain about 1 P.M. for a few moments only: at noon magnetic inclination needle was oscillating: night dark.

March 26 Fine freezing rain in the morning: wind N.E.: drizzling all day: raining harder & closer about 4 P.M.; clear about 10 P.M.: faint auroral light 11 P.M.

581 March 27 $9\frac{17}{60}$ Clear with some scattered cirro-cumuli: wind N.W., strong: Groups a, b, smaller & filled up: c has now only one spot: spots f, g, h, are new: the small spot e has disappeared. Wind strong all day: weather very cold: about 5 P.M. wind went down & it clouded up almost wholly: about 9 P.M. faint auroral light.

582 March 28 $9\frac{28}{60}$ Clear, calm: wind W., light: spot f has disappeared: groups a, b, smaller: d somewhat larger: k, m, n, are new, but the spots of m & n are extremely small & hardly visible, mere pores: p, q, seen at

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March 28 about 3 P.M. are extremely small spots or pores under the edge of the faculae: about 10 P.M. sky wholly overcast.

583 March 29 $9\frac{23}{60}$ Wholly cloudy, wind S.E.; about $10\frac{1}{3}$ A.M. [this disagrees with the date of the sketch] the sun came out for a few minutes between the cumuli, and afterwards immediately disappeared again: I had time however to get a good sketch. All the groups smaller: a & b much smaller; g has lost a spot, m barely visible, n no longer to be seen: d also smaller; it is a little too large as sketched; the umbra & penumbra should be somewhat smaller: I did not have time to draw the faculae: spot s is new. Cloudy the rest of the day, with rain about 4 P.M.

584 March 30 $2\frac{1}{2}$ Morning partly cloudy: fewer clouds after noon: wind W. S. W., strong: s is a group of several spots: d larger: a, b, g, smaller: m no longer existent: h larger: z, p, are small new groups.

585 March 31 $2\frac{1}{3}$ Morning cloudy and rainy from 9 A.M. to about noon: wind S.; about noon wind shifted to W. N. W. & it cleared up: sun came out about $1\frac{1}{4}$ P.M.: one of the spots of group a has gone off the limb; h & r are larger: d, s, a little smaller: t is a small new group. Fine all the afternoon: at sunset clouded up, with strong wind.

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586	April 1	$9\frac{24}{60}$	Fine, calm, wind W.: spots a, g, b, p, k, have disappeared: groups h, t, larger: u, v, are new. Rather fine aurora, with streamers, between 8 and 10 P.M.; as soon as the aurora appeared, clouds began to gather: at 10 P.M. no star could be seen: rain about midnight.
	April 2		Overcast, wind E., rain in the morning: cloudy after noon & following night, wind shifting to N.E., then to N.
587	April 3	$9\frac{43}{60}$	Rather fine, some cumuli: wind W.: groups s a little smaller, u obliterated: h smaller, d also much smaller, z larger: clouded up entirely after noon: cleared off at 9 P.M.
588	April 4	$9\frac{5}{12}$	Partly cloudy with cirro-cumuli: wind N.W.: group s closed up on one side & opened out on the other: h has almost disappeared: z smaller: v not seen.
	April 5		Cloudy all day.
	April 6		Cloudy; sun somewhat visible in the morning, under thick clouds, but I saw group s: rain about 6 P.M.: drizzled following night.
	April 7		Fog & fine rain in the morning: wind E.N.E.: cloudy all day with fog: drizzled following night.
589	April 8	$12\frac{18}{60}$	Morning cloudy with some drops of rain: sky cleared off about noon. Groups t, h, d, z, gone off the disk: s smaller: groups f, c, d, e, a, b are new. Overcast rest of day, but sun almost always visible. Fog about 5 P.M.: following night cloudy.

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April 9 — Overcast & cloudy all day; wind E.N.E.: about 7 P.M. fine rain, continuing into the following night.

590 April 10 $9\frac{12}{60}$ Morning cloudy: sun came out about 8½ A.M., but sky half occupied by cirro-cumuli: wind N.W.: groups f, d, larger; e smaller: b has more spots; h & g are new: s is close to the limb; wind N.W., strong: but clouds move from the S. northwards. Magnetic disturbance about 10 P.M.; needle moves over 68 divisions of the scale.

591 April 11 $9\frac{1}{6}$ Morning fine, seeing excellent: wind S.W.; after noon sky extensively cloudy with cirro-cumuli & about 4 P.M. wholly cloudy: s has disappeared, f is smaller; b, d, larger; the pores p, r, q, m, n, are so small as to be seen only because the seeing is uncommonly good.

April 12 — Wholly cloudy, wind E.N.E.; rain about 10 A.M.; very close snow from about 4 P.M. till night: sky cloudy following night.

April 13 — Rainy & snowy, wind N.; weather continued the same all day & into the following night: magnetic inclination needle oscillating between 11 A.M. & noon: following night cloudy; (snow storm began at Omaha.)

[Notes continued in Vol. II.]

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[Continuation of note of June 12, 1873: for beginning see first pages of this book.]

After removing to Cambridge, Mr. Trowbridge regularly used the instruments at the Observatory for his sketches, & when his own instrument was used, the fact appears in his notes. From about sketch No. 240 to & including the sketch of March 4, 1873, the instrument used regularly was a small telescope of 2½ inches aperture & about 42 inches focal length. The screen on which the image was projected was separate from the telescope, and the drawings are not all exactly of the same diameter, but nearly all have a diameter of $3\frac{13}{16}$ inches. The method employed was to draw a circle of the intended dimensions of the drawing & to adjust the positions of the eye-piece and screen so that the image of the sun might just fill this circle. On June 12, 1873, about 11 A.M. the image of the sun, as well defined as possible, was made to fill one of these circles (diameter $3\frac{13}{16}$ inches,) and the distance from a point on the eye-piece to the projected image was measured with a piece of tape. The instrument was then turned away from the sun to the open sky, and the distance from the same point of the eye-piece to the narrowest part of the beam emergent from the eye-piece was measured with a rule. The result of these measurements is to give the quantity D of Peters, or the distance from the narrowest part of the beam emergent from the eyepiece to the projected image, for this date, equal to $25\frac{27}{32}$ inches.

From the sketch of March 5, 1873, to the present time, Mr. Trowbridge has regularly used the West Equatorial for his sketches. This instrument has an aperture of $5\frac{1}{4}$ inches & a focal length of about 90 inches. The screen is carried on the telescope, 102½ inches from the object-glass by measurement today, & has been kept in the same place throughout. Hence the image of the sun cannot be kept well defined and still always made to fill the same circle. All the drawings have been made,

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however, uniformly 5 inches in diameter, the places of the spots having been marked upon the blurred image made just to fill the circle, and their figure having been afterwards drawn. This day, June 12, 1873, setting the eye-piece so that the image of the sun was well defined upon the screen, & then directing the telescope to the sky at a distance from the sun, the quantity D, or the distance between the narrowest part of the beam emergent from the eye-piece and the screen was found to be just 9 inches: when the eye-piece had been set so that the image of the sun upon the screen just filled the circle 5 inches in diameter, the quantity D was found to be, by the same method as before, just 9 1/4 inches. These measurements were made about 10½ A.M.

There is no assurance that the projections have been made in such a way as to bring the centre of the picture upon the line of the optical centres of the object-glass and eye-piece. However, care has been taken to make the image circular so far as the eye could judge, so as to coincide everywhere with the circle previously drawn on the paper.

See also note following No. 562 in this volume.

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