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Harvard College Observatory.
Notes to sketches of sun by L. Trouvelot.
Volume II.

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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 Harvard College Observatory,
 Cambridge, Mass.

Volume II.

See notes to Vol. I for account of
 instruments, etc.

Notes on solar spots, faculae, and protuberances, underscored with black ink.
 " auroras, underscored with red ink.
 Dates underscored with red ink, are those on which photographs of the sun were taken at Harvard College Observatory.
 Parentheses () enclose notes of L. Trouvelot not relating to his own observations.
 Brackets [] enclose matter added by the translator, queries, etc.
 The hour of the sketch, in civil time, is given in the column following that of the dates.

Sketch No. 773 $\frac{1}{2}$ was found by Mr. Trouvelot after the notes from sketches 773 and 774 had been entered in this volume. The notes from sketch 773 $\frac{1}{2}$ are as follows:

1873, Dec. 11, 9 $\frac{3}{4}$ A.M. Sun somewhat visible at sunrise; sky soon clouded over; sun seen tolerably distinctly beneath clouds at 9 $\frac{2}{3}$ A.M.; clouds soon thickened again; spots f, k, g, h, could not be seen; they had probably closed up, at all events f, which should have appeared near the centre of the sun's disk; at noon, some snowflakes falling, with rather strong S.W. wind; cloudy after noon, with a little snow; a few stars seen for a moment in the evening.

Dec. 12. Cloudy, rainy, foggy; wind S.S.W.; weather continued the same all day and following night.

Dec. 13. Rain continuing to fall, rather heavy, wind N.; still raining at 12 $\frac{1}{2}$ P.M.; afternoon and evening rainy, with snow in the night following.

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1873

592 April 14 $11^{\frac{22}{60}}$

Wholly cloudy; wind N.N.W., strong: sun seen only a few minutes. Spots and groups c, r, f, g, p, n, m, seem no longer existent: spot a considerably smaller: group d has hardly more than one spot left: h, t, are not visible: chief spot of group b much smaller: rain about 1 P.M., lasting almost all the afternoon, but not very heavy. (Snow storm at Omaha.)

593 April 15 $9^{\frac{33}{60}}$

Three quarters of sky occupied by heavy cumuli: wind N., rather strong: group b larger: extensively cloudy all day: occasional showers just like March squalls: at 5 P.M. wind went down: between 6 & 8 P.M. sky clear: about $8^{\frac{2}{3}}$ P.M. it clouded over entirely in a few minutes: at this moment the magnetic declination needle was disturbed: and about 11 P.M. I saw some auroral light among the clouds in the north: (Snow storm still continued at Omaha.)

594 April 16 $9^{\frac{1}{6}}$

Morning very fine: about 9 A.M. clouded up with cirro-cumuli over three quarters of the sky: sun however seen through clouds: groups d, b, smaller: small new group e: today also a black spot appears crossing ray C occupying the position marked on the sketch by the double line m: it was $4\frac{1}{2}$ revolutions of the spectroscope screw in length: as each revolution is $47^{\circ}.2$ [the whole distance is $212^{\circ}.4$].

1873
April 16

This absorption line appeared at first as a very black dot as wide as line C: then in proportion to the movement of the slit towards the sun's centre this black dot extended over the spectrum each side of line C: it then appeared irregular: another black spot appeared on group f at the place marked + on the sketch: also another near group g, also marked +: on the back of this sketch are drawings showing the appearance of these spots on line C: cumuli all day long but sun visible through them.

April 17

Wholly cloudy; wind S.S.E., light: misty weather; during the day alternate snow, rain, & hail, but very little and only for a few minutes. Following night wholly cloudy.

April 18

At the very beginning of the day, that is, about 1 A.M., it rained: rain continued till about noon: afternoon cloudy & overcast: wind N.N.W.

[After this date the sketches are made on paper ruled so as to show more accurately the height of protuberances, position angles, etc.]

595 April 19 $9\frac{1}{12}$

Sky half covered with large cumuli: wind N.W.: groups d, a, e, have disappeared: groups k & g considerably smaller: group c has appeared: shower about 5 P.M.: magnetic disturbance beginning about 5 P.M.: at $8\frac{1}{2}$

1873
April 19

P.M. the oscillation angle was 95 divisions of the scale: at nightfall rather bright auroral light, seen only among the numerous clouds: rain ceased at 5½ P.M.

596 April 20 8½ Fine, but heavy cumuli over three tenths of the sky: wind W.N.W. light: nothing left of group but one very little spot: spot d is new, & may have come on at 5 P.M. yesterday in connection with the magnetic disturbance & aurora: much cumulus clouds the rest of the day: clouds increasing after noon, cirrus as well as cumulus: cleared off entirely just after sunset: about 10 A.M. the magnetic declination needle had retrograded a little, from its customary position: by nightfall auroral light was visible & about 8½ P.M. fine streamers rose to the polestar: the streamers were red west of the meridian, as usual: very few eastern streamers and all inclined eastwards at least 12° to 15°: they reached their maximum at 8⅔ P.M.: then they wholly disappeared in less than five minutes, & nothing was left but a faint light.

597 April 21 9

Overcast: sun seen only for a few minutes, under thick cloud: wind N.: at noon, wind E.: at 2 P.M., N.E.: at 1½ P.M. some drops of rain: spot d new, & came on yesterday with the aurora: cleared off afternoon: cloudiness on the horizon only in the evening: after 4 P.M. abnormal movement of magnetic declination needle.

1873

598 April 22 9 $\frac{7}{12}$

Much of the sky occupied by cirro-stratus clouds: wind N.W.: since yesterday groups & spots h, e, g, f, k, have appeared: a, c, smaller: yesterday the magnetic declination needle retrograded in its customary oscillation: group b must now be on the extreme western limb & about to go off: wind shifted to S.W., then to S.: it clouded up more and more.

599 April 23 10 $\frac{1}{2}$

Sky half covered with light cirri: e larger, m new: sky continued somewhat cloudy with cirri, but the weather was fine & the sun visible all day: magnetic disturbance about 10 P.M.; still continuing at 3 $\frac{1}{2}$ A.M. next morning.

600 April 24 10

Calm & clear: some cumuli: wind light: wind N.W.: groups f, m, h, d, e, all larger: very small pores at n: afternoon cloudy.

601 April 25 9 $\frac{1}{6}$

Clear early in the day: about 10 A.M. many cumuli came on; wind N.W.: k is on the limb & about to go off: n was not seen: e, h, m, are smaller: d larger: spot p has just come on at the eastern limb.

602 April 26 9 $\frac{22}{60}$

Extensively cloudy with large cumuli: wind N.W.: group h smaller: m almost filled up: a somewhat smaller, f somewhat larger: some protuberances, but the sun remains in sight too short a time to admit of sketching them.

1873

- 603 April 27 $10\frac{2}{3}$ Cumuli over one quarter of the sky; group f somewhat smaller; so also e: group m larger. Several large cumuli not rising high, & prolonged into trains below, appeared in the afternoon: they were probably charged with electricity. Following night calm & clear. Between 11 P.M. & 1 A.M. faint auroral light: some shooting stars seen.
- 604 April 28 $9\frac{5}{12}$ Calm & clear; some cumuli: wind N.W. very light. Groups p & m larger; d, h, f, smaller: r has today 3 very small lateral spots.
- 605 April 29 $9\frac{1}{6}$ Extensively cloudy with cirro-cumuli: f has now only one spot; h continues to diminish: spots e, a, smaller: group m considerably closed up: p, r, larger: s has today only one spot; it is new: wind N.W.: group u was only seen at 2 P.M.: wind shifted to E. about noon & so continued through the day: rather thick rain at about 4 P.M.: rain ceased at 5½ P.M.: magnetic disturbance at once.
- 606 April 30 $9\frac{1}{2}$ Fine, with light mists in the horizon: wind N.N.E., light: group p somewhat, is considerably enlarged: h no longer visible: f has two spots again: t larger: c must now be on the extreme limb: magnetic disturbance about 10½ P.M.: aurora between 8 & 10 P.M.
- 607 May 1 $9\frac{1}{4}$ Fine, calm: wind N., very light: t larger: r has disappeared: rest of the day fine: at sunset it clouded up entirely with cirrus

1873
May 1

cloud, through which however the moon could be seen till 9 P.M.: then it became wholly cloudy: at this instant there was a magnetic disturbance of the declination & also of the inclination needle.

May 2

Wholly cloudy: wind light, N.W.E.: rain about 1 P.M., continuing till about 4 A.M.

May 3

May 4: wind violent in the night.
Wholly cloudy: wind N.E., strong: magnetic inclination needle oscillating: rain at noon, growing heavier: mixed with snow about 4 P.M.: snowing very thick at 6 P.M., continuing rather late: at least three inches of snow.

608 May 4 9⁴⁷/₆₀

Clear, calm: wind N., light: spots u, a, e, d, f, g, have disappeared: group p smaller: spots n, v, are new: magnetic disturbance between 9 & 10 P.M.

609 May 5 9²/₃

Cloudy, wind W.S.W.: but sun seen occasionally among cumuli: groups t, u, smaller: spot m, not seen, on the western limb, but it should have been still visible in the place assigned to it on the sketch: group x has come on since yesterday: wind W.S.W., light: spots z, w, seen only at 3 P.M.: their place on the sketch is not very exact, as they were not projected, which was impracticable

1873
May 5

owing to clouds; wind at this time N., but the clouds were moving from the S.W.: at 10 P.M. magnetic disturbance; northern sky cloudy.

610 May 6 9 $\frac{1}{2}$ Clear, calm, wind N.: spot m has disappeared, w invisible; t somewhat larger; w invisible; x larger; evening calm & clear, but the seeing with the telescope is bad; magnetic needle shows a large magnetic disturbance, but no aurora appears: but the moon is bright.

611 May 7 9 $\frac{5}{12}$ Morning clear; about 9 $\frac{2}{3}$ A.M. horizon became cloudy, & many light cirri gathered; wind at first N.N.E., E.S.E. at 10 A.M.; group t smaller; seeing very bad; after noon continued to cloud up with cirri; wind continued S.E.; sky at 6 P.M. everywhere covered by cirri not thick enough to hide the sun under them. Each of the intervals between the concentric circles about the sketch is equivalent to 21,004 miles.

612 May 8 9 $\frac{1}{3}$ Light cirri still covering the sky, horizon cloudy; wind S.S.E., light; spot p no longer visible; group x larger; group y formed since yesterday. At 2 P.M. group x somewhat larger & a spot has appeared west of this group; cirrus cloud thickening continually; at 5 $\frac{1}{4}$ P.M. slight disturbance of magnetic declination needle; following night cloudy throughout.

1873
May 9

Wholly cloudy, wind E., a little fine rain: wind east all day, with rain: rain all following night.

May 10

Cloudy & foggy all day, with east wind: sun seen a few moments at 5½ P.M. under heavy clouds: see note on back of sketch [as follows:] there was just time to make out spots as on rough sketch annexed, x, y, v; which were clearly the same as those of May 8: but group z had appeared since then; the position of these spots on the annexed sketch is of course approximate only. There were signs of clearing up, but it clouded over again directly, and so continued all the following night, with a little rain.

May 11

Fog & very fine rain by morning: a heavy thunderclap at 7 A.M., on which the rain fell somewhat thicker, but this did not last over half an hour: cloudy & rainy all day and evening.

613 May 12 9¼

Extensively cloudy with large cumuli, separated by patches of blue: wind N.W., moderate. Group t has disappeared: v much smaller: y closed up: x considerably smaller: group a is new & must have come on in the evening of May 10. Magnetic disturbance between 10 & 11 P.M.

1873

614

May 13

10⁵/₁₂

Wholly cloudy with thick cirro-cumuli; wind S.W., very strong: sun seen at times under clouds: group $\times$ smaller: slight magnetic disturbance $7\frac{1}{2}$ to $9\frac{1}{2}$ [P.M.?]: sky alternately cloudy & clear: a few drops of rain about 11 A.M.: thundershower between 3 & 4 P.M., rather heavy, with strong wind.

615

May 14

9³/₃

Cirro-cumulus cloud over one third of the sky: wind W. S.W., light: group α somewhat larger: v not seen: about 9 P.M. a fine bright shooting star in the S., visible 2 seconds at least, its course very decidedly undulating as in sketch annexed.

616

May 15

9¹³/₆₀

Cirro-stratus cloud over two tenths of the sky: wind N.W.: clear the rest of the day: at 8 P.M. magnetic disturbance of declination needle & horizontal force: at $8\frac{1}{2}$ P.M. fine aurora, forming at 9 P.M. an arch passing nearly through the zenith, with many fine streamers; those at the E. & W. being the largest: at $9\frac{1}{2}$ P.M. aurora reduced to indefinite light: no streamers: beginning to cloud up.

617

May 16

9³/₄

Extensively cloudy with cirro-cumulus clouds: spot $\times$ could not be made out, though the definition was pretty good: in its place there are many faculae: clouds increasing, but apparently promising to clear off about 4 $\frac{1}{2}$ P.M.

1873

May 16

when the sun came out: unusually good seeing with the telescope: a group of spots forming towards the eastern limb of the sun, near the equator: faculae seen very sharply: so also the rice grains, which were round & reached the very edge of the penumbra of spot a, except on the north, where a facula encroached on the spot: a few drops of rain about 6 $\frac{2}{3}$ P.M., with distant thunder: clear in the evening: about 5 $\frac{3}{4}$ P.M. a magnetic disturbance began: between 9 & 11 P.M., aurora without streamers.

618 May 17 9 $\frac{1}{2}$ Extensively cloudy with heavy cumuli: wind N.W.; some drops of rain about 8 [P.M.?

619 May 18 11 $\frac{1}{4}$ Extensively cloudy with cumuli: a little shower about 8 $\frac{1}{2}$ [A.M.?): wind N., strong: a smaller & separated into two: a very small new spot, b, has appeared since yesterday.

620 May 19 10 $\frac{1}{4}$ Clear from sunrise to about 7 A.M., then cloudy: about 10 A.M. sun occasionally seen in gaps between clouds: wind N.W.: spot [a] much smaller: growing clearer: about 4 P.M. the clouds did not cover more than two tenths of the sky: at 4 P.M. spot b no longer visible & nothing left of a but a little pore seen only by attentive observation: I never saw so few spots on the disk before.

1873

May 19

the protuberances were drawn at 4 P.M. :
between 8 & 9 P.M. magnetic disturbance :
about 11 P.M. faint auroral light.

621 May 20 9 $\frac{1}{4}$

Clear; no clouds; wind N.E. : a scarcely
visible δ is now only a little pore; ϵ has
disappeared : c is a little group of two
small spots which has appeared since
4 P.M. May 19 : at 3 P.M. spot c had
already considerably increased & consisted
of two groups arranged as in small annexed sketch.

622 May 21 9 $\frac{1}{4}$

Clear at sunrise, but cloudy in the horizon
about 8 A.M. δ at 9 A.M. clouding over
everywhere : spot c , which was larger yesterday
afternoon, is now only a very small double spot :
only two small groups of faculae seen on the sun :
too cloudy to see protuberances : wind E.S.
E. all day : ^{cirrus} clouds increasing : at 6 P.M.
wholly overcast : about 10 P.M. fine rain,
continuing all the following night.

May 22

Wholly cloudy; wind S. S. E. : a little
clearer at sunset; stars visible : soon
cloudy again.

623 May 23 9 $\frac{1}{4}$

Heavy cumuli over half the sky : wind S.,
very light : faculae in place of spot c , which
is no longer visible : groups a & b are new,
and appeared since the evening of May 21 : half
cloudy all day : growing cloudier about 5 P.M. :
clearing off about 9 P.M. : aurora with some

1873

May 23

streamers seen: at 10 P.M. a pale red streamer in the true north: about midnight wholly cloudy.

624 May 24 9²/₃ Clouds over only third of the sky, & the rest somewhat hazy, wind W.S.W.: the double spot on the E. of group a is filling up: the northern umbra is almost wholly occupied by faculae: c is a small new group: at 3¹/₂ P.M. thunder shower, little rain: one hour later sky perfectly clear & wind had shifted to W.: about midnight slight magnetic disturbance.

625 May 25 12 Morning clear: clouding up at 10 A.M. with heavy cumuli, almost continuous: sun seen only a few moments, & the sketch is not very accurate respecting the places of the spots, but cannot be far wrong: weather very fine afternoon & sky blue, but sun not examined again with the telescope: great changes since yesterday: groups b & c larger: d is a new group.

626 May 26 Morning fine & clear: about 9 A.M. many cirrus clouds gathering: I am not sure whether or not the spots have changed since yesterday, the sketch of May 25 being very imperfect: no protuberances seen, the cirrus cloud being already rather thick: soon afterwards it dispersed & the sky

1873

May 26

became clear again, except for rather numerous cumuli: protuberances seen at 2 P.M.; about 12½ P.M. abnormal movement of magnetic declination needle.

627 May 27 9½

Clear, calm: wind S. S. W.: group d somewhat smaller: spot on the east of group a filling up: b & c larger: e is a new group: under the two spots of group a the Spectroscope shows a black line wider than line C & crossing it: this is not visible with the telescope.

628 May 28 9½

Morning fine: about 10 A.M. much light cirrus cloud: wind rather strong: group d has now only its western spot: b, c, e, larger: a somewhat smaller: a little below group a, at the place marked on the sketch, the spectroscope still shows a dark spot wider than the spectrum line C, & crossing it: nothing can be seen in this place with the telescope alone, but the definition is bad today: at 3 P.M. the cirrus cloud was growing thicker: spot d no longer visible: about 4½ P.M. thunderstorm: little rain.

629 May 29 9½

Much cirrus cloud in the morning: sky wholly clear at 9¼ A.M.: groups b & c have fewer spots & are smaller: e larger: at 9 A.M. magnetic disturbance of declination needle: group f is new: about 8 P.M. magnetic

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May 29

disturbance of horizontal force & declination
needle: at 9 P.M. auroral light without
streamers: at 10 $\frac{1}{2}$ P.M. magnetic declination
needle oscillating over 159 divisions of the scale.

630 May 30 12 $\frac{1}{4}$

Morning wholly cloudy: wind N.W.: at
9 A.M. magnetic disturbance of declination needle:
about 11 A.M. sun seen in large gaps
among clouds: then cloudy again till 2
P.M.: then clear in places about 2 $\frac{1}{2}$ P.M.:
groups a, b, c, smaller: e, f, larger: g, h, new:
total spotted surface less: seeing too bad
to observe protuberances.

631 May 31 9 $\frac{1}{2}$

Fine & calm, but seeing extremely bad:
a sort of haze in the atmosphere: wind
E.S.E.: groups a, c, e, smaller: b, g, as
yesterday: f larger: total spotted surface
only $0\frac{3}{10}$ less than yesterday: spot h not
seen, but with such bad definition it
would be invisible if it was still on
the disk: below group a there is still seen
with the spectroscope an elongated dark
mass crossing line C & spreading over
the spectrum on each side of it: this mass
is a little farther to the right than on May
26 & 27: the shape it must have is sketched
by the mark + on the sketch. Cloudless all
day & following night: between 8 & 10 P.M.
magnetic disturbance: no auroral light

1873

May 31

seen, the moon being already bright. Spot k must have been on the disk, as it was seen again next day.

632 June 18⁷

Clear: no clouds: definition bad: wind W. S. W., light: group b has disappeared: groups a, e, g, & especially f, larger: spotted surface 16 units larger: the protuberance marked + seemed much less red than the others near it: it was very plainly orange yellow, while the others were the color of the spectrum: this effect of color lasted at most two minutes, after which this protuberance seemed of the same tint as the others. Was this an illusion?

633 June 2 9¹/₂

Much cirrus cloud: wind S.E.: at 9 A.M. magnetic disturbance of horizontal force: groups c, e, f, g, smaller: a larger: k new: total spotted surface less: cirrus clouds & east wind all day: magnetic disturbance in the evening & also auroral light, seen only through a very small gap in the clouds: wholly cloudy about 9 P.M.: about 9 A.M. the magnetic declination needle moved abnormally; at 9 P.M. magnetic disturbance & faint auroral light among clouds in the N. [as already stated]

634 June 3 9¹/₂

Cirrus clouds over whole sky: sun seen with much difficulty: perhaps some small spots escaped observation: wind E., light.

1873
June 3

Groups a, c, smaller: g no longer visible:
k a little larger: spotted surface less than
yesterday: cloudy till 5 P.M., when the wind
shifted to S.E. & it cleared off a little,
especially in the N.: sun visible under
clouds: group k considerably enlarged
since morning: at 10 $\frac{1}{4}$ A.M. irregular
movement of magnetic declination
needle; at 6 P.M. a magnetic disturbance began.

635 June 4 11 $\frac{1}{12}$ Cloudy all the morning, wind S.W., strong: at
about 11 $\frac{1}{2}$ A.M. the sun became somewhat
visible under thick clouds, soon becoming
invisible again: about 2 $\frac{1}{2}$ P.M. it cleared
off a little, & the sun could be well seen:
group a smaller: c no longer visible: groups
e, f, k, larger, especially k: m & n have
appeared since yesterday: spotted surface
12.5 units larger than yesterday: evening
cloudy: a little rain in the evening & following night.

636 June 5 10 $\frac{3}{4}$ Wholly cloudy till 10 $\frac{1}{2}$ A.M., when the sun
could be seen under the cirrus clouds occupying
the whole sky: groups f & m smaller: spot a
has disappeared: e, k, n, a little larger: total
spotted surface less than yesterday: wind E.S.E.:
clearer after noon, with some whitish
cloudiness: evening clear, but about 8 $\frac{1}{2}$
P.M. definition very bad: at 9 P.M. magnetic disturbance of declination
needle & horizontal force: probably auroral light, but moon too bright to see it.

1873

637

June 6

9⁵/₆₀

Fine; slight cloudiness about the horizon: morning foggy: wind E., light: spots m & n have disappeared: the three groups r, s, t, are new: e, f, p, larger: spotted surface increased: definition bad: becoming cloudy after noon, clearing up in the evening: lightning in the north horizon: slight magnetic disturbance about 9 P.M.

638

June 7

Morning cloudy; a little rain between 7 & 8 A.M.; wind N.: partly cleared up afterwards: spots t & p have disappeared; groups e, f, k, smaller: r, s, larger: spotted surface less.

639

June 8

1¹/₂

Morning cloudy with rain: sun somewhat visible under clouds: wind N.E., strong: afternoon fine: these spots were not projected as usual, but simply seen with my telescope, and placed upon the sketch by aid of the projections of June 7 & 9: as their magnitude is consequently only estimated, they have not been measured.

640

June 9

9¹/₃

Fine; cloudless: wind E. N.E.: group e & r have disappeared: all the others smaller: t is new: clear all day, evening cloudy: slight magnetic disturbance about 9 P.M.

641

June 10

8⁵/₆

Sky almost wholly occupied by light cirrus cloud, under which the sun can be seen: wind N.W.: seeing bad: group s has disappeared: groups f, k, t, smaller: u is a new spot: spotted surface less: a characteristic protuberance over group s, which has passed off: rather clear all day; growing cloudy in the evening.

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642 June 11 2½ Rain all the morning; wind W.S.W.: about noon signs of clearing up, & at 11 P.M. the Sun was occasionally visible among the numerous clouds; a single spot is visible: f, u, & t, have disappeared: spotted surface less: slight magnetic disturbance about 9 P.M.

643 June 12 9½ Fine, calm, cloudless: seeing bad.

644 June 13 9¼ Fine, almost cloudless, with some cloudiness in the horizon: wind E.: sun's surface entirely free from spots: not the smallest pore visible: only three small groups of faculae: aurora & magnetic disturbance between 9 & 11 P.M.: beginning to cloud up at midnight.

June 14 Extensively cloudy with rather thick cirrus cloud, under which however the sun can be seen pretty well: about 10 A.M. I could not see any spot on the sun: wholly cloudy after 4 P.M.: a little very fine rain in the evening.

645 June 15 10 Fine; wind W.: some cirro-cumulus clouds: no spot visible: only some faculae: rather bright auroral light between 9 & 10 P.M.

646 June 16 9½ Fine, wind W.: only some cumulus clouds: two small groups have made their appearance: magnetic disturbance & presumably auroral light about 9 P.M., but the northern sky was wholly cloudy: afterwards it clouded over entirely: distant storm with lightning, but no thunder heard: a little rain for ten minutes.

1873

June 16

Fine shooting star about 9 P.M., visible about a second, passing horizontally from S. to N. in a decidedly undulating path, leaving a train.

647 June 17 9⁵/₁₂ Fine: a few cumuli: wind W.: b is the only spot visible: a is no longer to be seen: three groups of faculae.

648 June 18 9 Fine: some cirrus cloud: wind N., light: spot b no longer visible: spot c has appeared: over it there are eruptive protuberances: much cirrus cloud in the evening: rather bright auroral light between two clouds in the N. about 11 P.M.

649 June 19 9¹/₄ Much light cirrus cloud: wind W. S. W., light: groups e & d have appeared since yesterday: magnetic disturbance at 10³/₄ P.M.

650 June 20 9¹/₄ Fine & hot: wind N. N. W.: about 9 A.M. great cumuli gathered and covered much of the sky: at 9 A.M. the magnetic declination needle stood at least 8 divisions farther east than is usual at this time: the great spot f has appeared during the night: about 10 A.M. the sky was quite cloudless.

651 June 21 9¹/₃ Fine: only a few little cumuli: wind N.: group e is filled up: evening cloudy: at 9 P.M. bright light in a small gap in the clouds just on the northern horizon, due no doubt to an aurora.

652 June 22 10 Very fine: only some light cumuli: wind S.:

1873

June 22

definition bad: facula pretty well seen
about 20° from the centre of the sun: fine
 all day & evening: some shooting stars
 between 9 & 10 P.M. 65

653 June 23 9½ Fine: sky clear: wind S.: spot g is new:
in the evening magnetic disturbance &
rather fine aurora without streamers between 9 & 10 P.M.

654 June 24 9½ Fine: sky clear: only a few light cumuli:
 wind S.S.W., light: group c smaller: d, f,
 larger: four groups of faculae, three of
them very bright, extending to the border
& projecting as flames: magnetic disturbance
in the evening & aurora 9 P.M. to midnight.
Chromosphere very thin in a place marked on the sketch.

[On the back of No. 654 are, as usual, drawings
 of protuberances. These are dated June 25, and
 one of them has the following note:] the clouds
in the rear are extremely thin & transparent,
consisting of delicate scarcely luminous vapor:
those in front are bright. 65

655 June 25 9½ Clear & cloudless, though the hardly perceptible
 wind is E.N.E.: horizon misty: slight
 magnetic disturbance between 8½ & 9½ P.M. 66

656 June 26 9⅔ Rather fine, some cirrus cloud: wind N.S.W.
 Many lateral spots, as s, n, m, k: at 9 P.M.
 slight magnetic disturbance of declination needle: between 10
 & 11 P.M. brilliant aurora, with streamers, & irregular flashings
 occurring at unequal intervals often of several

1873

June 26

minutes each, and in sets of 2 or 3, or even 5 or 6 flashings in close succession, followed by quiet intervals.

657 June 27 9 $\frac{1}{4}$

Much of the sky occupied by light cirrus cloud; beneath which however the sun is well seen: wind W. S. W., light; at 3 P.M. spot & filling up: slight magnetic disturbance in the evening: aurora without streamers at 9 P.M. & later: still visible at 11 $\frac{1}{2}$ P.M.

658 June 28 9 $\frac{5}{12}$

Much of the sky occupied by cirro-cumulus cloud: wind [not stated]: Spot & closing: many small spots opened since yesterday: distant storm about 1 P.M.: a little rain: also a little rain in the evening. [On the back of No. 658, besides sketches of protuberances, with date of June 29, is a sketch marked] facula north of & near spot &: [the date of this is no doubt June 29.]

659 June 29 9 $\frac{1}{4}$

Sky half covered by cirro-cumulus cloud: wind S. W.: thunderstorm about 2 P.M.: (faint aurora in the evening, by meteorological record of Harvard College Observatory.)

660 June 30 9 $\frac{1}{4}$

Almost wholly cloudy with cirro-cumulus cloud: wind S. S. W.: seeing too bad to make out the protuberances: magnetic declination needle very abnormal in its movements: cloudy all day with clear intervals: group u rapidly developing: its form, that of an inverted figure 6, is drawn on the back of No. 660: about 9 P.M. wholly cloudy: a little fine rain in the following night.

1873
July 1

Cloudy with light rain much of the day: sun however repeatedly visible, but not long enough at a time to be drawn by projection: I had time to see the spots, which were little changed, except that group u was larger.

661 July 2 $8\frac{2}{3}$ Fine; a few cumuli; groups c, d, m, v, have disappeared since June 30. At $3\frac{1}{2}$ P.M. group u was rapidly enlarging; evening wholly cloudy.

662 July 3 11 Storm in the morning with thunder, lightning, and rain. Group f has disappeared. Evening cloudy: a little rain in the following night.

663 July 4 $9\frac{1}{6}$ Morning cloudy; cleared up a little about $8\frac{1}{2}$ A.M.; many cirro-cumuli; wind S.

664 July 5 $9\frac{1}{12}$ Sky more than half covered by strato-cumuli and cirro-cumuli; wind S.W.; clouds increasing after noon; evening wholly cloudy with large quickly moving cumuli.

665 July 6 $9\frac{5}{12}$ Fine; a few cumuli; wind N.W.; spot g has disappeared; three clouds around group u, which strongly absorb the light.

666 July 7 $10\frac{1}{4}$ Rather fine; a few cumuli; wind E.; seeing bad. (Cincinnati, July 8. Despatches received from various points in Southern Ohio and Southern Indiana report the continuance of very heavy rains.)

667 July 11 $10\frac{3}{4}$ Wholly cloudy; sun only seen a few moments; rest of the day cloudy; sun repeatedly appeared

1873

July 11

for a moment at a time; wind E.; a few drops of rain about 1 P.M.; storm with rain after 6 P.M.; still raining late in the evening; afterwards cleared off. Illness of observer prevented sketches being made between July 7 and 11.

668 July 12 $9\frac{1}{2}$ Fine; a few cirro-cumuli; wind N.W.; groups b and w have disappeared.

669 July 13 $9\frac{2}{3}$ Much cirro-cumulus cloud; wind S.W.; rather fine aurora about 10 $\frac{1}{2}$ P.M. [Following notes on back of sketch, with drawings of protuberances of July 14.] Protuberance at 270 f as wide as the spectrum; one at 311 p a little more than half as wide as the spectrum.

670 July 14 $9\frac{1}{2}$ Rather fine; many light cirri; wind S.W.; group b obliterated; afternoon and all the evening cloudy. Black spots on line C near group c.

671 July 15 $9\frac{1}{3}$ Fine; calm; a few cumuli; wind N.W.

672 July 16 $9\frac{1}{6}$ Fine; no clouds; wind N.; definition bad; magnetic inclination needle disturbed; evening cloudy; a little rain in the latter part of the night following.

July 17

Wholly cloudy; slight disturbance of magnetic declination needle about noon; rain began falling at 1 P.M. and continued this afternoon and all the following night.

1873

July 18
July 19

Light rain all day, wind E.
Rainy and cloudy all day, sun seen for about
one or two minutes only about 6 P.M.; continued
cloudy till next morning.

673 July 20

Fine; all the groups visible July 16 have
disappeared or become obliterated; two
new groups visible today; very few
protuberances; chromosphere very deep on
the preceding side between 260° and 280°
west; rather bright aurora between 9
and 10 P.M., with dark segment and
with streamers.

674 July 21 $9\frac{1}{2}$

Sky half covered with cirro-cumuli; wind
W.; not clear enough for observations with the
spectroscope.

675 July 22 $9\frac{1}{3}$

Fine; wind N.W.; the most western spot
of group e wholly covered with light
vapors like cirrus clouds; and in places
above them flocculent clouds closely resembling
"rice grains". The "rice grains" are much
more conspicuous today than usual,
being very easily seen.

676 Aug. 4

Observer absent for vacation between last
date and this. Sky about one third
covered with cirro-stratus cloud; about
9 P.M. faint auroral light; magnetic
disturbance at the same moment.

677 Aug. 5 $9\frac{1}{2}$

Fine; a few cumuli; wind N.W.; Spot b

1873

Aug. 5

not visible today. [Following note on back of sketch refers to a protuberance of Aug. 6.] Transparent allowing the chromosphere to be seen through it.

678 Aug. 6 $9\frac{1}{6}$

Fine; horizon hazy; seeing very bad; spot g has disappeared; groups K, K, are new.

Transparent protuberance [seen Aug. 8, according to note on back of No. 678.]

679 Aug. 7 $10\frac{3}{4}$

Wholly cloudy; sun came out for a few moments about 11 A.M. sufficiently to be seen beneath the haze; rest of the day cloudy with occasionally a few drops of rain; sun at times imperfectly visible; wind S.W.; magnetic declination needle moving irregularly all day.

680 Aug. 8 $9\frac{1}{3}$

Fine; much cirrus cloud and haze; one quarter of the sky covered with cumuli; definition bad. Spot d has disappeared; the spots seen in its region today have been formed since yesterday; there are two small lateral spots in penumbra b.

681 Aug. 9 $9\frac{1}{4}$

Fine, calm; wind N., light. Some fine meteors seen between 9 and 10 P.M.; the first, which descended in the south, moved very slowly in a sinuous and irregular path; almost all the meteors were large and left phosphorescent trains.

682 Aug. 10 $10\frac{1}{3}$

Fine, calm. About $10\frac{1}{2}$ P.M. two large shooting stars some seconds apart in

1873

Aug. 10

their time of appearance; their paths were parallel; the first left a long train.

683 Aug. 11 9 $\frac{1}{2}$

Much cirro-cumulus cloud and haze; seeing bad; wind E. N. E.; spot a has disappeared; lateral spot c obliterated.

684 Aug. 12 9 $\frac{1}{2}$

Sky almost wholly covered with light cirro-cumulus clouds, among or beneath which the sun is at times seen pretty well; wind N. E.; between 9 and 11 P.M. rather bright auroral light. [Following note below the sketch.] Chromosphere excessively thin at 197°.

685 Aug. 13 9 $\frac{1}{2}$

Wholly cloudy; wind E.; sun seen for a moment at a time with difficulty under the clouds; clouds less heavy after noon; magnetic disturbance about noon.

Aug. 14

Wholly cloudy; wind N. E.; fine rain; heavy and continuous rain after noon and in the evening.

Aug. 15

Cloudy all day; sun not to be seen; wind N.; some stars visible following night; clouded over again afterwards.

686 Aug. 16 10 $\frac{1}{2}$

Wholly cloudy in the morning, with fog; wind S. S. W.; afterwards the sun came out, disappeared, and came out again.

Aug. 17

Sunday; observer absent, but observed sun

1873

Aug. 17 with small telescope at home; same spots
seen as Aug. 16, except small group e,
too small to be seen with the telescope used.

Aug. 18 Cloudy all day; fine rain after noon;
wind E.; magnetic declination needle
unsteady all day; rain following night.

687 Aug. 19 $2\frac{5}{12}$ Cloudy all the morning; after noon,
the wind shifted to W., and the
sun came out; evening cloudy.

Aug. 20 Cloudy.

Aug. 21 Cloudy with rain, day and following night.

Aug. 22 Cloudy with rain.

688 Aug. 23 $9\frac{1}{2}$ Fine; half the sky covered with
cirro-cumuli. Groups b, c, d, g, e
have disappeared or closed up. All
the groups seen today are new except group f.
Rather fine aurora during the evening.

689 Aug. 24 $11\frac{5}{12}$ Fine; wind N., strong. Spot m not to be
seen; spot s is new. Rather fine
aurora in the evening. (Storms and
foul weather in America and Europe.)

690 Aug. 25 $9\frac{1}{3}$ Fine; calm; wind N. W.; definition bad;
group s scarcely to be seen; movement
of one spot of group n; rather fine
aurora in the evening, with some red
and white streamers; magnetic disturbance
during the aurora.

691 Aug. 26 $10\frac{3}{4}$ Sky much overcast in the morning;

1873
Aug 26

nearly clear after noon; magnetic disturbance during the morning; in the evening magnetic disturbance and aurora with streamers.

- 692 Aug. 27 $9\frac{1}{3}$ Fine, calm, cloudless; definition bad.
- 693 Aug. 28 $9\frac{1}{3}$ Sky half covered with light cirri; wind N., light; definition bad; in the evening magnetic disturbance and faint auroral light; sky covered with undefined cloudiness.
- 694 Aug. 29 $9\frac{1}{12}$ Almost wholly cloudy with cirro-cumulus and stratus cloud; definition bad; the spectroscope not available; afternoon clearer, with S.W. wind; sun then observed with the spectroscope.
- 695 Aug. 30 $2\frac{1}{12}$ A little rain about 5 and 6 A.M., afterwards cloudy; sun somewhat visible under clouds about 11 A.M.; somewhat clearer after noon, but with light cirri wherever the sky was not occupied by cumuli; spectroscope not available; magnetic disturbance observed about 1 A.M.

Aug. 31

Cloudy all day; a little rain between 2 and 3 P.M.

- 696 Sept. 1 $9\frac{1}{6}$ Hazy, with much cirro-stratus and cumulus cloud; wind E.; definition too bad to allow of seeing the protuberances; group f has disappeared; wind shifted

1873

Sept. 1

to S. at 2 P.M., the sky became wholly cloudy, and a magnetic disturbance produced oscillations of the declination needle extending over 10 divisions; a slight retrograde movement of the declination needle was going on all the evening, still continuing at 11 P.M.

697 Sept. 2 9¹/₆

Fine, calm; a few cumuli only; wind W.

698 Sept. 3 9¹⁷/₆₀

Much light cirrus cloud; wind W.; groups n, p, have disappeared; y cannot be seen; spot z appeared last night; in the afternoon the cirrus cloud became thicker and covered much of the sky; much of the sky overcast in the evening.

699 Sept. 4

3¹/₁₂

Rainy, rain beginning early; wind E. S. E.; rain lasted all the morning; almost all the groups are smaller; towards noon the wind shifted from E. S. E. to S.; the sun came out a little about 3 P.M.

700 Sept. 5 9⁵/₁₂

Fine; only a few clouds; but the sky is whitish blue, and the seeing so bad that the chromosphere could not be seen with the spectroscope; seeing somewhat better at 2 P.M., when some protuberances were seen; storm, with thunder, lightning, and rain, between 6 & 8 P.M.; magnetic disturbance at 9 P.M.

1873

- 701 Sept. 6 $9\frac{5}{12}$ Fine; a few cumuli; spots v, b, c, have disappeared.
 [Following note on back of this sketch refers to a protuberance of Sept. 7.] Base upon this side [of the limb] and transparent.
- 702 Sept. 7 $8\frac{23}{60}$ Fine; cool; wind N.; sky nearly cloudless; group t has disappeared; group x is larger; slight magnetic disturbance at 8 A.M.
- 703 Sept. 8 $9\frac{1}{6}$ Much Cirro-cumulus cloud; wind N.N.W.; too much diffused light from clouds to allow the use of the spectroscope; spot a has disappeared; observer absent on account of illness from this date to Sept. 12.
- 704 Sept. 12 $9\frac{3}{4}$ Clear, calm; seeing magnificent.
- 705 Sept. 13 $10\frac{8}{60}$ Morning wholly cloudy; wind S.; sun seen among clouds for a few seconds about 10 A.M.; sky almost clear at $10\frac{2}{3}$ [A.M. or ~~more likely~~ P.M. ?] [Probably A.M.; prominences were sketched]
- Sept. 14 Cloudy all day; a little rain in the morning; clearing off at sunset; evening clear; rather fine aurora between 8 & 10 P.M.
- 706 Sept. 15 $9\frac{18}{60}$ Clear; calm; cold.
- 707 Sept. 16 $9\frac{3}{4}$ Morning cloudy; about $9\frac{2}{3}$ A.M. the sun came out from time to time between the cumuli in rather large open spaces; wind S.S.W.
- 708 Sept. 17 $9\frac{3}{4}$ Calm; nearly cloudless; but seeing bad on account of some light cirrus cloud scarcely visible; spots a, e, g, invisible; magnetic disturbance about 90 P.M.

1873

709 Sept. 18 $9\frac{1}{2}$ Rather clear, with some light cirrus cloud spreading and thickening; magnetic disturbance about 10 P.M.

Sept. 19 Cloudy all day; rather heavy rain from noon till evening; at 9 A.M. magnetic declination needle 7 or 8 divisions west of its ordinary place. (Terrible storm in Florida Friday morning, Sept. 19.)

710 Sept. 20 $9\frac{25}{60}$ Almost wholly cloudy, except on the N. W. horizon; wind N. W.; sun sometimes visible through clouds; group of much smaller; a, b, c, not to be seen; k also smaller; so too m; at 9 A.M. magnetic disturbance of declination needle, which was west of its regular place; after noon sky not over one quarter cloudy; protuberances sketched at 2½ P.M.; spots p and q seen at that time, not seen in the morning; magnetic disturbance about 9 P.M. [Note following from back of sketch, refers to a protuberance of Sept. 21.] Width of the spectrum.

711 Sept. 21 $10\frac{2}{3}$ Clear; fine; no clouds; group p obliterated; at 8 P.M. auroral light, and magnetic disturbance, the needle being about 12' east of its regular place, clouds rapidly increasing and hiding all the stars; clear again two hours later.

712 Sept. 22 $9\frac{1}{6}$ Cloudiness increasing; too much of it to

1873
Sept. 22

allow protuberances to be seen; wind N.W.E.; small spots c, n, k, obliterated; a fine group, s, on the eastern limb; its spectrum could not be seen.

Sept. 23

Cloudy all day; sun visible for a few moments about 3 P.M.; observer in Boston at that time and accordingly could not make observations; rain began about 1 P.M.; all following night rainy and foggy.

713 Sept. 24 3

Morning cloudy; clearing off after noon; group f has disappeared; groups u, t, v, have been formed since Sept. 22; heavy fog [following?] night.

714 Sept. 25 9 $\frac{1}{4}$

Much cirrus cloud; protuberances could not be seen in the morning; sky less covered with cirrus cloud after noon; protuberances and small group x seen at 2 $\frac{1}{2}$ P.M.; clouded up entirely at 9 P.M., with fog; slight magnetic disturbance at the same time; needle on the mean of its oscillation west of its regular place. [Following note from back of sketch refers to a protuberance of Sept. 26.] A little wider than the spectrum.

715 Sept. 26 9 $\frac{25}{60}$

Cloudless, sky magnificent; calm; wind W.; at 9 A.M. magnetic needle 3' east of its regular place; faint aurora seen at 8 $\frac{1}{2}$ P.M.; magnetic disturbance [at same time.] [Note on back of sketch referring to Sept. 27 as follows.] Umber of spot s turned towards centre.

1873

716 Sept. 27 9 $\frac{1}{4}$ Clear; calm; cloudless; group m obliterated; magnetic disturbance at 9 P.M. [Following note from back of sketch.] Group z, y, x, Sept. 27, has a facula extending from one spot to the other.

717 Sept. 28 9 $\frac{1}{6}$ Rather clear, with some whitish cloudiness, diffused in the atmosphere; definition bad, doubtless on this account; groups r and q have reached the western limb; q should still be in sight, but was not seen, doubtless on account of the bad seeing; magnetic disturbance about 8 P.M.; the light shadings southeast of groups x, y, z, were not seen with the telescope, but appeared in the spectroscope in the form of lines darker than the absorption line C, their size and shape being nearly as on the sketch.

718 Sept. 29 9 $\frac{35}{60}$ Almost wholly cloudy; wind S.W.; sun occasionally visible; all the groups smaller; group a has come on by the sun's rotation; groups b, c, d, formed since yesterday; group d doubtless belongs to the same set of spots as the r & q of Sept. 27; protuberances not to be seen; cloudy all day; sun seen at times; wind very strong after noon; light rain beginning about 8 P.M. and continuing all the night following.

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719 Sept. 30 $9\frac{2}{3}$ Almost wholly cloudy; sun seen only under thick clouds and at long intervals; group d invisible; at 9 A.M. magnetic disturbance; mean position of needle west of its regular place; wind N., rather strong; cloudy all day, sun sometimes but seldom coming out; faint auroral light about 10 P.M.

720 Oct. 1 $9\frac{22}{60}$ Almost cloudless, but seeing very bad; wind N.; magnetic disturbance at 6 A.M.; needle at 9 A.M. west of its regular place; Slight magnetic disturbance eastwards at about 9 P.M. and perhaps faint auroral light; moon too bright to make sure.

721 Oct. 2 $9\frac{1}{6}$ One fifth of the sky occupied by cirro-stratus clouds; wind W.N.W., very light; It has disappeared; groups s and z are smaller; spot c, which has been diminishing, forms today a small group; magnetic disturbance westwards about 9 P.M.; wholly overcast with light semi-transparent cloudiness.

722 Oct. 3 $9\frac{1}{3}$ Partly Cloudy at sunrise; at 9 P.M. only horizon somewhat cloudy; wind W.

723 Oct. 4 Wholly cloudy, wind N.; [direction of wind from note on No. 722;] continued cloudy from early in the day till $9\frac{1}{2}$ A.M.; sun then seen under very thick clouds for a few moments at a time; sketch made, but it probably

1873
Oct. 4

shows only the large spots, as no doubt small spots could not be seen; sun wholly disappeared at $9\frac{3}{4}$ A.M.; cloudy all day and following night. Measurement of spotted area probably deficient from want of small spots which could not be seen.

724 Oct. 5 $10\frac{42}{60}$

Rain about 5 A.M. continuing with intermissions till 9 A.M.; at $10\frac{1}{2}$ A.M. the sun seen at times between the clouds; wind S.S.W.; earlier in the day S.S.E.; a shower about 11 P.M.; afterwards half clear, and half cloudy with large cumuli; at 8 P.M. perfectly clear. Comparison of spotted areas of today and yesterday worthless on account of the impossibility of seeing the small spots yesterday, owing to clouds.

725 Oct. 6 $9\frac{12}{60}$

Three quarters of the sky covered by Cirrus cloud sometimes thick enough entirely to hide the sun; wind S.W., very light; group c not seen, although it cannot have gone off the limb yet; group e came on in the course of the day yesterday; slight magnetic disturbance at 9 A.M.; sun disappeared about 2 P.M. and the clouds thickened more and more; about 8 P.M. distant storm on the northern horizon, with thunder and lightning; rain at about 11 P.M., continuing all the night.

1873

Oct. 7

Rain; wind N.N.E., very strong; weather very stormy; at 9 A.M. magnetic disturbance eastwards; rain almost all the forenoon, with less wind; rain all the afternoon; following night cloudy. (London, England, Oct. 7. The weather throughout England is wet. Thunder and lightning in England.)

726 Oct. 8 9¹²/₆₀

Wholly cloudy, clouds so thick that it was difficult to get a projection; group f could not be projected, so that its position is not as exact as could be wished; this group could be seen only by looking through the telescope; magnetic declination needle much agitated in a vertical direction; at 3¹/₂ P.M. the cirrus cloud became thinner and the sun could be seen pretty well beneath it; group d, which could not be seen this morning, has been placed upon the sketch in the position it should have occupied at 9¹²/₆₀ A.M.; clouded up again entirely after sunset; at 10 P.M. wholly clear; strong magnetic disturbance eastwards at 10 P.M.

727 Oct. 9 9¹²/₆₀

Perfectly clear; wind N.N.E., pretty strong; faint aurora between 8 and 9 P.M.; magnetic disturbance eastwards from the regular place [of the declination needle.]

728 Oct. 10 9¹/₄

Clear; groups d, g, h, have disappeared.

1873
Oct. 10

By observation with the Spectroscope, oblique rays were seen proceeding from the group of protuberances at 100° on the eastern or following limb of the sun. These rays were inclined towards the north. They did not all appear together; that nearest to the equator was first seen, at $9\frac{23}{60}$ A.M., local time. It lasted about 40 seconds. Another ray a little more to the south appeared at $9\frac{24}{60}$ A.M.; it started from the spectrum as sketched, [see sketch on back of No. 728,] and did not touch the edges of the slit, and was removed some distance from it towards the violet. This ray lasted about 30 seconds. Afterwards some shorter rays appeared & at $9\frac{2}{3}$ A.M. the most southerly ray showed itself, after which the phenomena disappeared. No change was made in the Spectroscope during the time, about 15 minutes, for which this phenomenon lasted; and the disappearance of the first ray and appearance of the second more towards the south was observed without any alteration whatever in the instrument. After observing the second ray, the spectroscope was directed to other parts of the sun, where nothing

1873

Oct. 10

of the same sort, was seen. On returning to the same place the rays were still seen, but changed in position as above described. The slit of the spectroscope was very wide, so that it took in the whole height, near $2'$ of arc, of the group of protuberances. The ray was invisible, to the best of the observer's recollection, in the space visible between the edges of the slit as seen in the spectrum.

It began at the edge of the slit nearest the violet end of the spectrum, and crossed the spectrum obliquely, at an angle of about 50° in the case of the first ray. It was narrowest at its origin and widened out as it proceeded farther from the slit, becoming more diffused at the same time. The rays were very well seen and well defined.

729 Oct. 11 9³⁵/₆₀ Fine; cloudless; wind N.; clouded up entirely in a few minutes at 9 $\frac{1}{2}$ P.M.; at 7 P.M. strong magnetic disturbance eastwards, still continuing, but not so strong, at 9 $\frac{1}{2}$ P.M.; auroral light at 8 P.M.

730 Oct. 12 11 $\frac{1}{6}$ Morning cloudy; cleared off suddenly at 10 $\frac{1}{2}$ A.M. and scarcely any clouds were left at 11 $\frac{1}{2}$ A.M.; clouded up entirely about 4 P.M. and so continued during the following night.

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- 731 Oct. 13 $9^{\frac{12}{60}}$ Wholly cloudy at sunrise; at 8 A.M. no clouds except a few on the horizon; wind N.N.W., strong; group b has disappeared.
- 732 Oct. 14 $9^{\frac{5}{12}}$ Morning wholly cloudy; clearing fast at $9^{\frac{1}{2}}$ A.M., but seeing very bad.
- 733 Oct. 15 $9^{\frac{22}{60}}$ No clouds, but rather thick smoky haze over the whole sky; slight fog in the evening, becoming thick in the night following; magnetic disturbance at 9 P.M.
- 734 Oct. 16 $9^{\frac{1}{2}}$ Thick fog in the morning dispersing as the sun got higher, but the sky continued hazy, especially at the horizon; some stratus cloud; clouding up more and more about 4 P.M.; wind S.W., strong; cleared off a little about 10 P.M., but clouded up again in ten minutes, and a few drops of rain fell about 11 P.M.; magnetic needle farther west than usual, and remarkably steady, as it was all the day.
- 735 Oct. 17 $9^{\frac{18}{60}}$ Clear and cloudless; wind N., rather strong; magnetic disturbance westwards at 9 A.M.; clear all day and evening; magnetic disturbance at $9^{\frac{1}{2}}$ P.M.
- 736 Oct. 18 $9^{\frac{8}{60}}$ Heavy fog by morning; sun seen for a while between 8 and 9 A.M.; wholly cloudy at $9^{\frac{1}{4}}$ A.M.; wind S.E., light. Group c should still be in sight on the

1873

Oct. 18

limb, but was not seen; partly clear at
 M.A.M. when group k was seen, smaller; group
 m has come on since yesterday; at 3½ P.M.
 clouded up completely; wind E.; evening cloudy,
 clearer for half an hour at 9½ P.M., then wholly cloudy.

737 Oct. 19 10³⁸/₆₀

Wholly cloudy; sun seen with difficulty for
 a few moments; heavy fog, last part of
 previous night; group k larger but more
 broken up than yesterday; sun occasionally
 visible till 2 or 3 P.M.; afterwards wholly
 cloudy; rain beginning about 4 P.M. and
 continuing more or less heavy through
 the following night.

Oct. 20

Rainy; wind E.S.E.; rain all day, heavier in
 the evening, lasting into the following night.

738 Oct. 21 9⁵/₁₂

Still somewhat cloudy in the morning,
 soon clearing off; large cumuli occupying
 about one fifth of the sky at 10 A.M.;
 clear after noon; alternately clear and
 cloudy about 7 P.M.; magnetic disturbance about 8 P.M.

739 Oct. 22 9¹/₆

Fine; a few small cumuli only on the
 horizon; wind S, very light; magnetic disturbance at 9 A.M.

740 Oct. 23 9⁸/₆₀

Fine; cloudless; calm; slight magnetic disturbance
 at 9 A.M.; aurora about 9½ P.M.; partly clouded
 up afterwards.

741 Oct. 24 9⁸/₆₀

Almost wholly cloudy; wholly cloudy in the evening.

742 Oct. 25 9¹/₆

Morning cloudy; clearing off at 9 A.M.; some
 cirrus cloud remaining, especially in the east

1873

Oct. 25

and south; wind N.; magnetic disturbance at 9 A.M.; slight magnetic disturbance at 9½ P.M.

743 Oct. 26 9¹²/₆₀

Morning very clear; at 9 A.M. cirri rapidly gathering and occupying almost all the sky; strong magnetic disturbance at 9 A.M.; too hazy to allow view of protuberances; clear after a short time and so continuing till evening; wholly cloudy evening and following night.

Oct. 27

Slight rain; wind S.E., very strong, becoming violent; rain till sunset; immediately afterwards the western horizon cleared off; wholly clear at 10 P.M.

744 Oct. 28 9⁵/₁₂

Extensively cloudy; sun seen occasionally for a moment at a time; wind S.W.; very strong magnetic disturbance at 9 A.M.; sky $\frac{8}{10}$ cloudy all day; at 4¼ P.M. a spot seen near the eastern limb, not seen in the morning on account of clouds; its exact place could not be determined, the sun being too low for a projection.

745 Oct. 29 9¹/₁₂

Fine; only some scattered cumuli; wind S.W., rather strong; evening extensively cloudy; no clouds at 11 P.M.; auroral light about 10½ P.M.

746 Oct. 30 9²²/₆₀

Clear; wind N.; at 9 A.M. rather strong magnetic disturbance; cumuli gathering after noon; wind E.; immediately after sunset clouded up entirely, so remaining following night; a little rain towards morning.

Oct. 31

~~Chromosphere very thin in a place marked on the sketch.~~
Wind N., very light; fine rain all day; following night cloudy.

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- 747 Nov. 1 $9\frac{12}{60}$ Cleared off immediately after sunrise; wholly cloudless at 9 A.M.; wind W.; at 9 A.M. magnetic needle not so far east as on other days; its range of oscillation very small; at 9 P.M. slight magnetic disturbance; auroral light.
- 748 Nov. 2 $9\frac{2}{3}$ Fine; clear; wind S.W.; some cumuli gathering at 10 A.M.; magnetic disturbance at $9\frac{1}{2}$ A.M.; cloudy about 11 P.M.
- 749 Nov. 3 $9\frac{1}{6}$ Fine; a few cumuli, occupying about one seventh of the sky.
- 750 Nov. 4 $9\frac{1}{12}$ Perfectly clear; magnetic disturbance at 9 A.M.; afternoon and evening clear.
- 751 Nov. 5 $10\frac{7}{60}$ Large cumuli covering a quarter of the sky, moving rather fast with the N.E. wind; the forms marked # on the sketch do not stand for spots but for clouds of absorbent vapors crossing line C of the spectrum and extending over the neighboring parts of the spectrum on both sides of the line; these clouds thought to be visible with the telescope as spaces somewhat darker than the rest of the sun's surface; definition not very good, and this point therefore not well determined; about noon cleared off entirely; remarkably clear after noon; almost wholly cloudy at 11 P.M.; slight magnetic disturbance at 7 P.M.

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- 752 Nov. 6 9 $\frac{1}{2}$ Almost wholly cloudy; sun seen with difficulty for a few moments; wind N.; slight magnetic disturbance at 9 A.M.; cleared off entirely about 3 P.M.; form [marked on sketch with a line to the margin] is that of a spot seen only in the spectroscope.
- 753 Nov. 7 9 $\frac{5}{12}$ Much light cirrus cloud; magnetic disturbance at 9 A.M.; clouding up more and more; wind E. about noon; sun no longer visible at 2 P.M.; rain beginning about 9 P.M. and continuing without interruption all the following night.
- Nov. 8 Rain all day; cleared off about 9 P.M.; soon afterwards remarkably clear.
- 754 Nov. 9 11 Large cumuli over half the sky; constantly passing clouds prevented more protuberances being seen than are represented on the sketch; cleared off after sunset; clouded up entirely about 8 P.M.
- 755 Nov. 10 2 $\frac{23}{60}$ Cloudy entirely till about 1 P.M., when it began to clear off; wind N.W.; some snow flakes occasionally; magnetic disturbance at 9 A.M.; observation of protuberances incomplete, owing to passing clouds in the part of the sky where the sun was; slight magnetic disturbance about 8 P.M.; evening cloudless.
- 756 Nov. 11 9 $\frac{1}{4}$ Cloudless; rather strong magnetic disturbance at 9 A.M.

1873

Nov. 12

Snow and rain in the latter part of the preceding night; morning cloudy; sun visible about 2 P.M. for a few minutes; no time to sketch the spots; but besides the disappearance of group e, all the spots, especially those of group c, were made out to be smaller; clouded up again at once and so continued till at least near midnight.

757 Nov. 13 9 $\frac{1}{4}$ Sky at least one third covered with cumuli; cleared off entirely about 4 P.M.; night following calm and fine.

758 Nov. 14 10 $\frac{3}{60}$ Remarkably clear before 9 A.M.; afterwards three quarters covered with large cumuli; protuberances not in any way remarkable; the almost continual passage of clouds prevented them from being sketched; wholly cloudy after 11 A.M.

759 Nov. 15 9 $\frac{23}{60}$ Sun seen with difficulty under very thick haze; about 10 A.M. the cloudiness was less general and blue sky could be seen among numerous cumuli; following night cloudy.

Nov. 16 Cloudy all day & night following; snow in the afternoon.

Nov. 17 Cloudy all day with a few snowflakes in the morning; rain & high wind all following night.

Nov. 18 Cloudy & raining; barometer very low 28.15; [minimum of barometer was 28.6;] snow after noon; cleared off directly after sunset; cloudless at 7 P.M.

1873

- 760 Nov. 19 $9\frac{24}{60}$ Clear; calm; wholly cloudy after sunset; clear again at 7 P.M.; aurora with some streamers between 8 & 10 P.M.; magnetic disturbance.
- Nov. 20 Cloudy, with some light snowflakes in the morning; cloudy all day & following night, with a little snow in the evening.
- 761 Nov. 21 $9\frac{1}{4}$ Fine; a few light cirri; strong magnetic disturbance at 9 A.M.; clouded up entirely about noon and so continued afternoon & evening.
- 762 Nov. 22 $9\frac{1}{3}$ Many cirri; slight magnetic disturbance at 9 A.M.; weather fine all day, but sky whitish with light cloudiness; evening almost wholly cloudy; at 11 P.M. auroral light suspected in a clear strip of sky on the northern horizon.
- 763 Nov. 23 $10\frac{5}{10}$ Light cirrus cloud over the whole sky; sky everywhere hazy, especially at the horizon; not clear enough for looking for protuberances; light cirrus cloud all day; at times wholly cloudy; evening cloudy; snow night following.
- Nov. 24 Rain and melting snow by morning; wind E.; following night cloudy with a little fine rain.
- Nov. 25 Cloudy; a little sleet and snow in the morning; sun slightly visible about 2 P.M. under dense clouds, too thick for the spots to be seen; it soon disappeared and remained invisible the rest of the day.
- 764 Nov. 26 $9\frac{1}{2}$ Fine; cloudless; wind N. N. W.; all the groups of Nov. 23 have disappeared; spots a & b are new; clear all day; faint auroral light between 8 & 9 P.M.; slight magnetic disturbance at the same time; clouded up about 11 P.M.

1873

Nov. 27

Cloudy all day; snow after noon; cloudy till about 11 P.M.; then cleared off.

765 Nov. 28 10 $\frac{1}{12}$

Fine; only some light cirro-stratus cloud in the horizon.

766 Nov. 29 9 $\frac{38}{60}$

Morning clear; at 9 $\frac{2}{3}$ A.M. clouds coming on from the N.W.; at 10 A.M. wholly cloudy; at 9 A.M. slight magnetic disturbance; at 11 A.M. beginning to clear off, the continuous clouds breaking up into numerous cumuli; only a few cumuli remaining after noon.

767 Nov. 30 11

Fine; only a little stratus cloud; evening and following night cloudy.

768 Dec. 1 9 $\frac{1}{4}$

Wholly cloudy, but sun somewhat visible under clouds; spot f seen, but very indistinctly, and thought to be smaller than yesterday; seeing too bad to make certain of this; no spot could be seen on the limb; strong magnetic disturbance at 9 A.M.; protuberances could not be seen; sun wholly invisible at 10 $\frac{1}{2}$ A.M.; cleared off about 4 P.M.

Dec. 2

Wholly cloudy; a little snow falling almost all the day and evening; following night cloudy.

769 Dec. 3 2 $\frac{5}{12}$

Wholly cloudy and foggy till about 1 P.M.; about 2 P.M. the sun came out for a few minutes, but not long enough to allow of examining the Chromosphere; spot b has apparently shifted its place.

1873

Dec. 3

seeming too far north and not far enough west; it probably has a real proper movement, as its place was laid down with much care, and pains taken to have everything correct; evening cloudy.

Dec. 4

Cloudy all day, with violent south wind; a few drops of rain at intervals.

770 Dec. 5 9¹⁷/₆₀

Three quarters of the sky covered with cirro-cumulus cloud; magnetic disturbance at 9 A.M.

Dec. 6

Morning cloudy; afternoon & evening clear; observer not now engaged at the Observatory afternoons, hence no sketch; strong magnetic disturbance at 9 A.M.; auroral light in the evening.

771 Dec. 7 11¹⁸/₆₀

Clear, fine, cloudless; slight magnetic disturbance at 10¹/₂ [A.M.?]; sky magnificent all day and following night; slight auroral light suspected.

772 Dec. 8 9⁵/₁₂

Morning clear; cirrus cloud soon gathering, and already too thick at 9¹/₂ A.M. to allow observation of solar protuberances; at 10 A.M. sun no longer visible; magnetic disturbance at 9 A.M.; cloudy increasing and diminishing by turns till noon; afternoon and evening wholly cloudy; rain began about 11 P.M.

Dec. 9

Cloudy with rain till about noon; afternoon only cloudy; clearing up a little in spots at sunset.

1873

- 773 Dec. 10 $9\frac{1}{2}$ Sky half covered by cumuli moving rather quickly before a N.W. wind; slight magnetic disturbance at 9 A.M.; sky clearing off more and more; afternoon & evening cloudless.
- Dec. 11 Morning cloudy; sun visible however at sunrise.
- 773 $\frac{1}{2}$ Dec. 12 $9\frac{3}{4}$ [A sketch dated Dec. 11, 1873, was found after this copy had been made. See page following title of this volume.] Cloudy and rainy by meteorological record of Observatory.
- Dec. 13 [Cloudy and rainy by meteorological record of Observatory.]
- 774 Dec. 14 $10\frac{12}{60}$ Clear and cloudless; magnetic disturbance at $9\frac{3}{4}$ A.M.; all the groups have disappeared except group c, of which some traces are left; group h wholly new; evening & following night cloudy.
- 775 Dec. 15 2 Morning extensively cloudy; afternoon clear; magnetic disturbance about 2 P.M.
- 776 Dec. 16 $9\frac{7}{60}$ Clouding up rapidly with cumuli; clouds too thick at 9 A.M. to allow observation of chromosphere; magnetic disturbance at 9 A.M.; evening clear.
- 777 Dec. 17 $12\frac{28}{60}$ Cloudy and foggy all the morning; sun came out at $12\frac{5}{12}$ P.M.; afternoon and evening clear.
- 778 Dec. 18 $9\frac{1}{3}$ Thick and increasing haze over all the sky; sun still sometimes visible under it; observation of chromosphere impossible; magnetic disturbance at 9 A.M.; cloudy at noon; clearing off after noon; evening clear; rather thick fog on horizon.
- Dec. 19 Magnetic disturbance at 9 A.M.; wholly cloudy; began to rain about $3\frac{1}{2}$ P.M., and so continued in the evening.

1873

- 779 Dec. 20 $9\frac{7}{12}$ Extensively cloudy; cleared off almost entirely about $9\frac{1}{2}$ A.M., and again clouded up in ten or fifteen minutes, not giving time for examination of chromosphere; slight magnetic disturbance at 9 A.M.; fine at noon; evening cloudy; then clear about 11 P.M.
- 780 Dec. 21 $10\frac{22}{60}$ Fine; cold; strong magnetic disturbance at 10 A.M.
- 781 Dec. 22 $9\frac{1}{2}$ Sky half covered with cirri till $9\frac{1}{2}$ A.M.; then almost wholly cleared off; slight magnetic disturbance at 9 A.M.; afternoon and evening fine.
- Dec. 23 Wholly cloudy; magnetic disturbance at 9 A.M.
- 782 Dec. 24 $9\frac{1}{2}$ Sky magnificent; magnetic disturbance at 9 A.M.; fine all day and evening. Marks on sketch having beside them the symbol + represent dark markings seen in the spectroscope near line C.
- Dec. 25 Cloudy all day.
- Dec. 26 Cloudy; rain about noon; snow after noon and following night.
- Dec. 27 Sun slightly visible soon after sunrise; at 9 A.M. no longer visible; sky wholly cloudy.
- Dec. 28 Morning cloudy; afternoon clear; (Sunday.)
- Dec. 29 Partly cloudy; observer in Boston on business for the Observatory.
- 783 Dec. 30 $9\frac{47}{60}$ Sky magnificent.
- 784 Dec. 31 $9\frac{32}{60}$ Fine; magnetic disturbance at 9 A.M.

1874

- 85 Jan. 1 $11\frac{5}{6}$ Sky extensively cloudy; sun only seen under clouds.
- Jan. 2 Cloudy with rain.
- Jan. 3 Foggy and cloudy.
- 786 Jan. 4 $9\frac{1}{4}$ Rather fine, but cirri numerous.
- Jan. 5 Cloudy all day; evening rainy.
- Jan. 6 Cloudy with sleet.
- Jan. 7 Cloudy.
- 787 Jan. 8 $12\frac{2}{3}$ Morning cloudy and rainy; towards 1 P.M. the sun came out a little; clouded up again afterwards; clear at 11 P.M.; all the spots are new; none of those seen Jan. 4 are now left.
- Jan. 9 [Note on back of No. 787.] Chromosphere seen through large protuberance; width of protuberance $16''$.
- 788 $9\frac{11}{60}$ Fine, with very few cumuli; fine all day & evening. Chromosphere very thin in two places marked on sketch.
- 789 Jan. 10 $11\frac{6}{60}$ Morning cloudy with a little rain; cleared off about $10\frac{1}{2}$ A.M. [Note on back of No. 789, of date Jan. 11 or 12(?)] Protuberance as wide as the spectrum.
- Jan. 11 [Sunday, and weather unsettled, with a little snow.]
- 790 Jan. 12 $10\frac{57}{60}$ Fine, no clouds except a few cumuli; at 9 A.M. magnetic disturbance; chromosphere very thin in almost all parts of the limb; the shaded strip marked + on the sketch was seen only with the spectroscope on line C and beyond it towards the violet.

1874

- 791 Jan. 13 $9\frac{23}{60}$ Fine; magnetic disturbance at 9 A.M.; evening cloudy; snow during following night.
- 792 Jan. 14 Jan. 15 $9\frac{1}{2}$ Snow all the morning; afternoon becoming cloudy. Sky clear; magnetic disturbance at 9 A.M.; aurora in the evening.
- 793 Jan. 16 $9\frac{2}{3}$ Clear till 9 A.M.; then sky almost wholly covered with thick haze which obscured the sun considerably; cleared off again after 10 A.M.; group of not found; sky clear rest of the day; aurora with streamers visible from $6\frac{1}{2}$ P.M. to midnight.
- 794 Jan. 17 $9\frac{1}{4}$ Sky clear; magnetic disturbance at 9 A.M.; rather fine aurora about midnight; chromosphere very thin in a place marked on the sketch.
- 795 Jan. 18 $10\frac{2}{3}$ Fine all day; evening cloudy.
Jan. 19 Morning cloudy and foggy; afternoon and evening foggy with fine rain.
- 796 Jan. 20 $9\frac{5}{12}$ Fine; cloudless; slight magnetic disturbance at 9 A.M.; chromosphere thin at and near two places marked on sketch.
- Jan. 21 Cloudy with snow.
- Jan. 22 Cloudy; foggy all day and night following; a little rain.
- Jan. 23 Cloudy.
- 797 Jan. 24 $9\frac{22}{60}$ Fine; slight magnetic disturbances at 9 A.M., and between 7 & 9 P.M.
- 798 Jan. 25 $10\frac{1}{3}$ Sky clear; wind violent; slight magnetic disturbance at 10 A.M.

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- 899 Jan. 26 $9\frac{11}{60}$ Sky clear; wind strong; cold; definition very bad; evening cloudy.
- Jan. 27 Cloudy; a little snow.
- Jan. 28 Cloudy; fog & frost; cleared off at sunset.
- 800 Jan. 29 $9\frac{53}{60}$ Sky clear all day; clouded up entirely at sunset; still wholly cloudy half an hour past midnight.
- 801 Jan. 30 $9\frac{35}{60}$ Sky clear; wind N., strong and cold; slight magnetic disturbance at 9 A.M.; clouded up about 7 P.M.
- Jan. 31 Snowing.
- Feb. 1 Morning cloudy; sun occasionally seen under clouds; some openings among clouds; observer absent.
- Feb. 2 Wholly cloudy; snow after noon.
- Feb. 3 Snow all day. (Auroral light seen in France; see Bulletin of French Scientific Association for February 1874.)
- 802 Feb. 4 $11\frac{5}{6}$ Sun in view till about $8\frac{2}{3}$ A.M.; then wholly cloudy; about $11\frac{2}{3}$ A.M. sun seen at times between clouds; cleared off after noon. (Aurora and easterly deviation of magnetic needle observed in France; see Bulletin of French Scientific Association for February 1874.)
- 803 Feb. 5 $9\frac{47}{60}$ Fine all day; fine aurora between $6\frac{1}{2}$ P.M. & midnight.
- 804 Feb. 6 $9\frac{1}{3}$ Fine all day; evening cloudy.
- Feb. 7 Snow in the morning; partly clear afternoon & evening.
- 805 Feb. 8 $9\frac{42}{60}$ Fine; cold.
- 806 Feb. 9 $9\frac{1}{4}$ Light hazy cirri.
- Feb. 10 Morning cloudy; sun occasionally visible.

1874

Feb. 10

after noon, but observer in Boston on Observatory business; evening clear.

807 Feb. 11 $9\frac{5}{12}$

Sky clear; chromosphere thin in place marked on sketch.

808 Feb. 12 $9\frac{4}{60}$

Clear; some slight haze; seeing very bad.

809 Feb. 13 $10\frac{3}{4}$

Wholly cloudy at sunrise and later; after 10 A.M. sun slightly visible under thick cloud; rain for half an hour about 2 P.M.; rain all the evening & following night.

810 Feb. 14 $9\frac{26}{60}$

About half the sky cloudy; auroral light between 10 & 11 P.M.

811 Feb. 15 $10\frac{12}{60}$

Much cirrus cloud; protuberances not to be seen; wholly cloudy after noon and all the following night.

Feb. 16

A little snow at 7 A.M.; cloudy, with a little more snow after noon; cleared off entirely about 6 P.M.

812 Feb. 17 $9\frac{1}{3}$

Sky nearly all covered by clouds.

813 Feb. 18 $9\frac{1}{4}$

Sky clear.

{ Feb. 19 }
{ Feb. 23 }

Observer unwell Feb. 19, 20, 21, 22, 23; no observations; weather cloudy & raining much of this time.

814 Feb. 24 $3\frac{1}{6}$

Morning overcast; clouds thick; none of the spots of Feb. 18 now left, except the small group c.

Feb. 25

Wholly cloudy till about 10 A.M.; thick snow from that time till about 10 P.M.

815 Feb. 26 $9\frac{1}{2}$

Sky wholly clear; evening partly cloudy.

816 Feb. 27 $9\frac{24}{60}$

Half of the sky overcast till about 10 A.M.; then cleared off; evening cloudy.

817 Feb. 28 $10\frac{3}{60}$

Morning wholly cloudy; about 10 A.M. some openings among cirri, but seeing very bad & chromosphere not to be examined; clear after noon.

1874

- 18 March 1 $10\frac{1}{2}$ Cirrus cloud till about 9 A.M.; afterwards rather fine.
- 19 March 2 $9\frac{1}{3}$ Cloudless, but whitish haze everywhere.
- 820 March 3 $9\frac{1}{4}$ Magnetic disturbance at 9 A.M.; sky almost wholly covered with light cirri; only one protuberance could be seen, as the clouds increased too much during the observation; evening wholly cloudy; showers after midnight.
- 821 March 4 $4\frac{31}{60}$ Rain all the morning, and till about 3 P.M.; cleared off after 4 P.M.
- 822 March 5 $9\frac{23}{60}$ Cloudless; seeing not very good; magnetic disturbance at 9 A.M.
- 823 March 6 $9\frac{14}{60}$ Light cirrus cloud almost covering the sky, and continually thickening; seeing so bad that the protuberances were very imperfectly observed; magnetic disturbance at 9 A.M.; cloudy after noon & night following.
- March 7 Cloudy with a little snow; rain, snow, and sleet all day; snow during following night.
[Note of March 8 on back of No. 823. Chromosphere thicker at 290° .]
- 824 March 8 12 Morning cloudy with a little snow; then somewhat clearer, clouding up again, and again clearer. Evening almost wholly cloudy.
[Note of March 9 on back of No. 824.] Chromosphere very thin between 2 protuberances.
- 825 March 9 $9\frac{1}{3}$ Slight magnetic disturbance at 9 A.M.; sky by turns cloudy and clear; March weather all day; evening partly cloudy. Chromosphere thin at a place marked on sketch [see also note on back of No. 824.]

1874

826 March 10 11
March 11

Squally; sun seen a few moments at 11 A.M.
Wholly cloudy all day and evening; very
strong magnetic disturbance of inclination
and declination needles 6 P.M. and later;
following night very windy and cold.

827 March 12

Cloudy till about 9 A.M., afterwards quickly
clearing off; slight magnetic disturbance
at 9 A.M.; morning cold, with strong wind;
sky clear at 10 A.M. and the rest of the day;
slight magnetic disturbance in the evening.

[Note on back of No. 827.] On March 12 a faint
absorption band was seen coincident
with D^3 , diffused and hardly perceptible;
another band as faint near it towards the
violet; these two bands more easily seen in
the spectrum of spot d.

828 March 13 9 $\frac{1}{2}$

Many cirri between 8 & 9 A.M., soon dispersing;
slight magnetic disturbances at 9 A.M. & in the evening.

829 March 14 9 $\frac{27}{60}$

Seeing very bad, & impeded by some cirrocumuli.

830 March 15 11

Sky quite clear, but seeing bad.

831 March 16 9 $\frac{8}{60}$

Cirri covering $\frac{3}{4}$ of the sky and preventing
observation of chromosphere; partly
cloudy all day; evening wholly cloudy.

March 17

Fine rain all day & following night.

March 18

Cloudy all day, with fine rain; about 10 $\frac{1}{2}$ A.M.
the sun was visible under thick clouds, but not
enough for a view of the spots; following
night cloudy.

1874

- 832 March 19 11 $\frac{1}{2}$ Morning wholly cloudy; at 11 $\frac{1}{2}$ A.M. sun seen for a few minutes at times under very thick clouds.
- 833 March 20 9 $\frac{17}{60}$ Cirro-cumuli over $\frac{3}{4}$ of the sky; not clear enough to examine the chromosphere except with much difficulty; afternoon & evening clear; magnetic disturbance at 10 P.M.
- 834 March 21 9 $\frac{5}{12}$ Many light cirri; definition bad; afternoon & evening clear.
- March 22 Morning rainy; afternoon & evening clear; Sunday.
- 835 March 23 9 $\frac{26}{60}$ Wind W., violent; many large cumuli; wind blowing since 4 A.M.; evening clear till about 9 $\frac{1}{2}$ P.M.; then wholly cloudy with a little fine snow. Strong magnetic disturbance at 10 P.M.
- 836 March 24 9 $\frac{17}{60}$ Clear & cold; wind strong; definition very bad; auroral light about 11 P.M.
- 837 March 25 9 $\frac{1}{6}$ Sky clear; wind strong; line C reversed in the neighborhood of group m; much of the sky overcast in the evening.
- 838 March 26 9 $\frac{5}{12}$ Overcast; sun seen with difficulty under thick clouds; evening clear.
- 839 March 27 9 $\frac{1}{3}$ A few light cirri; view of chromosphere hindered by the very bad definition; clouded up about 11 P.M.
- 840 March 28 10 $\frac{16}{60}$ Snow previous night and till 8 A.M.; beginning to clear off at 10 A.M.; afternoon partly,

1874

March 28

evening wholly clear.

March 29

Morning wholly cloudy; afternoon & evening clear; Sunday.

841 March 30 $9\frac{24}{60}$

Clear at sunrise; large cumuli soon collecting and covering half the sky; definition unusually good.

March 31

Wholly cloudy all day, clearing off a little in the evening.

842 April 1 $9\frac{1}{6}$ Morning clear; clouding up considerably at $9\frac{1}{2}$ A.M.; strong magnetic disturbance of the inclination needle during previous night; evening cloudy.

843 April 2 10

Overcast almost everywhere with very light whitish haze; definition bad.

844 April 3 $10\frac{26}{60}$ Extensively overcast with large cumuli; definition of spots good when the sun can be seen; observation of chromosphere prevented by constantly passing clouds; aurora in the evening, with large magnetic disturbance.

845

[Separate sketch of group ν , April 3, at $10\frac{5}{6}$ A.M.]846 April 4 $3\frac{1}{4}$ Snow in the morning; cloudy till noon; afternoon clear with strong wind; magnetic disturbance and aurora in the evening.847 April 5 $8\frac{5}{6}$

Morning clear; gradually clouding up after noon; wholly cloudy by evening; a little snow in the evening.

848 April 6 $9\frac{1}{6}$ Half overcast with many cirrus clouds, but light ones; definition very bad; magnetic disturbance and aurora in the evening.

1874

April 7

Rain & snow in the morning; afternoon & evening cloudy.

849 April 8

9 $\frac{1}{2}$

Foggy before 8 A.M., clearing off afterwards; not more than half cloudy at 9 A.M., but much cirrus cloud, which interferes with the view of the chromosphere.

April 9

Morning rainy; afternoon and evening cloudy; appearances of clearing up about 5 P.M., but only for a few moments; snow & rain in the latter part of the night following.

850 April 10

3 $\frac{1}{2}$ Stormy; strong wind; rain & melting snow; magnetic disturbance at 9 A.M.; sun came out for a few minutes at 3 $\frac{1}{2}$ P.M., but soon disappeared; evening cloudy; a little snow about 10 $\frac{1}{2}$ P.M.

851 April 11

9 $\frac{7}{60}$ Quite clear from sunrise to about 9 $\frac{1}{2}$ A.M.; afterwards numerous cirri formed and covered the whole sky with their thin wreaths; rest of the day cloudy; squall, with rain, in the afternoon; rain & strong wind, after 4 P.M.

852 April 12

8 $\frac{37}{60}$

Sky very clear all day & evening; slight disturbance of declination, and great disturbance of inclination, needle about 9 P.M.

853 April 13

9 $\frac{23}{60}$

Rather clear, with some light cirrus cloud; auroral light at 2 A.M. of April 14.

April 14

Somewhat cloudy; clouds increasing; evening wholly cloudy; observer absent today, having been on duty all previous night.

854 April 15

9 $\frac{1}{4}$

Almost wholly cloudy with thick cirrus clouds; sun scarcely visible at times; wholly cloudy

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April 15

at noon; rain after 4 P.M.; cloudy till about 9½ P.M.; rather clear afterwards.

855 April 16 9 $\frac{24}{60}$

Wholly overcast; sun visible beneath clouds; somewhat clear towards evening.

April 17

Wholly cloudy all day; snow afternoon and evening, perhaps 3 inches deep.

856 April 18 9 $\frac{32}{60}$

No clouds, but seeing not good; slight magnetic disturbance at 9 A.M.

857 April 19 11 $\frac{43}{60}$

Clear all day.

April 20

Cloudy and raining all day and evening; thunderclap about 8 P.M.

858 April 21 12 $\frac{6}{60}$

Cloudy all the morning; sun visible beneath clouds about noon; evening cloudy.

859 April 22 9 $\frac{5}{12}$

Sky half overcast; clear after noon; slight magnetic disturbance in the evening.

April 23

Light rain in the morning; snow in the afternoon.

860 April 24 9 $\frac{37}{60}$

Sky half overcast all day.

April 25

Morning cloudy; snow all the afternoon.

April 26

Cloudy with a little snow; wind strong all day.

861 April 27 9 $\frac{4}{4}$

Sky almost wholly overcast; sun visible beneath clouds.

862 April 28 9 $\frac{17}{60}$

Clear till 9 A.M.; continuous clouds then gathering; rest of the day cloudy.

April 29

Cloudy and raining all day.

863 April 30 9 $\frac{4}{4}$

Wholly overcast; sun somewhat visible beneath clouds.

864 May 1 9 $\frac{13}{60}$

Clear; clouding up after noon; evening wholly cloudy.

May 2

Morning cloudy; sun came out after noon; observer absent.

1874

- 865 May 3 $11\frac{3}{4}$ Clear all day and evening; very strong magnetic disturbance at $9\frac{3}{4}$ P.M.
- 866 May 4 $9\frac{1}{4}$ Morning clear; but cloudiness increasing and obstructing view of chromosphere; cloudy all day and evening.
- 867 May 5 $9\frac{12}{60}$ Wholly overcast; clouds so thick as almost wholly to obscure the sun; strong disturbance of magnetic inclination needle at 9 A.M.
- May 6 Morning clear; clouding up a little afternoon; evening wholly cloudy; a little rain following night; observer absent.
- 868 May 7 9 Sky covered for one fourth of its extent with heavy cumuli; the protuberance shown above group f on the following side was not at all to be seen at 10 A.M., when that part of the chromosphere was examined; on returning to the same region at $10\frac{4}{60}$ A.M., to obtain the spectrum of group f, the jet just mentioned was very brilliant, rising to a height of $1\frac{1}{2}$ revolutions, or $71''$.
- 869 May 8 $9\frac{12}{60}$ Almost wholly overcast with clouds so thick that the sun could be seen only with difficulty and the protuberances scarcely at all.
- May 9 Wholly cloudy.
- May 10 Partly cloudy; sun came out in the morning and afternoon.

1874

- 870 May 11 $11\frac{8}{60}$ Morning cloudy; sky afterwards becoming clear for three quarters of its extent; evening clear.
- 871 May 12 $9\frac{3}{4}$ No clouds, but hazy.
- 872 May 13 10 Fine all day and evening.
Observer absent till May 18.
- 873 May 18 $9\frac{27}{60}$ Morning clear; many cumuli gathering about 9 A.M.
May 19 Observer absent May 19 and 20.
May 21 Rain all day.
- 874 May 22 $9\frac{1}{4}$ Extensively cloudy; chromosphere not to be seen; evening cloudy.
- 875 May 23 $9\frac{12}{60}$ No clouds except some cirro-stratus; evening cloudy.
- 876 May 24 ^(no time given) $9\frac{1}{4}$ Almost wholly cloudy after 9 A.M.
May 25 Cloudy all day with a little rain; lightning & thunder about 6 P.M.
- 877 May 26 $9\frac{6}{60}$ Sky magnificent.
- 878 May 27 $10\frac{1}{4}$ Almost wholly cloudy.
- 879 May 28 $9\frac{13}{60}$ Clear, seeing magnificent.
- 880 May 29 $9\frac{1}{60}$
- 881 May 30 $9\frac{13}{60}$ Almost wholly overcast with continuous & rather thick cirrus cloud.
May 31 Sunday; observer absent; sun visible; rain in the following night.
June 1 Cloudy with rain in the morning; observer absent after noon.
- 882 June 2 $9\frac{1}{6}$ Sky covered with cumulus cloud to a great extent; clouds prevented any view of the chromosphere.
- 883 June 3 $9\frac{1}{4}$ Fine.
June 4 Cloudy and rainy.
- 884 June 5 $10\frac{4}{60}$ Morning cloudy and foggy; at 10 A.M. the sun came out for a few minutes and then disappeared.

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- 885 June 6 $9\frac{2}{60}$ Sky almost wholly overcast; clouds so thick as scarcely to allow the sun to be seen.
- June 7 Cloudy; thunderstorm night following.
- 886 June 8 $9\frac{1}{4}$ Large cumuli, covering a quarter of the sky; evening cloudy till about 10 P.M.
- 887 June 9 $9\frac{28}{60}$ Cirro-stratus cloud, occupying a third of the sky.
- June 10 Fine; observer absent.
- June 11 " " "
- June 12 Cloudy and stormy with rain.
- 888 June 13 $9\frac{5}{12}$ Cumulus cloud, covering half the sky.
- June 14 Fine; Sunday.
- 889 June 15 $9\frac{1}{6}$ Clear; a few clouds only; f represents an absorption spot near C, towards the violet.
- 890 June 16 $11\frac{6}{60}$ Cloudy; sun seen at times, beneath thick clouds, after 11 A.M.; too cloudy for examination of the chromosphere.
- June 17 Morning cloudy and rainy; sun occasionally visible after noon; observer then absent.
- 891 June 18 ^(no time) _(given) Extensively cloudy; chromosphere could not be seen.
- June 19 Cloudy with rain.
- June 20 Cloudy.
- June 21 Cloudy.
- 892 June 22 $9\frac{23}{60}$ Fine.
- 893 June 23 $9\frac{1}{6}$ Much cirrus cloud.
- 894 June 24 $9\frac{1}{12}$ Clear; evening cloudy.
- 895 June 25 $9\frac{1}{12}$ Almost wholly overcast.
- 896 June 26 ^(no time) _(given) Extensively cloudy; cleared up after noon; evening cloudy till about 11 P.M.

1874

897 June 27 10 Cloudy till about 10 A.M.; afterwards clouds wholly disappeared.
 June 28 Sun not seen.

June 29 " " "
 898 June 30 $9\frac{1}{3}$ Fine.
 July 1 Fine; observer absent.

July 2 " " "
 899 July 3 $9\frac{47}{60}$ Wholly overcast; sun only occasionally visible for a few moments at a time.
 July 4 Cloudy and rainy.

July 5 " " "
 900 July 6 $9\frac{1}{2}$ Fine.
 901 July 7 $9\frac{28}{60}$ Observer absent or occupied; almost wholly cloudy.

July 8 " " " " " "
 July 9 " " " " " "
 July 10 " " " " " "
 902 July 11 $10\frac{1}{2}$ Extensively cloudy; chromosphere not visible; evening cloudy and rainy.

July 12 Rainy and stormy all day.
 903 July 13 $11\frac{3}{4}$ Cloudy and foggy till $11\frac{1}{2}$ A.M.; clear towards night.
 July 14 Fine; observer absent.

904 July 15 $9\frac{24}{60}$ Much very light cirrus cloud.

Probably from July 7 till today the spots have been out of position [on the sketches], the spectroscope having been removed for cleaning and not put back in the proper place again, so that the zero point is inexact.
 July 16 Observer absent; morning fine; stormy and rainy after noon; evening cloudy.

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- 905 July 17 $9\frac{5}{12}$ Fine. Beginning with today, the position circle has been set so that the following side answers to the printed numbering on the east limb [of the sketch]; for the preceding or western side, the numbers marked on the back of each sketch, to denote the positions of the prominences, should each be increased by 180° .
- 906 July 18 $9\frac{4}{60}$ Fine.
- July 19 Partly cloudy; observer absent.
- July 20 Cloudy and rainy after noon; observer absent.
- July 21 Morning cloudy; afternoon clear; observer absent after noon.
- 907 July 22 $9\frac{12}{60}$ Clear and calm.
- 908 July 23 $9\frac{5}{12}$ Fine.
- 909 July 24 $10\frac{53}{60}$ Cumuli heavy and numerous; sun slightly visible at times; chromosphere could not be seen; evening clear.
- 910 July 25 $9\frac{1}{2}$ Fine.
- July 26 Fine; Sunday.
- July 27 Fine; observer absent.
- 911 July 28 9 Fine; calm.
- 912 July 29 $9\frac{29}{60}$ Almost wholly cloudy; observation could not be completed; rain after noon & in the evening.
- 913 July 30 $9\frac{23}{60}$ Many small detached cumuli.
- 914 July 31 $9\frac{1}{2}$ Fine; evening cloudy.
- 915 Aug. 1 $9\frac{1}{4}$ Seven tenths of the sky overcast.
- Aug. 2 Fine; Sunday.
- 916 Aug. 3 $9\frac{18}{60}$ Fine; seeing not very good. In this sketch,

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Aug. 3

The spots are perhaps a little out of place,
as the observer forgot to see that the screen
was rightly set; the error may be 2 or 3 degrees.

- 917 Aug. 4 $9\frac{1}{4}$ Fine; definition very bad; evening cloudy.
 918 Aug. 5 $9\frac{1}{6}$ Extensively overcast with thick cirrus cloud;
 chromosphere could not be observed.
 Aug. 6 Observer absent; morning clear; storm after noon.
 Aug. 7 Shutter cannot be opened; rope broken.
 Aug. 8 Rain.
 Aug. 9 Rain.
 919 Aug. 10 $9\frac{28}{60}$ Fine; evening partly cloudy.
 920 Aug. 11 9 Fine; calm.
 921 Aug. 12 $10\frac{53}{60}$ Morning cloudy till 11 A.M.
 Aug. 13 Cloudy with rain; thunderstorm towards evening.
 Aug. 14 Cloudy with rain.
 Aug. 15 Cloudy.
 Aug. 16 Sunday.
 Aug. 17 Observer absent.
 922 Aug. 18 11 Fine.
 923 Aug. 19 $9\frac{12}{60}$ Almost wholly overcast with thick haze.
 924 Aug. 20 $9\frac{11}{12}$ Wholly overcast; cloudiness too great for
 observation of chromosphere; evening
 cloudy with a little rain.
 925 Aug. 21 $10\frac{54}{60}$ Overcast; cloudiness too great for observation
 of chromosphere; sun seen only for a few
 moments.
 Aug. 22 Morning cloudy and rainy.
 Aug. 23 Sunday; morning cloudy.

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- 926 Aug. 24 $9\frac{1}{2}$ Fine.
- 927 Aug. 25 $9\frac{1}{4}$ Overcast; sun scarcely visible.
- 928 Aug. 26 $9\frac{2}{3}$ Fine.
- 929 Aug. 27 $9\frac{60}{12}$ Almost wholly overcast; cloudiness too great for observation of chromosphere.
- 930 Aug. 28 $9\frac{22}{60}$ Cloudiness too great for observation of chromosphere; evening cloudy.
- 931 Aug. 29 $9\frac{18}{60}$ Sky clear.
- Aug. 30 Sunday; partly cloudy.
- Aug. 31 Fine; observer absent.
- 932 Sept. 1 $9\frac{5}{12}$ Fine.
- 933 Sept. 2 $9\frac{1}{6}$ Fine.
- Sept. 3 Partly cloudy.
- 934 Sept. 4 $9\frac{1}{4}$ Fine.
- 935 Sept. 5 $9\frac{21}{60}$ Fine.
- Sept. 6 Partly cloudy.
- 936 Sept. 7 $9\frac{1}{2}$ Clear and calm; aurora with streamers between $10\frac{1}{2}$ and 11 P.M.
- Sept. 8 Observer absent; part of the day cloudy.
- 937 Sept. 9 $9\frac{1}{3}$ One quarter of the sky overcast.
- Sept. 10 Partly cloudy in the morning.
- 938 Sept. 11 $9\frac{1}{3}$ Fine; afternoon cloudy.
- 939 Sept. 12 $10\frac{56}{60}$ Cloudy in the morning; aurora in the evening.
- Sept. 13 Fine; Sunday; observer absent.
- Sept. 14 Observer absent.
- 940 Sept. 15 $9\frac{3}{4}$ One quarter of the sky overcast.
- Sept. 16 Cloudy.
- Sept. 17 Cloudy with rain.

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Sept. 18

Rainy.

Sept. 19

Rainy.

Sept. 20

Rainy.

941 Sept. 21 $9\frac{1}{3}$ Three quarters of the sky overcast.942 Sept. 22 $9\frac{1}{3}$ Fine.943 Sept. 23 $9\frac{1}{12}$ 944 Sept. 24 $9\frac{24}{60}$ Fine.945 Sept. 25 $9\frac{1}{6}$ Fine.946 Sept. 26 $9\frac{1}{4}$ Fine.

Sept. 27 Cloudy and rainy.

Sept. 28 Cloudy and rainy.

Sept. 29 Cloudy and rainy.

947 Sept. 30 $9\frac{1}{4}$ Sky half overcast.

