

AUSTRALASIAN ANTARCTIC EXPEDITION

1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, O.B.E., B.E., D.Sc., F.R.S.

SCIENTIFIC REPORTS.

SERIES B.

VOL. II

TERRESTRIAL MAGNETISM AND RELATED
OBSERVATIONS.

PART I.

RECORDS OF THE AURORA POLARIS.

BY

DOUGLAS MAWSON, Kt., O.B.E., B.E., D.Sc., F.R.S.
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WITH SIX PLATES AND FIFTEEN TEXT-FIGURES.

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EDITORIAL PREFACE.

In this volume are to be grouped reports on several related subjects, comprising, firstly, Auroral Phenomena; secondly, Atmospheric and the Strength of Signals in connection with wireless communication from Macquarie Island to Australia, New Zealand, and Antarctica; thirdly, Magnetic Storms as recorded by the Eschenhagen Magnetograph.

It is hoped that the analysis and discussion of these records will result in furthering knowledge, not only concerning each department independently, but also the more important question of inter-relationship.

As this was the first polar expedition to be equipped in all three departments mentioned, a special effort was made to secure a visual record of auroral manifestations as complete as possible. This applies particularly to the Main Base Station in Adelie Land, where the recording magnetograph was set up. By comparison, the auroral logs of the other bases are more or less scanty, and, further, they suffer from deficiency of observers already well trained in observations of that nature.

An added interest is given to these results on account of the geographic position of the stations. The Main Antarctic Base was in an entirely new sphere. Also it was on the opposite side of the Magnetic Pole to the McMurdo Sound region, where the bulk of previous Antarctic records of the kind had been secured. Finally, it was very suitably spaced in relation to a Western Base (Queen Mary Land) and a Subantarctic Base (Macquarie Island); also to Captain Scott's bases at Cape Adare and Cape Evans, which were contemporaneously occupied for portion of the time.

The records from Macquarie Island have a special value, for they constitute the first continuous data from the great Subantarctic region lying southward of Australasia.

This first part of the volume entitled "Records of the Aurora Polaris," is intended to include, besides the journals of the actual observations, only such analytical and discussional matter as arises out of a simple treatment of the observations. This I have personally undertaken, recognising that, other things being equal, an analysis of the record should preferably be conducted by the actual recorder, on account of better understanding what the references imply. Further analysis and general discussion is reserved for those better able to deal with the subject, and will embrace the correlative magnetic and "wireless" phenomena.

D.M.

RECORDS OF THE AURORA POLARIS.

BY

DOUGLAS MAWSON, K.T., O.B.E., B.E., D.Sc., F.R.S.

(Professor of Geology and Mineralogy in the University of Adelaide.)

WITH SIX PLATES AND FIFTEEN TEXT-FIGURES.

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I.—INTRODUCTION.

This contribution comprises the records of auroral observations made by the Australian Antarctic Expedition, together with certain tabulations and remarks relating thereto. The report deals with journals compiled at each of the base stations,* recording auroræ observed; in all, three records, namely:—

1. Cape Denison, Adelié Land (lat. $67^{\circ} 00'$, long. $142^{\circ} 40'$)—Main Antarctic Base.
2. "The Grottoes," Queen Mary Land (lat. $66^{\circ} 20'$, long. $95^{\circ} 02'$)—Western Antarctic Base.
3. Macquarie Island (lat. $54^{\circ} 30'$, long. $158^{\circ} 57'$)—Subantarctic Base.

As will be noted, the observations recorded at Cape Denison are on a much more detailed scale than is the case at the subsidiary stations, where, on account of the limited staff, observations were, of necessity, less frequent and searching. Indeed, at the Main Base Station, Adelié Land, a special effort was made to secure a record as continuous as possible of the appearance and phases of auroral manifestations. As I had been specially interested in the recording of auroral phenomena at Cape Royds†, in the Ross Sea area on a previous expedition, it was most fitting that I should take charge of the record on this occasion also.

In the loggings of the phenomena at Cape Denison all members of the Expedition contributed, it being one of the duties of the officer who happened to be on watch at the time. As members of the staff were not all equally gifted with observational powers it must be allowed that the records, day by day, are not strictly comparable in detail and precision. However, I made it my duty to be on hand whenever important demonstrations were in progress, so that besides being personally responsible for a large proportion of the entries, I was able to abstract and edit the matter in the present tabulated form at regular and frequent intervals at Winter Quarters; whilst there was still a chance of checking, with the observer, all doubtful entries.

Entries made during our second year at Cape Denison (1913) were more regular, and probably, on the whole, more accurate than those of 1912, for a smaller number of staff took part, and they were, after the first year's training, more accustomed to the work. Apart from my own contributions, the Cape Denison log is more especially indebted to E. N. Webb (the magnetician) and to the following gentlemen, who spent a second year with me:—R. Bage, C. T. Madigan, A. L. McLean, F. H. Bickerton, and A. J. Hodgeman.

Steps were taken to secure uniformity in the methods of observing and recording. The program included scanning the heavens at intervals, so far as possible, not exceeding one hour; but at shorter intervals at times of the day when the phenomenon was most prevalent, and in all cases when demonstrations were actually in progress.

* For maps illustrating the distribution of Stations refer to Vol. I of this series.

† *Vide* Auroral Observations at the Cape Royds Station (British Antarctic Exped., 1908). Trans. Roy. Soc., Aust., Vol. XL, pp. 151-212.

The remarkably adverse weather—high winds and dense drifting snow—which proved to be a feature of the Cape Denison locality greatly increased the difficulties of observation. During frequent and prolonged periods the heavens would be completely obscured; either overcast by cloud or invisible owing to dense drifting snow, which, at times, filled the atmosphere for days together, impelled by winds of hurricane velocity sweeping down the coastal slopes from the interior of the continental ice-cap. All such occasions of obscured sky are logged, so that the record of auroræ observed can be related to the actual period of unobserved sky.

On many occasions very detailed records of visual observations at close time intervals were made, with a view to careful comparison with magnetic deflections as recorded by the magnetograph; at other times, for comparison with the record of the intensity of signals received by our wireless telegraphic equipment from the similar installation at Macquarie Island.

In all cases care was taken to secure accuracy in the times of observation. Where the entries appear at short and frequent intervals, special accuracy was secured by observing the time by a half-chronometer watch carried on the person, and checked against the chronometer time within the hut. Loggings were sometimes made in this way to fractions of minutes and are strictly comparable with the magnetograph time records. All time entries are in terms of local mean time.

The record of the Western Base Station, Queen Mary Land, was contributed to by all members of the party, but was the particular duty of the meteorologist, M. H. Moyes, who was more especially supported by A. L. Kennedy, the magnetician. As at the Main Base, the time entries refer to local mean time. A system of night-watch was maintained as at Cape Denison, so that the record deals with the whole of the twenty-four hours, though very limited in the frequency of entries. Both in this log and in that of Macquarie Island the method of entry and the character of observation differs considerably from the standardised model adopted for Cape Denison.

The auroral log at Macquarie Island was kept by G. F. Ainsworth, meteorologist in charge, during the years 1912 and 1913. The loggings for the year 1912 are so meagre as to be scarcely worth reproducing, but the following year special attention was given to the subject, and a useful record is presented. After that date, Mr. H. A. Hunt (Commonwealth Meteorologist) maintained and occupied the Station with members of his staff; but the records of the year 1914, made by Mr. Power, were lost with him in the foundering of the relieving steamer *Endeavour*; as a consequence, only such remarks are available as were entered by Mr. Henderson, the wireless operator, in his journal, which merely records the presence or absence of auroral phenomena each evening at the time of communicating with Hobart and Wellington. The records for the year 1915, made chiefly by Mr. Tullock, are available, and are reproduced herein. All times are local mean time.

II.—TERMS EMPLOYED IN THE DESCRIPTION OF AURORAL PHENOMENA.

THE following types of Auroræ are recognised:—

Arches and *Arcs* are luminous manifestations in the heavens of more or less regular or evenly curved form as ribbons of considerable longitudinal extent, usually continuing beyond the limits of the horizon on either hand.

There is considerable confusion in literature in the application of the two terms, some observers taking them to be synonymous. It seems best to restrict the application of the term *Arch* to those forms which traverse the upper atmosphere along a more or less straight path, which, by keeping its vertical distance from and following the curvature of the earth is, in fact, arched or curved in a vertical plane (Plate I, figs. 1 and 2).

The term *Arc* well describes such forms as are distinctly bowed in a more or less horizontal plane (Plate II, fig. 1).

Arches and Arcs are sharply defined along their lower margin, and pass upwards in the vertical plane as gradually fading luminescence, either nebulous (Plate I, fig. 1) or in long parallel rays referred to as *Streamers* or *Filaments* (Plate I, fig. 2, and Plate II, fig. 1).

Bands are less regular forms than the foregoing, elongated and sinuous, but often very variable in cross-sectional dimensions. This term is also used frequently in the journal when referring to a short length of arch or arc.

Curtains are the most delicately defined types of auroral manifestations. Here the luminosity appears in a narrow vertical plane, often of great vertical depth. The lower margin is always well defined and sharply terminated below, but rising upward therefrom are long vertical filaments or streamers which fade out as they rise upwards—a circumstance which results in a much-frayed and indefinite upper limit. The intensity of the luminous phenomena is always greatest along the lower margin of curtains (*vide* Plate II, fig. 2).

This vertical plane of luminous traceries is often folded upon itself in its course across the heavens, giving it an unmistakable resemblance to a hanging curtain (Plate III, fig. 1). Such draperied phenomena may hang suspended in the heavens for many minutes without apparent motion. At other times, especially when of greater intensity, it may gently vibrate, giving to it an aspect of peculiar beauty. Frequently curtains may extend continuously from horizon to horizon, but in cases of weaker intensity the brighter sections only are visible and a broken or disjointed curtain is the result. Where still fainter, only isolated streamers may remain, yet the experienced eye may still be able to note that the isolated phenomena are to be regarded

as elements of a non-continuous (so far as visibility is concerned) curtain. Note the outline of three curtains shown in Plate III, fig. 2; the upper ones are successively fainter, only isolated streamers (or rays) appearing in the case of the most elevated example.

Rays (Columns or Pillars).—These appear to be nothing more than isolated streamers, often of considerable height or intensity. In appearance and, no doubt, also in genesis, they are not to be distinguished from the first or last visible streamers of a waxing or waning curtain; an end on view of a curtain or related form would present this same appearance. In this journal, therefore, these forms are not specially noted, but referred to as "isolated streamers."

Whirls or Vortices.—A rapid rotation of the luminous mass in a horizontal plane, or in spiral form, about an axis perpendicular to the horizontal plane. Such movements can be properly discerned only when the phenomenon is near the zenith, as it needs to be viewed from below to determine the nature of the activity.

Coronas as recorded in the Arctic Regions are often described as separate bars of luminescence, which radiate out from the same point, usually taken to be at or near the zenith.

During three years spent in the Antarctic Regions the only appearances I have witnessed referable to this type, or apparently so, are yielded by more or less annular bands, or convolutions of curtains, with well defined streamers, when viewed from directly below. Under such circumstances the vertical filaments appear to converge upwards to the zenith, an effect due to perspective. This is illustrated in Plate IV, fig. 1.

Sheets are broad, nebulous masses of luminescence which spread more or less horizontally over considerable areas of the sky, usually as the later stages of auroræ of great intensity. In their early stages they are usually very intense and then gradually fade away.

Patches are irregular nebulous masses of small dimensions of cloud-like luminescence, usually of weak intensity and fading out at the margins. Plate I, fig. 3, illustrates a patch, on the right-hand side of the Plate. When of the weakest possible intensity, of the nature of diffuse gleams, the term auroral *blush* is more appropriate. See Plate I, fig. 3, on the left side.

Auroral Haze is an almost imperceptible luminescence of the most diffuse type.

All auroral phenomena are constantly changing in intensity of illumination. These changes are referred to in the Journal of Records as *Waxing and Waning*. Usually the rekindling of the luminescence, after each period of waning, operates definitely from one particular direction; this is referred to as the *Travel of the Luminescence* or *Excitation*. The latter term is more particularly used to indicate

the stimulation which is often regularly and rhythmically communicated to the luminescence of the filaments of curtains, causing the sensation of a rippling of light from one end to the other.

By *Trend* is meant the actual geographic bearing of the course of an arch, curtain, &c. The trend is difficult to reckon accurately, unless the phenomenon is near the zenith. In the case of a series of parallel arches across the heavens, only such as cross the zenith appear to continue from horizon to horizon as a straight line. Those nearer the horizon on either hand appear bowed away from the observer, due to the effect of perspective. Thus they appear to converge on the horizon in opposite regions of the sky—the *Noah's Ark* effect commonly observed in the case of parallel bars of cirrus cloud. Plate II, fig. 2, shows parallel curtained arches converging on the horizon.

Body Travel refers to the movement of the luminous manifestations *en masse* across the celestial vault.

Many very delicate effects are recorded in this Journal of Auroræ. So faint were some of these that they were rendered distinctly visible only by staring sideways—a trick which throws the focus upon a fresh and more sensitive portion of the retina.

The terms employed in describing the phenomena witnessed at the Queen Mary Land Station and at Macquarie Island do not correspond fully with the above nomenclature.

A perusal of the records shows definitely that the character of the manifestations in the Subantarctic Zone is frequently quite different to that prevailing in higher southern latitudes.

In all cases directions stated in the following Records of Auroræ refer to true bearings not magnetic. Time is Local Mean Time, and is recorded as hours, one to twenty-four, beginning and ending at midnight.

III.—RECORDS OF AURORÆ.

ADELIE LAND.

1.—JOURNAL OF AURORAL OBSERVATIONS FOR THE YEARS 1912
AND 1913, CAPE DENISON STATION, COMMONWEALTH BAY.

Chief Recorder: D. MAWSON.

1912.

February.

13-23-45 Trace of three auroral curtains extending E. and W. low in the N. sky; the principal curtain is 12° above the horizon. The excitation travels mainly from W. to E. This is apparently a brilliant display, for the sky from the zenith to the S. is still well lit by daylight.

The display remained visible for a period of 10 minutes only.

Observations from now until 25th instant interfered with both by the strength of daylight and the prevalence of overcast skies.

25-23-00 An arch trending approximately E. and W. situated about 6° above the N. horizon.

24-00 No aurora seen.

26-23-15 An arch 6° above the N. horizon between N.N.W. and S.S.E. This constituted of streamers rising from a nebulous lower border. The excitation seen to travel both ways. Two parallel arches visible near the zenith.

24-00 No aurora reported.

Sky overcast during the 27th and 28th instant.

29-23-00 A faint nebulous arch stretching across the N. sky about 5° above the horizon.

24-00 A faint trace of aurora in the N.

March.

Sky obscured during the 1st instant by drifting snow until 23 h.

1-24-00 Aurora in the N. and N.W. Sky temporarily clear.

Sky obscured by cloud and drift snow until 12 h. on the 8th instant.

8-23-00 A strong auroral display in the N.W. about 5° above the horizon. Chiefly consisting in a curtain extending E. and W., bright despite haze and moonlight.

Sky obscured by clouds until 21 h. on 10th instant.

10-24-00 A strong display. Curtain waxing and waning about 10° above the horizon extending from N.E. to N.W.

Sky overcast by clouds until 18 h. on 12th instant.

12-24-00 A faint aurora in the N.N.E.

13-01-00 Sky clear, but no aurora reported.

20-30 An arch about 5° up in the N. extending from N.N.E. to N.N.W. The excitation travelling from the E. A faint red lower border visible for a while. This arc is bowed to the S., part of a circle centric upon a focus to the N. A fragment of another arc is visible to the N.N.E. concentric on the former.

1912.

March.

- 13-21-50 Since 20 h. 30 m. the phenomenon has continued, though the arcs have risen considerably. The lower limbs are now 8° above the horizon and some of the streamers are particularly high, even to 30° . An arc now stretches from the W. horizon to the E.N.E. The excitation travelling both from E. and W.
- 22-25 The aurora continues, but is slightly more elevated. The arc is now passing behind a bar of cirro-stratus cloud.
- 22-55 The display continues strong and is sending up high streamers. Part of three curtains are visible in the N.N.E. They have now risen to 15° above the horizon.
- 24-00 An extensive arch 20° above the horizon extends from N. to E. Other fragments appear in the N. and E. sky.
- 14-00-15 Aurora faint in the N.
- 00-25 Aurora absent.
- 02-30 Two fragments of a curtain in the southern sky up to 30° of elevation. Another extending from the zenith into the northern sky.
- 02-45 Faint aurora in the southern sky.
- 03-10 Aurora absent.
- 21-45 Aurora on the N.N.E. horizon. One streamer rising to an altitude of 10° .
- 24-00 Faint aurora behind a bank of cumulus clouds in the N.W.
- Sky obscured by clouds from 3 h. on the 15th instant to 21 h. on 17th instant.
- 17-24-00 Sky clear, no aurora visible.
- 18-04-00 Ditto.
- 20-40 A faint auroral glow in the N.E.
- 21-45 A dull auroral glow extending from N.N.E. to E. to an altitude of 10° .
- 22-05 Aurora disappeared.
- 24-00 Aurora absent.
- 19-03-15 Long auroral bands from near N. horizon over zenith, to 20° above S. horizon.
- 03-23 Aurora fading.
- 03-30 Aurora disappeared.
- 24-00 Faint glow in N. and N.E.
- 20-01-00 Aurora absent.
- 24-00 No aurora visible.
- 21-01-50 A faint auroral glow at an elevation of 10° extending from N.N.E. to N.E.
- 02-15 A faint auroral glow from N.W. to N.N.E.
- 19-45 An auroral arch in the N. sky extending from E. to W. at an elevation of 6° . Second magnitude stars just visible through it. The arch sends up very high streamers and has risen slowly from the horizon to its present altitude. Nebulous patches which were left at intervals drifted slowly bodily to the W.
- 20-30 The arch is now steady and waning.
- 20-40 The aurora had slightly increased forming a bright nebulous band about 5° above the horizon stretching from the N.E. to W.N.W.
- 21-00 An arch extended near the horizon from N.W. to E.N.E. It is about 2° in vertical depth and quite nebulous.
- 21-10 The arch has broken down into a number of separated portions.

1912.

March.

- 21-22-00 A curtain 12° in highest altitude extending from N.N.E. to W. In the E. a fragment of a curtain shows at an altitude of 10° .
- 22-15 A faint glow from W.N.W. to N.N.W. Four faint streamers in the N.N.E. The phenomenon gradually faded.
- 23-00 A glow just visible from N.E. to N.N.W. at an altitude of 10° .
- 23-30 Aurora absent.
- 23-40 Faint glow in N.W. to W.N.W. at an altitude of 8° .
- 24-00 A glow in the N.W.
- 22-00-30 Aurora absent.
- 01-00 A faint auroral glow in the N. and N.E.
- 23-21-00 An auroral glow on a low bank of cloud on the N. horizon.
- 21-45 A faint auroral glow still persisting on the N. horizon.
- 24-20-30 A nebulous glow on a cloud bank on the N. horizon.
- 21-15 A strong nebulous arch 8° up to the N. extending from N.E. to N.W. Several ill-defined streamers rising above the arch.
- 22-00 The arch had risen a little higher and the chief illumination appeared at the E. end.
- 23-15 The arch still persisted in approximately the same position.
- 24-00 An auroral arch waxing and waning at intervals situated just above a cloud bank on the N. horizon from the E.N.E. to W.N.W.
- 25-02-00 No aurora visible.
- 04-00 No aurora visible.
- 19-45 A faint nebulous aurora, several degrees above the N. horizon.
- 20-00 A fairly strong nebulous arch 5° above the horizon to the N. This appears along the upper edge of a cloud bank on the horizon as was the case the previous evening.
- 20-30 The aurora has risen slightly and extended from E. to W.
- 21-00 The aurora continues waxing and waning. It is now quite bright and has risen several degrees.
- 23-50 A nebulous band with occasional streamers about 12° above the N. horizon, steadily increasing in brilliancy.
- 24-00 As last reported, but much brighter.
- 26-00-15 The phenomenon has now waned and is represented by a faint glow to the N. and N.E., some 12° to 15° above the horizon; brighter in the latter direction.
- 00-30 A faint glow in the N. and N.E.; more extensive in the latter direction.
- 01-00 Aurora absent.
- 20-00 A faint nebulous aurora 10° above the horizon in the N.
- 20-30 As last reported.
- 21-00 A large patch of aurora 20° up in the N., also another 40° up to the W.N.W.
- 21-45 Two faint bands; one very faint 5° up in the N.; the other 15° up to the N.
- 22-30 A faint glow 20° up to the N.
- 23-30 Aurora absent.
- 24-00 Sky overcast.
- 27-03-00 Sky overcast.
- 04-15 A faint aurora 10° up in the N., observed in a temporary clearance in the clouds.

Sky obscured by cloud until 18 h. on 29th.

1912.

March.

- 29-20-30 A bright auroral glow on the N. horizon appearing behind a large iceberg and below a bank of strato cumulus clouds.
- 22-00 Bright moonlight obscured any faint auroral effects.
- 22-30 The clouds clearing away in the N. and the moon shining bright in the N.N.W. Notwithstanding this, a fine display of aurora appears in the N. sky extending from E. to W. This is in the form of concentric curtains, as many as three of which are visible. They wax and wane rapidly. The highest of the curtains reached an altitude of 60°.
- 24-00 A faint arch about 10° up in the S. extending E. and W.; waning slowly.
- 30-00-30 Aurora absent.
- 01-05 A brilliant curtain aurora in the form of two concentric arcs 10° and 15° up respectively, extending E. and W. across the N. sky.
- 01-40 The aurora is now fainter. A single curtained arc about 50° up extends from the N.W. horizon to the E.
- 02-40 A very faint fragment of a curtain in the N.E.
- 03-30 A faint arc about 20° up extends from N.W. to N.E.
- 04-15 Aurora absent.

North sky obscured by clouds between 18 h. and 24 h., and later completely obscured for the remainder of the month.

April.

Sky completely obscured by clouds.

- 1-19-00 A small auroral glow to the W.N.W. continuing until 20 h.; visible in a temporary gap in the clouds.

Sky obscured by clouds and drifting snow until 21 h. on the 13th instant.

- 13-21-30 An auroral glow 10° above the horizon extending from E. to N.
- 22-00 The aurora has continued re-illuminated at intervals from the E.
- 24-00 A faint nebulous arc curved to the N. 20° above the horizon, extending from E. to N.W.
- 14-00-30 The arc has faded to a feeble glow, lasting longest in the N.W.
- 01-15 A feeble auroral glow in the N.W.
- 02-15 An arch extending from the horizon in the southern sky across the zenith to a point 20° up in the northern sky. Trending from the zenith to the west of north.
- 03-00 A feeble curtain across the zenith from the northern to southern sky.
- 03-30 Aurora not visible; but moon has now risen.
- 19-45 A nebulous arch near the horizon extending from the N.E. by E. to the N.E. The excitation travelling from the E. end.
- 21-00 The band has extended further to the N.W., so that it stretches from N.E. by E. to N.
- 21-10 Drifting snow obscures the sky, but a faint auroral light visible through it from the N.E.
- 24-00 Drifting snow still obscures the sky; but a faint glow still visible in the N.E.

Sky obscured by clouds until 21 h. on 16th instant.

- 16-22-00 The drift cleared away, but no aurora visible.
- 22-20 A faint auroral glow on the N. horizon.
- 24-00 A faint curtain about 5° up in the N. sky, extending from N.W. to S.E.
- 17-01-15 An arch about 20° up, extending from N.W. to N.E.
- 02-45 A nebulous arch in the same position.
- 04-40 Three small auroral patches about 30° up in the N. sky.

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17-05-00 Nebulous patches about 20° up, extending from N.W. to N.E.

20-30 Aurora absent.

21-45 Faint indications of an aurora on the N. horizon.

23-00 Aurora absent.

Sky clear. No aurora seen between 24 h. on 17th to 18 h. on 18th instant.

18-20-10 A curtain aurora 4° in depth and some 10° up, extending from N.E. to W.N.W.

21-30 A bright glow 3° above the horizon, extending from N. to N.E., with streamers rising above.

22-25 A faint glow extending along the horizon from N. to N.E.

22-35 The glow somewhat brighter and a few streamers rising above it.

24-00 An auroral glow visible above a bank of nimbus clouds on the horizon, extending from N. to N.E. A streamer rises high above the cloud.

19-01-00 A faint glow in the N.

02-00 A luminous arch extending from N.N.E. to N.N.W. appears just above a bank of cloud.

02-30 Aurora absent.

20-00 A slight drift. No aurora visible.

24-00 Sky partly obscured. No aurora visible.

Sky overcast between 1 h. and 15 h. on 20th instant.

20-18-00 A faint aurora about 6° up, extending from N. to N.E.

19-00 A strong glow extending from N.N.W. to E., between 8° and 18° of altitude. Streamers show between N.E. and E.

19-20 Two auroral arches with faint streamers rising above them; the first 5° in altitude, the second 10° in altitude. These extend across the N. sky from W. by N. to E. by S. They are brightest in the E.

19-40 The arches have faded at extremities, and concentrated in the N.E. A faint glow in the S., 20° above the horizon.

19-50 The arches brightened considerably in the E., and now extend from the N.W. to E. by S. The altitude of upper arch is 12°.

20-30 A very faint glow extends from the N. to the N.N.E., with very faint streamers 15° above the horizon.

21-00 A very faint glow in the N., N.E., and E., in the same position as previously.

22-00 Drift denser and no aurora visible.

23-00 A nebulous band extending from the N.W. horizon to the E., reaching an altitude of 15° to the E. Streamers rose 30° in the N. and N.E.

23-15 A very strong aurora just above the N. horizon, extending from E. to W. From N. to N.W. it forms a closed ring. Excitation passes rapidly from W. to E.

23-40 No aurora visible. A bank of cloud obscures the N. horizon.

24-00 Banked clouds on the N. horizon. No aurora visible.

21-01-40 Aurora extends from S.E. to N.E. near the horizon; sky almost wholly obscured by clouds.

02-30 Very faint aurora N.E. to S.E.

03-50 Aurora absent, although sky unclouded except close to the horizon.

21-15 A nebulous band above a cloud bank 8° above the horizon, extending from E.N.E. to N. The band slowly extending towards the W.

22-15 A faint auroral glow in the N.E.

24-00 Aurora apparently absent, but moderate drift obscures delicate effects.

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- 22-20-45 A faint auroral glow 10° up in the W.N.W.
 23-20 Sky partly obscured. No aurora visible.
 24-00 A bright curtain about 10° up in the N., extending 5° or 6° horizontally. The phenomenon faded very quickly.
- 23-00-30 A nebulous aurora a few degrees above the N. horizon, waxing and waning at intervals of a few seconds; re-illumination comes dominantly from the W.
 01-05 A faint auroral glow on the N. horizon.
 02-15 No aurora visible.
- 19-30 Aurora absent, though sky clear.
 20-30 Aurora absent. Sky clear.
 24-00 Ditto.
- 24-02-00 An auroral glow just above the N. horizon, extending from the N.W. to the W.S.W. Brightest at the N.W. end; from where also the excitation appears to come.
 05-30 The glow continued between 2 h. 30 m. and 5 h. 30 m., though creeping round slowly to the S.W.
 06-00 A faint auroral glow in the N.W. to S.W.
 07-00 Sky obscured by clouds until the evening of 26th.
- 26-21-00 Ditto.
 22-00 An auroral glow 25° up in the N.N.E. Seen during strong moonlight.
 23-00 Sky largely overcast.
- 27-03-00 Ditto.
 04-00 A faint curtain aurora stretching from the W.N.W. horizon up to 15° in the W.S.W., and down to the S. by E. horizon. The depth of the curtain was uniform, about 6° . The excitation moved towards the S.W.
 04-10 Aurora faded except for a faint patch in the W.S.W.
 04-40 A faint band about as strong as the Milky Way stretching from S.S.E. to a point 10° E. of the zenith.
 05-10 A faint band stretching from the S.E. to the zenith, then curves around to a point 10° E. of the zenith.
 05-20 The band has faded, except a fragment of a curtain at the zenith, trending N.W. by N.
 05-30 No aurora visible.
 06-00 Ditto.
- 20-00 A curtain extends from N.N.W. to N.E., 10° up at the extremities and 20° in the centre. The brilliance is dimmed by bright moonlight.
 20-30 A strong curtain, 5° up, extending from N.W. to N.N.E. Ripples of luminescence travel rapidly along it. The colour is a fairly uniform siskin-green, the effect of viewing in moonlight being to modify the apparent colour. At this time the N. horizon appears of a pinkish hue to a height of 4° .
 24-00 Sky overcast. No evidence of aurora.
- 28-05-15 The N. sky obscured. Several streamers in the zenith.
 06-00 A fragmentary curtain extends from a point 45° up in the S.S.E. to a point 30° up in the N.N.W. The sky has cleared.
- Sky considerably obscured by cloud and drift snow until the 30th.
- 30-03-00 No aurora noted. Sky partly obscured.
 06-00 Drift snow obscured the sky to an altitude of 20° . No aurora visible.
 24-00 The zenith clear and moonlight strong. No aurora visible.

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2-20-00 Sky partially clear. No aurora visible.

24-00 Light drift snow and strong moonlight. No aurora visible.

3-01-00 Ditto.

03-00 Ditto.

06-00 Ditto.

18-00 The lower sky, only, obscured by cloud. No aurora visible.

21-30 Clear in the zenith. No aurora visible.

24-00 Sky partially obscured. No aurora visible.

4-06-00 Very little drift; cloud on the N. horizon only. No aurora noted.

18-00 Sky clear; light drift only. No aurora visible.

22-00 A fine auroral curtain 15° up, from N.N.W. to E.N.E.22-40 Sky clear. A faint auroral glow 10° to 12° above the N. horizon, extending from N.N.E. to N.N.W.

24-00 Sky clear; slight drift. No aurora seen during the early morning hours.

5-06-00 Ditto.

18-00 Clear sky. Bright moonlight. Light drift. No aurora visible.

21-30 Clear sky. Bright moonlight. Slight drift. A bright aurora in progress. A contorted curtain about 45° up extends from N.W. to E. The luminescence flits from one streamer component to another. The brightest of the streamers shows strong colour in vertical arrangement, being tinted green on one side, yellow in the centre, and pink on the other (E.) side. The trend is approximately W.N.W. to E.S.E.21-35 The curtain has now risen to 60° up, and has extended to the W.N.W. It now shows considerable convolutions.

21-40 It has now faded, excepting a faint demonstration in the N.W. The most brilliant display in connection with this demonstration appears to have taken place at the eastern end.

22-45 No aurora visible.

24-00 Ditto.

Sky now obscured by cloud until the 9th inst.

9-02-15 Sky clear. Slight drift. No aurora visible.

06-00 Sky clear. Bright moonlight. No aurora visible.

18-00 The N. sky clouded to a height of 20° . No aurora visible.

Sky now became overcast until the morning hours of 12th inst.

12-06-00 Bright nebulous patches representing a discontinuous arch crossing the zenith in a S.E. to N.W. direction. Faint streamers appeared in the sky between N.E. and N.W.

06-05 The arch over the zenith now bunched.

06-10 Bright curtains extending from the zenith.

06-30 A faint curtain and isolated streamers in the N.W., and a fragment 40° up in the N.

06-35 A faint aurora in the N.W.

06-45 Faint streamers in the N.W. The fragment in the N. sky now brightens up.

06-50 Three arches in the N. and N.E. sky. The first about 25° in lateral extension and 15° up in the N.; the second at an altitude of 60° ; the third a small fragment, only somewhat N.E. from the zenith.

06-58 The arches just referred to travelled slowly to the E., or somewhat S. of E. The streamers in the N.W. again became visible for a few minutes.

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- 12-07-15 A faint arch at an altitude of 35° appears in the N.W. Within a few minutes later several others also appear in the W.N.W. and N.W., and all travel rapidly to the E.
- 07-45 The twilight is now so strong as to obliterate any auroral effects.
- 16-45 The sky is now dark enough to discern several of the brighter stars. An auroral glow is just visible in the N.E., and is rapidly spreading.
- 17-00 A fine display is in progress, extending from N.N.W. to E. to a height of about 20° .
The phenomenon recorded in the last two entries consisted chiefly of a principal curtain with several subsidiary fragments extending N.W., later becoming W.N.W. In the earlier stages the W. ends curved to the N. The lower border of the principal curtain showed red in colour from time to time. The excitation appeared to come dominantly from the E. On its first appearance the curtain was built up of streamers, but as time elapsed the streamers became leavened, and the arch assumed the character of an even nebulous band, waxing and waning at intervals.
- 18-00 The nebulous arch still continues but is gradually fading.
- 21-45 An arch 15° to 20° in altitude, extending from N.W. to E. Streamers rising from the E. extremity.
- 24-00 Sky clear. No aurora visible.
- 13-00-45 A nebulous irregular band extending from N.E. to S.E.
- 01-15 No aurora visible.
- 06-00 Sky obscured by drift.
- 18-00 Ditto.
- 24-00 Most of the sky clear. No aurora visible.
- 14-00-10 An auroral glow 10° above the horizon, extending from N.E. to W.S.W.
- 00-15 A curtain develops from the S. by E. towards the N., passing 5° E. of the zenith.
- 00-20 A curtain 5° E. of the zenith trending N. and S.
- 00-25 A faint glow 15° above the S.S.W. horizon.
- 00-27 Aurora disappeared.
- 01-00 Aurora absent.
- 02-00 A faint glow in the S.S.W.
- 02-10 A faint glow 10° above the N.N.W. horizon.
- 03-00 A faint band trending S. by E., extending from 15° above the S. horizon to a point 5° N. of the zenith. It disappeared a few minutes later.
- 04-00 Aurora absent.
- 05-00 Ditto.
- 06-10 A faint auroral glow in the N.E.
- Sky now obscured until 20 h. on the 15th inst.
- 20-45 A bright nebulous band 30° up, extending from N.W. to E. At the E. extremity was a strongly coloured green, yellow, and red streamer.
- 21-00 A fine curtain 25° in altitude, extending from N.W. to E.N.E. It appears to be extending to the W.
- 21-11 A thin band 10° in altitude extending from N.N.W. to N.E. Most intense in the N. by W.
- 21-30 A faint band 10° in altitude, extending from N. by W. to E.
- 21-39 A band 12° in altitude, extending from N.W. to N.E. A second band rising from the E. to an altitude of 50° in the N. by E. and terminating in a very high and bright streamer.
- 21-45 A faint broad nebulous glow in the N., extending from N.W. to E.N.E.
- 22-15 Faint auroral patches at an elevation of 8° in the N.W. and N.E.
- 23-00 A faint bar of auroral nebula from N.W. to N.E. near the horizon.

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14-23-25 No aurora visible.

24-00 Northern sky partially obscured by clouds. No aurora visible.

16-01-00 No aurora visible.

05-05 Nebulous bands and patches visible all around the horizon, excepting the S. and S.W. An indistinct curtain 60° up in the S.E. Three bands cross the zenith trending from the E.S.E. to the N.W. Another 30° in altitude extending from N.N.E. to N.W.

06-00 A nebulous arch 30° up in the E.S.E. Several bands extend across the zenith from E.S.E. to W.N.W. An arch moving rapidly shows in the N.E. sky 25° up. Irregular patches and streamers observable in all quarters, excepting in the S. and S.W.

06-55 Patches of aurora were visible in the zenith, though obliterated elsewhere by daylight.

17-30 A curtain 10° up from N. to E.N.E.

18-00 A bright nebulous auroral band extending from a point 10° up in the E. to a point 20° up in the W.N.W. Brightest at the E. extremity.

19-55 The auroral band has continued since the last observation but has extended towards the W. It now extends between W. and E.N.E. at an altitude of 8° above the N. horizon; in the N.W. it is bifurcated, a small branch rising a little higher.

20-50 A faint nebulous band about 12° up, extending between N.E. and N. by W. Another band about 15° up, extending between N.E. and N. by E.

21-40 A nebulous band, showing over a cloud bank 5° above the horizon between N.E. and N.; recurved at the N.E. end. The excitation travelling from E. to W. Several streamers rising from the band.

22-45 Aurora absent.

23-20 A bright display extending from W.N.W. to E. Several confused curtains extend, some 10° above and parallel to the horizon, extending from W.N.W. to N. A good curtain with long streamers extends round near the horizon from N. by E. to the E.

23-30 A bright aurora is in progress, having continued since 23 h. 15 m. It consists mainly in a long curtained arch trending for the most part S.E. by E. to N.W. by W. The curtain is rising slowly towards the zenith. It has extended from the horizon in the E.N.E. to that in the N.W., and has reached a height of 20° up. At the W. end it terminated temporarily in several curves, but finally withdrew from that quarter, leaving only a large persistent mass of nebulous luminescence. The curtain waxes and wanes, sending off several offshoots. No special colour effects have been noted.

00-10 A small patch of nebulous luminescence 5° up in the N. and less in the N.W.

00-37 A faint nebulous patch 10° up in the N.E.

01-02 A long nebulous arch about 8° up, extending from the N.N.E. to E., trending apparently N.N.W. and S.S.E.

01-15 Aurora absent, excepting for a glow on the E. horizon.

01-26 Aurora absent.

01-41 A faint auroral light on the E.S.E. horizon.

01-50 Aurora practically absent, only the merest trace on the E. horizon.

02-10 Aurora quite absent.

02-50 Faint auroral streamers in the S.E. and S.S.E.

03-10 A fairly bright curtain from the horizon in the S. to a point a few degrees E. of the zenith, then curving (parabolic) away to the S.E. The latter end continued to wax and wane for some time.

03-15 The curtain now fainter, and the S.E. end begins to straighten out.

03-25 A faint band extending from the S.E. horizon to a point 50° up in the E., thence to 40° up in the E.N.E. The original curtain has evidently straightened out and is travelling E.

03-45 A very faint curtain extending from the S.E. to the zenith.

04-00 No aurora visible.

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- 17-04-25 No aurora visible.
 05-00 Ditto.
 05-30 Ditto.
 06-00 Several streamers appear 60° up in the E.
 17-20 A glow 15° up in the N. by W.
 17-25 A nebulous arch across the sky, extending from the E. by N. horizon across the zenith to the W. by S. horizon. The excitation comes from the E. The E. by N. end is the brightest, the brilliance waxing and waning in rapid succession.
 17-30 No aurora visible.
 18-00 Sky somewhat obscured. No aurora visible.

Sky now obscured by cloud and drift until evening of 20th inst.

- 20-18-00 A nebulous arch extending over the zenith from E. to W. Also nebulous patches in the zenith.
 20-20 Sky clear. No aurora.
 21-00 No aurora.
 22-00 A faint curtain 20° up in the W.N.W., trending approximately N.N.E. and S.S.W.
 22-30 No aurora.
 24-00 An auroral glow on a cloud bank on the N.E. horizon.
 21-00-45 An auroral arch just appearing over a cloud bank low down in the N.
 02-00 A strong auroral glow in the N.E. and N.W., extending up to 9°.
 04-30 Nebulous auroral arches, extending from N.W. to S.E. Patches in the zenith.
 05-30 Ditto.
 06-00 Aurora all over the N. sky. Patches in the zenith and in the S.E.
 06-30 Abundant patches of aurora in the sky.
 18-00 Sky obscured.
 24-00 Ditto.
 22-03-10 Sky clear in the zenith. No aurora noted.
 05-00 Ditto.
 06-00 Ditto.
 18-00 Ditto.
 24-00 Ditto.

Sky now obscured until 19 h. on the 24th inst.

- 24-21-30 Sky clear. No aurora noted.
 22-00 An auroral curtain formed a few minutes ago in the N.N.E. and spread to the W. and E., extending in a few minutes to the N.W. and E.N.E. This display appears faint, but is obscured by the light of a half-full moon.
 24-00 A nebulous band 10° above the horizon, extending from N.E. through E. to S. Several long streamers rising above the E. horizon.
 25-01-00 A fragment of a curtain 20° up in the N.W.
 01-45 No aurora visible.
 06-00 Clear sky. No aurora noted.
 16-00 Clear sky. No aurora visible.
 16-50 A nebulous aurora on the N.E. horizon.

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- 25-18-00 No aurora visible.
- 20-15 A faint auroral blush on the E.N.E. horizon.
- 21-00 No aurora visible.
- 22-20 Ditto.
- 24-00 A nebulous arch, about 35° above the horizon at its greatest elevation, extending from the E.S.E. and disappearing in the moonlight in the N.W. A fragment of a curtain in the E.S.E. and another in the N. Very rapid changes of formation are taking place.
- 26-00-20 A faint curtain in the N. extending over about 30° horizontally and reaching an altitude of 40°
- 01-15 A faint auroral nebula 20° up in N.N.W.
- 02-10 A faint auroral nebula 25° up in N.N.E.
- 03-15 No aurora visible.
- 06-00 A curtain extending from S.E. to N.W. over the zenith: Other curtains up to 45° up in the S.E. and N.E., and again up to 30° in the N.W. The curtains change form rapidly.
- 07-05 Two faint bands trending S.E. to N.W. in the zenith, extending through 30° of arc.
- 18-00 Sky partly obscured. No aurora visible.
- 20-00 Aurora in the form of a nebulous band 6° up, just appearing in the N.E. The colour appears rather more greenish than usual, as is always the case when viewed in moonlight.
- 20-30 No aurora visible, but a haze obscures the N. sky.
- 20-55 No aurora visible, but sky partly obscured by cloud and elsewhere veiled by haze.
- 22-30 Ditto.
- 24-00 Ditto.
- 27-02-30 A faint auroral glow 20° up in the N.N.E.
- 02-50 A nebulous aurora 30° up, extending from N.E. to N.W. In the N.N.W. streamers somewhat obscured by moonlight.
- 03-30 A well marked curtain aurora extending from S.E. to N.W. across the zenith, also three well marked curtains extending 45° above the horizon towards the zenith. They changed form rapidly. In a few minutes interval they were observed to change trend; in the first instance extending from the zenith to the N.N.W., then from the zenith to the N.W. Towards the N.W. the arches are more nebulous, whereas they are curtained in the S.E.
- 03-50 The curtain aurora still strong. Four faint curtains and one strong one extended across the zenith towards the N.W.; nebulous towards the N.W. curtained in S.E. Before dying away the main curtain just referred to was observed to change its position from S.E. to E.
- 04-15 The aurora is now fainter. Five faint bands extending to 40° up from S.E. horizon, there becoming nebulous and continuing to the N.W. In the N.W. there is a single well marked curtain rising 35° above the horizon.
- 04-50 Two well marked curtains extending towards the N.W. from a point 40° up in the S.E. In N.W. there are two extending to 40° above the horizon. In the S.E. there are three fainter bands extending to 15° up.
- 05-25 The curtains have brightened somewhat. Three well marked ones extending from the S.E. towards the N.W., two reaching the horizon in that direction, the other dying out at the zenith.
- 06-00 A well marked curtain extending across the zenith from S.E. to N.W.; also a faint band 30° up in the S.E. Three faint curtains 30° up in the N.W.
- 06-30 The display has become fainter. Two bands extending to a point 60° up in the S.E.; another reaching to the zenith. Between W. and W.N.W. there are three faint bands extending 30° up.
- 07-00 Three faint bands in the S.E., one reaching the zenith, the others reaching to 50° up.
- 07-30 The aurora has disappeared.

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27-18-00 Sky clear; bright moonlight. No aurora visible.

20-15 Ditto.

21-00 Ditto.

21-30 Ditto.

22-05 Ditto.

24-00 Ditto.

28-02-40 Ditto.

03-10 Ditto.

03-50 Ditto.

04-40 Ditto.

05-20 Ditto.

06-00 Ditto.

Sky now obscured until the evening hour of 29th inst.

29-16-00 Sky partially obscured. No aurora visible.

18-00 Ditto.

24-00 Slight drift, but clear in the zenith. Bright moonlight. No aurora visible.

30-06-00 Ditto.

18-00 Sky partially obscured. Bright moonlight. No aurora visible.

21-00 Ditto.

23-00 Ditto.

24-00 Ditto.

31-06-00 Sky clear. Full moon. No aurora visible.

18-00 Ditto.

24-00 Ditto.

Sky now overcast until 4 h. on 2nd inst.

June.

2-04-15 Sky partially obscured. Bright moonlight. No aurora visible.

06-00 Ditto.

07-15 Sky clear. Bright moonlight. No aurora visible.

18-00 Ditto.

Sky now overcast until the evening of 3rd inst.

3-16-00 Sky clear. No aurora visible.

18-00 Ditto.

21-30 An arch 6° up centred in the N.N.E., extending from the E. horizon to the N.W., fading away in the latter direction. Pulsations of light coming from the W. Bright moonlight.

21-40 The arch has slowly extended to the W., and is very bright and shows a red lower border and a greenish tint above. Rapid pulsations come from either extremity. Streamers shooting up from it show colour, being always red on the advancing edge and green on the other side. In all cases the red colour shows on the lower edge of the curtain and on the western face of the individual streamers. Streamers shoot up suddenly and disappear as quickly. Below the red lower selvage of the curtain the sky appears unusually black.

22-00 The display has faded very much, the brightest part appearing in the N.

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- 3-22-10 No aurora visible.
 22-30 Ditto.
 22-45 An auroral blush 6° up in the N.
 23-30 A faint band in the position of the bright arch of 21h. 30 m.
 23-45 No aurora visible.
 24-00 Ditto.
- 4-00-15 A faint band 6° up between N.N.E. and N.E.
 00-35 A nebulous patch 3° up in the N.N.W.
 00-45 Clear sky. No aurora visible.
 01-25 Ditto.
 01-45 Ditto.
 02-10 Ditto.
 02-45 Ditto.
 03-00 Ditto.
 03-45 Ditto.
 04-15 A long faint streamer rising from the W.N.W. horizon.
 05-10 No aurora visible.
 05-40 Ditto.
 06-00 Two faint auroral bands cross the sky from the S.E. to the zenith. Moonlight fairly bright.
 06-20 A faint curtain trending from the S.E. to the zenith; extending between points 30° and 60° above the S.E. horizon. A patch 30° up in the N.N.E.
- 07-10 No aurora visible.
 07-30 A portion of a band trending N.W. and S.E., about 70° up in the N.W.
 07-45 No aurora visible.

Sky now obscured until the evening of 6th inst.

- 6-18-00 Sky clear. Starlight. No aurora visible.
 20-45 Ditto.
 23-00 Ditto.
 24-00 Sky clear. Bright moonlight. No aurora visible.
- 7-06-00 Ditto.
- 17-00 An auroral streamer 40° above the W. horizon.
 18-00 An auroral streamer in the W.
 18-20 A faint streamer 25° to 30° up in the N.W.
 18-30 A faint streamer in the W.
 20-30 Sky hazy so that second magnitude stars just visible. No aurora visible.
 21-15 Ditto.
 21-45 First magnitude stars just visible. No aurora visible.

Sky now obscured until 6 h. on 8th inst.

- 8-06-00 Sky partially obscured. No aurora visible.
 10-00 Ditto.
- 17-15 A nebulous aurora 5° up; between N. and N.E.
 17-25 Display in the same direction becomes brighter and several streamers rise up.

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June.

- 8-18-00 Low drift obscures the horizon to a height of 6°. An auroral glow over the drift in the N.E.
- 18-15 Ditto.
- 20-35 A streamer in the N.E.
- 22-40 A medium bright to dull aurora in the N.E.
- 22-55 A very brilliant aurora in progress. Two strongly defined curtains overhead, and a glow in the N. seen through the drifting snow. The curtains trend W.N.W. and E.S.E., extending right across the sky passing some 25° N. of the zenith. These wax and wane rapidly and the streamers move so fast at times that the whole curtains appear to flicker. The luminescence ripples along the curtains, but so rapidly as to make it impossible to state from what direction.
- 22-55 The display shortly concentrated into one main curtain with minor fragments and patches at various situations in the N. sky. In an interval of ten minutes the curtain had reached the zenith by travelling bodily to the S. On each occasion of the display waxing most brilliant colours were exhibited. The first colour was observed about 22 h. 57 m., when one of the curtains showed a reddish lower border and red appeared also in the streamers. The brightest colour effects happened between 23 h. and 23 h. 5 m., when bright rose-pink and red appeared below the usual greenish-yellow of the curtain, and emerald to peacock-green above; rose-pink was noted on the advancing side of streamers. As the main curtain came overhead it was seen to be tinted reddish on the S. side, which at the same time happened to be the advancing side.
- Shortly after 23 h. a remarkable display took place in connection with the curtain just E. of the zenith. The curtain there spread out into a sheeted form, the whole of which area was occupied by a sea of breaking waves of luminescence (resembling a choppy sea with breaking waves), breaking further and further to the east. The waves were rose-pink and peacock-green, the former predominating, the latter appearing in flashes. The general spread of the luminescence has been from W. to E.
- 23-12 The colour effects have died away, and although the bands are extending, it is evident that the display is waning. The arcs are in the zenith, and trend somewhat more to the E. and W. than formerly. They still appear very bright at times and move rapidly.
- 23-25 The arches have crossed somewhat south of the zenith.
- 23-40 The arches after reaching a point somewhat S. of the zenith receded to the N., and are now again somewhat to the N. of the zenith. Occasionally now feeble colours are again visible.
- 23-45 The phenomenon is now concentrated in one great arch crossing the sky 65° up in the N., extending from E. to N.W. The display has been retreating towards the N. and E.
- 23-55 Several streamers about 25° up in the N.
- 24-00 A band trending E. and W. some 20° up in the N.
- 9-00-10 Ditto.
- 00-15 The auroral band has become fainter and more patchy.
- 00-20 The same band fainter and but 15° up.
- 00-30 A bright bent band 30° up in the N.E.; several streamers rising very high.
- 00-40 Two curtains 45° up, lying N.W. to S.E.
- 00-50 No aurora visible.
- 01-00 Two faint patches 10° up in N.
- 01-15 A glow along the N. horizon, and a patch 10° up in N.N.E.
- 01-30 No aurora visible.
- 04-15 Moonlight. No aurora visible.
- 06-00 Ditto.
- 17-00 A nebulous aurora 20° up, extending from N.W. to E.
- 17-15 The aurora is brighter, extending from N. to E., 30° up.
- 17-40 No aurora visible.
- 18-00 A nebulous auroral arch from the E. horizon to a point 20° up in the N.N.W.; brightest in the N.E.

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- 9-19-20 Aurora in a nebulous band 5° up, extending from N.E. to N.W.
- 20-00 A nebulous band about 5° up, waxing and waning; extending from N.N.W. to E.N.E.
- 21-45 Ditto.
- 22-25 Two very bright bands extending across the sky approximately E. and W., about 35° up in the N. These waned a few minutes later, but waxed again at intervals all the time slowly receding to the N.
- 22-40 A nebulous band E. and W. across the sky in the N., broadening out into a nebulous mass in the W.
- 22-44 The band commences to rise and wax again.
- 22-48 A small amount of colour appears on the band in the N., and the aurora has brightened generally.
- 22-50 Auroral bands appear, trending more or less E. and W. to the N. of the zenith. Some of the to bands are curved. There is a general body-movement from W. to E. At 22 h. 55 m. a band
- 23-05 commenced to rise, reaching the zenith at 23 h., then receding to the N. very quickly; sank to 45° up.
- 23-10 The aurora brightens in the N.E., chiefly consisting of a curtain 20° up.
- 23-12 The curtain 20° up becomes very bright and detached fragments appear in the N. sky.
- 23-15 A nebulous auroral band 15° up, extending from N.W. to E.; brightest in the N.W.
- 23-25 A sheet of auroral nebula 6° up, between N.N.W. and W.N.W.
- 23-35 Ditto.
- 24-00 Two concentric curtains respectively 5° and 8° up, extending across the N. sky from E. to W.
- 10-00-20 The aurora has increased in brilliancy. An arch 15° up in N.N.W., extending more or less E. and W., with a nebulous mass at the E. extremity.
- 00-40 The aurora now less brilliant in N.N.W., from which point a band comes in a S.S.E. direction until almost arriving at the zenith. A band 5° up, extending towards the E.
- 00-55 The aurora is much fainter. The band coming towards the zenith remains. Small patches of nebula near the N. horizon.
- 01-10 A faint nebulous glow in the W.; also on the horizon between E. and N.
- 01-50 Aurora almost absent, only a few nebulous patches remaining on the N.W. horizon.
- 02-35 Two nebulous patches, one N. the other N.W., about 4° up, but barely visible.
- 03-20 No aurora visible.
- 04-20 Ditto.
- 05-05 Very faint nebulous patches in N. and S. sky from 10° up to the zenith. At the same time there is considerable moonlight and drift.
- 05-30 No aurora visible.
- 06-00 A curtain faintly visible in the E. about 10° up.
- 06-25 No aurora visible. Bright moonlight.
- 07-00 Ditto.
- 07-20 Ditto.
- 15-55 A nebulous aurora, extending from N. to N.W., about 4° up.
- 16-30 A nebulous aurora 20° up, between N.W. and W.N.W.; also a band extending from the N.E. to a point 35° up in the N.
- 17-00 A curtain 35° up, extending from the E.S.E. to the N.W., with long streamers.
- 17-15 A very faint band rising from the horizon in the E.S.E. to a point 40° up in the N. by W.
- 17-30 A faint band 30° up in the N.
- 17-50 A band from the N.E. horizon to a point 20° up in the N.N.W.
- 18-00 A faint band 20° up, extending from N.N.E. to N.N.W.
- 18-30 A faint aurora in the N.
- 19-00 No aurora visible; lower sky obscured by drift.
- 20-00 Ditto.

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- 10-20-30 A faint band 15° to 20° up; extending from N. to E.; a faint curtain reaching a height of 35° in the E.N.E.
- 21-15 Lower sky obscured by drift. No aurora visible.
- 21-45 Ditto.
- 22-07 A nebulous arch rising to 6°, extending from N.E. to N.W.; brightest in the N.W.
- 22-15 A bright arch 7° up in the centre, extending from N.N.W. to N.E.
- 22-30 A nebulous arch 8° up in the N., extending from W.N.W. to E.S.E.
- 23-04 A bright arch 35° up in the N., extending between W.N.W. and N.E. Several other fragments in the northern sky.
- 23-05 At 23 h. 5½ m. the aurora burst out, forming a great broad mass 40° up, between N.W. and to N.N.W. The colouration on the upper portion was bright green, shading off below into rose-pink and red. The colour effect on this occasion is the greatest yet noted at Cape Denison. The display became very active and moved rapidly. The whole mass kept working to the E. by a succession of outbursts in the form of curtains and irregular masses. Colour effects repeatedly appeared until 23 h. 10 m., after which time the display continued in bands of the usual colour. These extended from E.S.E. to W.N.W., and for the most part at an altitude of 40°, though occasional fragments appeared even in the zenith. The phenomenon gradually waned.
- 23-20
- 23-30 The display began to brighten again.
- 23-32 Another increase took place.
- 23-35 A further and more brilliant increase took place. During the last few minutes a curved curtain worked its way across the sky from W. to E.
- 23-43 The W. end of the arch is strongest. Several isolated streamers are moving regularly across the sky S. of the main arch, travelling from W. to E. During the last few minutes the main arch has appeared bowed convex to the S.
- 24-00 A curtain from W. to a point 10° up in the N.
- 11-00-30 A faint curtain low down in the N.
- 01-00 Ditto.
- 01-25 No aurora visible.
- 03-00 Several streamers between W. and N. A bright curtain in the E.
- 03-30 A faint curtain 20° up, between N. and W.
- 04-10 A bright arch over the zenith, extending from N.W. to S.E. Also several fragments of curtains near the S.E. horizon.
- 05-00 Four faint curtains extending from the S.E. towards the zenith.
- 05-55 Two large curved arches from a point 30° up in the E.S.E., across the zenith to the N.W.
- 06-10 The aurora travelling slowly from the E.S.E. across the zenith to the N.W. Several streamers in the N.W.
- 06-30 A curtain in the zenith directed as at 5 h. 55 m.
- 07-00 Faint curtains in the E. and W. rising to the zenith.
- 07-30 Very faint curtains trending E. and W. in the zenith.
- 07-50 No aurora visible.
- 08-30 The sky overcast.
- 15-00 Ditto.
- 17-00 A nebulous arch 10° up, between E. and N.W.
- 17-40 An auroral glow on a cloud on the N. horizon from N.W. to N.E.; brightest in the N.E.
- 17-55 A very faint nebulous patch between N. and N.E.
- 18-00 No aurora visible.
- 18-20 Ditto.
- 19-10 Ditto.
- 19-40 Ditto.

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- 11-20-05 Drifting snow obscures the horizon to a height of 8°. A faint auroral glow appears above the drift to the N.
- 20-45 No aurora visible.
- 21-30 A very bright streamer arch extending from the E. by S. to a point 10° up in the N. The arch is rising rapidly and moving to the E.
- 21-48 The arch has brightened and developing into a double arch; strongest in the E. and N.E.
- 22-04 The arches have faded somewhat and moved to the E. Strong streamers appearing in the E, with which the appearance of dark vertical bands is associated.
- 22-10 A fragmentary curtain in the N., extending from the N.E. to N.W.
- 22-23 The faintest suspicion of aurora in the N.
- 22-30 No aurora visible.
- 22-32 A faint arch from N.N.W. to N.E.
- 22-40 A nebulous aurora 20° up, from N. to N. by W.
- 22-44 A moderately bright nebulous arch extending from N.W. to E.; brightest 15° up in the E.
- 22-50 A curtain extending from the E. horizon to 30° up in the N., fading away 20° up in the N.W.; moving to the E. Streamers rose 10° above the curtain.
- 23-10 A curtain 20° up, extending from N.W. by N. to N. by W.
- 23-10 Nebulous arches with occasional faint streamers extending across the N. sky from to W.N.W. to E.; rising and receding, reaching an altitude of 14°. Travel mostly from
- 23-25 the W.
- 24-00 A nebulous band extending from E. to W., with faint streamers rising to a height of 20° in the N.W. Also a faint nebulous arch 20° up, extending from S.E. to N.E.
- 12-00-25 A very faint nebulous glow extending from N.E. to W.N.W., with very faint streamers in the N.W. reaching a height of 12°.
- 00-45 A very faint nebulous glow in the W. extending upwards for some 5°.
- 01-10 A faint nebulous arch 12° up, extending from E. to N.W. A faint curtain 20° up, extending from N.W. to N.E., the luminescence travelling to the E.
- 01-35 A very faint nebulous glow 10° up in the W.N.W.
- 02-00 A nebulous arch 15° up, extending from the S.E. to the N.N.W. A well-marked curtain extends from the S.S.E. across the zenith to the N.N.W.; strongest in the S.S.E.
- 02-30 A nebulous arch 15° up, from S.E. to N.N.W. A single curtain extending from the S.E. across the zenith to N.W.
- 03-05 A faint arch 15° up in the W.
- 03-55 No aurora visible.
- 04-05 A nebulous arch 12° up, extending from S.E. to N.W. A faint curtain extending across the zenith from S.E. to N.W. The auroral light moved along the curtain towards the E.
- 04-40 A nebulous arch 20° up, extending from S.E. to W.N.W. A faint curtain extending across the zenith from S.E. to N.W.; also two fainter curtains from the S.E. to the zenith.
- 05-10 A nebulous arch from S.E. to W.N.W.; also two faint curtains extending from the S.E. towards the zenith, and two faint nebulous arches extending from the S.E. to an elevation of 30°.
- 05-30 A nebulous arch 15° up, between S.E. and W.N.W.; also two faint curtains extending across the zenith from S.E. to W.N.W.
- 06-00 A faint glow in the S.E. and W.S.W. Two faint nebulous bands extending across the zenith from S.E. to W.N.W.
- 06-33 A bright arch with streamers rising from it, extending from S.E. to N.W., averaging about 30° up. A faint curtain in the W.N.W.
- 07-03 An arch with streamers rising from it 25° up, extending from E. to N.W.; also two fairly well-marked curtains extending across the zenith from S.E. to W.N.W. The luminescence travelling towards the S.E. and rapidly changing form.
- 07-28 A faint glow 12° up in the N.W.; also faint nebulous bands in the W.N.W. reaching to 20°. Daylight now interfering with delicate effects.

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- 12-08-00 A nebulous band averaging 15° up in the N.W. Auroral effects obscured elsewhere in the sky by twilight.
- 15-40 A streamer in the E.
- 16-30 Two long faint auroral arches extending across the sky from E. to W.N.W. at an elevation of 30° in the N. Trend, W.N.W. to E.S.E.
- 17-15 Sky clear, but no aurora visible.
- 17-40 Streamers in the N.E.
- 17-50 Auroral bands between N. and N.E., low down; also a band from the zenith to the S.E.
- 18-00 A thin, nebulous band from the horizon in N.E. to a point 15° up in the N.N.W.
- 19-05 A nebulous arch 8° up, from N.E. to N.W.
- 19-45 Ditto.
- 20-15 A strong nebulous arch 12° up, from N.W. to E.S.E.; also several diverging branches and a few isolated streamers.
- 20-30 The aurora has temporarily faded, appearing as a glow along a cloud bank 5° up in the N., extending E. and W.
- 20-50 The aurora has almost disappeared.
- 21-05 A bright auroral arch from W.N.W. to E., 10° up in the centre. Brightest in the N.W. to N.E., which portion is a well-developed curtain.
- 21-20 The aurora is now very bright, 25° up in the E.N.E., extending rapidly to the W.
- 21-27 A great blaze of luminescence in the E.N.E.
- 21-32.5 A specially strong display in E.N.E.
- 21-57 Aurora faded until but weak.
- 22-20 A glow on the N. horizon.
- 23-00 A fairly bright nebulous band, 5° up from N. by E. to W.N.W. A faint streamer rising from the eastern end.
- 23-15 Two fairly bright nebulous arches 5° up, extending from E. to N.W.
- 23-30 A nebulous arch from E. to N.E. between 5° and 7° up, splitting into two bands between N.E. and N.W.
- 23-45 A nebulous arch 5° up, between N.E. and N.W., brightest in the N.W.
- 24-00 A nebulous band extending from E.N.E. to W.N.W., between 5° and 10° up, highest at the eastern extremity. Waxing and waning slowly, with western extremity brightest.
- 13-00-15 The eastern extremity of the above band has faded.
- 00-30 A nebulous band from N. to W.N.W. It appears to be rising slowly.
- 01-00 A faint glow 5° up, from N.W. to W.N.W.
- 01-30 A faint nebulous band 5° up, from W.N.W. to N.W., running out rapidly towards the E.
- 02-00 A very faint glow between N. and N.E.
- 02-33 Faint auroral glows in the W. by S. and W. 15° up, fading in about one minute. A faint glow from N.W. to N., about 15° up.
- 03-06 Two faint bars across the zenith trending N.N.W. and S.S.E., moving slowly in a N. direction. Another appeared at 3 h. 5 m., apparently parallel, about 15° up in the N.E. horizon.
- 03-36 Two nebulous bands 12° up in N.E., extending from S.S.E. horizon to the N. Overhead two fragmentary bands cross the zenith in a N. by W. to a S. by E. direction.
- 04-06 An auroral curtain extending from the S.S.E. horizon to 15° E. of the zenith. Several streamers near the S. by E. horizon.
- 04-13 Ditto.
- 04-36 A bright nebulous band, extending from near the S.E. horizon across the zenith to within 10° of the N.W. horizon. Several fragmentary bands in a parallel direction faded quickly. A nebulous arch 3° up between E. and E.N.E.
- 05-06 Six broken bands, trending S.E. and N.W. across the zenith. The centre band is the brightest. Waxing and waning.

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- 13-05-37 A nebulous band between N.W. and N. 5° up in N.W., and 16° up in N. A bright band S.E. to N.W. through the zenith, the luminescence moving to the N.W. and exhibiting rapid fluctuations in brilliance. Also a short faint band 2° above the S.E. horizon.
- 06-07 Two nebulous bands, extending from the W.N.W. to E.S.E., 15° up, and 5° in depth.
- 06-37 Several broken bands, extending W.N.W. to E.S.E. through the zenith.
- 07-07 Fragments of the bands reported at 6 h. 30 m. remain.
- 07-37 A faint nebulous bar, 5° long, trending N.W. and S.E., 50° up, in the N.W. The twilight now obliterates faint effects.
- 16-00 Sky overcast.
- 22-45 Ditto.
- 24-00 Sky clear, but no aurora visible.
- 14-00-45 Sky hazy. No aurora visible.
- 01-50 Sky overcast.
- 04-55 Ditto.
- 05-00 An auroral band from N.N.W. to S.E., ranging between 20° and 50° up.
- 05-15 The band has extended somewhat, and is noticeably brighter. A fragment of a parallel band 15° higher up has appeared.
- 05-33 A curtain extending from 5° above the N.W. horizon across the zenith to the S.E. Brightest in the N.W., where there are also several nebulous patches. Another fragment 60° up in the E.
- 05-38 Three faint bands extending from the N.W. almost to the zenith, trending in a S.E. direction.
- 05-45 Ditto.
- 06-00 A curtain crossing the zenith from 40° in the S.E. to 60° in the N.W. Also a luminous patch 50° up in the S.
- 06-27 Three curtains about 20° apart, extending from 30° up in the N.W. to the zenith.
- 06-43 Ditto.
- 06-50 Sky becoming hazy. Faint streamers 45° up in the N.
- 07-08 Sky very hazy. A faint aurora 25° up, from N. to N. by W.
- 07-23 Sky hazy. Streamers 20° up in the N.W., N. by W., and N.
- 07-35 An auroral band 30° up in the N.W., past the zenith, to 10° up in the S.E.
- 07-45 Sky hazy. No aurora visible.
- 16-50 A nebulous band 5° up, from E.N.E. to N.
- 17-30 A nebulous arch from the E. horizon to a point 10° up in the N.N.W. Also a band somewhat more elevated from the W. to the N., and fading away towards the N.E.
- 18-00 A continuous arch, 20° up in the centre, extending from E. to W.
- 19-37 An arch extending from the E. horizon to 5° up in the N.W. Brightest in the E., where streamers were showing.
- 20-07 Ditto.
- 20-37 A nebulous arch from N.E. to N.W., 5° up at the ends. Brightest in the N.E.
- 20-55 As at 20 h. 37 m., but fainter.
- 21-30 A nebulous arch from the E. horizon to 5° up in the N.W. A streamer at the E. extremity.
- 22-00 A very faint nebulous arch, 5° up, from N.E. to N.W.
- 22-37 A nebulous band in the N.E., 4° up.
- 23-15 No aurora visible.
- 24-00 Sky clear. No aurora visible.
- 15-06-00 Sky overcast.
- 18-00 Overcast and dense snowdrift.
- 24-00 Sky obscured.

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- 16-04-30 An auroral haze in the W.
 05-00 A nebulous aurora in the W.N.W.
 05-30 A streamer in the W., reaching 30° from the horizon.
 06-00 A streamer 45° up in the W.; another 10° up in the N.N.W.
 06-30 A streamer 20° up in the W. by N.
 07-00 A streamer 30° up in the W.
 07-30 A faint band in the W.
- 16-00 Sky clear. No aurora visible.
 17-00 Ditto.
 18-00 Ditto.
 19-40 Ditto.
 20-05 Ditto.
 20-50 Ditto.
 21-00 Two bright nebulous patches 10° up in the E.N.E.
 21-55 A very faint patch, 11° up in the N.N.E. A very faint patch 11° up in the N. A very faint band 6° up in the N.E.
 22-25 No aurora visible.
 23-05 A small nebulous band 5° up in the N.E.
 23-25 A nebulous band 5° up, between N. and N.E., becoming brighter.
 23-45 A bright nebulous band 6° up, extending from N. to E.N.E.
 24-00 No aurora visible.
- 17-01-10 A bright nebulous band, extending from N.E. to W.N.W., about 4° up. Brightest in the W.
 01-25 A band 7° up, from W.N.W. to N.E. Faint streamers rise from it. Increasing in brightness.
 01-30 The band now extends to the E. Brightest in the W.
 01-45 A bright curtain 10° up from N.W. to N.N.E.
 02-00 A band extending from 2° up in N.W. to 9° up in the E., reaching a maximum of 11° in the N.E. Faint streamers 12° up in the N.
 02-15 A nebulous arch, extending from 2° up in the W.N.W. to 10° up in the E., reaching a maximum of 15° up in the N.E. Isolated streamers rising 10° in the S.E.
 02-30 Arch as at 2 h. 15 m., but much fainter. Streamers reaching to 20° in E.S.E. Streamers up to 10° in N.N.W. Also a second very faint luminous band at 5° from E. to E.N.E.
 02-45 The principal arch still remains, but represented now by isolated nebulous patches only. No streamers remains.
 03-15 A faint arch, reaching an elevation of 6°, extending from N.W. to S.E. Streamers 20° up in the S.E.
 03-53 Three faint luminous arches, extending from the N. to E., reaching altitudes of 5°, 10°, and 15° respectively. Bright streamers in the E., reaching a height of 30°. Fainter and smaller streamers in the S.E.
 04-00 The aurora waned rapidly.
 04-20 A faint glow in the N.E.
 04-40 A considerable brightening in the E., about 2° up. Still faint in the N.E.
 05-20 A faint arch, reaching 8° from N.N.E. to E. Also a smaller arch at 20° in the N.E.
 06-00 A faint arch, extending from N. to E., rising to a maximum of 5°. Streamers rising from this to a considerable height. Additional streamers in the N.W. The luminosity is increasing.
 06-05 Streamers in the N.W., brightening rapidly and extending up to the zenith.
 06-15 A brilliant aurora. A low arch at 5°, extending from N. to E. as before. Above it, extending from N.W. to S.E., and changing rapidly are three arches constituted of short vertical streamers, elevated 20°, 40°, and 75° respectively.

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- 17-06-25 The low nebulous arch has risen to a maximum elevation of 9° , and extended from N.N.W. to E.S.E., steadily increasing in brilliance. Streamers now extend round to due W.
- 06-35 Thin curtains scattered across the sky from W. to E. Streamers in the zenith. Two low nebulous arches from N.N.W. to E.S.E. elevated 6° and 9° respectively.
- 06-40 A bright band crossing the zenith in a W.N.W. to E.S.E. direction. In N.E. 65° up, a broad nebulous band parallel to that in the zenith. Also a faint arch 9° up, extending from N. to E.
- 06-50 Two curtains, one crossing the zenith from W.N.W. to E.S.E., the other extends parallel to the former from a point 65° up in the N.W. These are brightest at their western ends. Nearer the horizon are two nebulous arches, extending from N.N.W. to E.N.E., elevated 9° and 20° respectively.
- 07-00 Auroral conditions similar to 6 h. 50 m., but faint curtains making their appearance in the W.
- 07-05 The whole phenomenon is waning.
- 07-15 A general brightening of the bands and curtains. Now much strongest in the E. A large curtain with streamers trending W.N.W. and E.S.E. about 50° up in the N.E. sky is very bright.
- 07-25 The curtains in the E. sky have faded. The aurora in the W. sky concentrated in one large curtain extending from the horizon due W. up to the zenith. A faint curtain in the N.W.
- 07-30 The curtains noted previously have faded out. Several curtains visible in the W. and N.W. sky. The most prominent extends from a point 30° up in N.W. to the zenith.
- 07-40 Aurora waning. Very faint in the N.W. sky. A faint curtain 45° up in the E.
- 07-46 A curtain 50° to 70° up in the N.W. has brightened up. Streamers visible in the E. and on either side of the bright curtain.
- 07-55 Faint streamers up to 30° , between W.N.W. and N.N.W.
- 08-00 A faint aurora.
- 10-00 Sky too light to observe aurora.
- 16-45 Very faint streamers, part of an approximately E. by S. and W. by N. curtain, crossing the heavens about 60° up to the N.
- 17-25 Several of the streamers near the zenith brightened up for two minutes, then the whole effect died away.
- 17-40 No aurora visible. Clear sky.
- 18-00 A faint curtain extending from a point 10° up in the E. to a point 15° up in the N.N.E.
- 18-30 No aurora visible.
- 19-20 The N. sky becoming hazed over. No aurora visible.
- 20-00 The sky obscured by dense haze. No aurora visible.
- 24-00 A few stars dimly discernible through the haze in the zenith. No aurora visible.
- Sky now obscured by cloud until 18 h. on 18th inst.
- 18-18-30 From the zenith to the N., sky hazed so that only the largest stars visible. No aurora visible.
- 20-00 The whole sky hazed over so that only four or five stars visible. No aurora visible.
- 21-20 Ditto.
- 24-00 Ditto.
- 19-04-35 Sky clear. Streamers in the N.W. between 5° and 30° in altitude.
- 05-00 The streamers are now barely visible. A faint nebulous band extending from N.W. to N.N.E., 8° up.
- 06-00 A curtain extending from 5° up in W.N.W. to the zenith. Also a faint nebulous band 8° up from N.W. to N.E.
- 06-30 Two parallel bands extending across the zenith from W.N.W. to a point 15° up in the E.S.E.
- 07-00 Faint bands extending from the W. horizon to the zenith.
- 07-30 Three faint curtains rising from the W. horizon to a height 15° .
- 07-45 No aurora visible.

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- 19-16-50 A nebulous glow 5° up in the N.W.
- 16-52 A faint arch 18° up at the highest part, extending from W.N.W. to E.N.E.; strongest in the W. This gives one the idea of an arch elevated in the centre, but this effect is probably due to its being at a somewhat greater height than usual.
- 17-10 An arch 9° up in the centre, stretching from W.N.W. to E.N.E.; somewhat brighter at either extremity than in the centre.
- 17-34 A nebulous arch from N.E. to W.N.W.
- 17-50 A continuous arch extending from E.N.E. to W.N.W., 8° up at the highest point. Somewhat fainter than earlier.
- 18-00 An arch from W.N.W. to N.E., 8° up.
- 19-13 A very faint arch 8° up, from N. to W.N.W.
- 19-35 A faint arch from N. to E.N.E. Excitation coming from the E.N.E.
- 20-05 A faint glow over a cloud bank 4° up from N. to E.
- 20-35 The glow had become much stronger, especially in the E.N.E.
- 21-05 The glow had increased and spread into a nebulous patch between E. and N.E.
- 21-35 A bright arch reaching an elevation of 12° , extending from the E. by S. horizon to a point 12° up in the N.N.W.
- 22-05 Arch about 12° up, from E.S.E. to N.E., then becoming fainter in an extension to the W., reaching a point 16° up in the N.N.W.
- 22-30 The arch is much fainter.
- 23-00 The faintest suggestion only of a glow about 10° up reaching from N.N.W. to W.N.W.
- 23-15 A faint nebulous patch in the N.W.
- 24-00 Sky clear. Aurora not visible.
- 20-00-30 Ditto.
- 01-00 Faintest suggestion of nebulous patches in N.W. and W.N.W.
- 01-45 Sky clear. Aurora not visible.
- 02-30 Ditto.
- 03-15 Ditto.
- 04-05 A faint nebulous patch in the N.W.
- 05-20 Several streamers in the W. about 7° to 10° up.
- 06-15 Sky clear. No aurora visible.
- 07-00 Ditto.
- 18-00 Clear moonlight. No aurora visible.
- 18-25 Ditto.
- 19-55 Ditto.
- 20-13 A very faint auroral band 8° up, between N. and N.E.
- 20-35 A very faint band 6° up, between E.N.E. and N.N.E.
- 21-00 The nebulous band was somewhat brighter, extending from N.E. to N., 14° up in the N. and reaching the horizon in the N.E.
- 21-10 The band had increased in brightness, extending from N.E. to N. and reaching a maximum height of 5° .
- 21-40 No aurora visible.
- 22-30 A faint nebulous band 4° up, from N. to N.E.
- 22-55 A faint arch rising from the E. horizon to 8° in the N.E.
- 23-15 As at 22 h. 55 m.
- 24-00 A faint curtain rising to 14° , extending from N.N.W. to E.N.E.
- 21-00-50 A dull low arch about 4° up, from N. to E.N.E.
- 02-15 A dull low arch about 4° up in the N.W.

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- 21-03-40. A faint nebulous aurora 6° up, from N. to E. A faint streamer 20° up in the N.N.W.
- 04-40 A faint glow 4° up in the N.
- 06-00 A bright curtain extending from the W.N.W. horizon up to the zenith. A fainter but similar curtain parallel to the former and some 10° to the N. of it.
- 06-20 The bright curtain has now extended to within 20° of the E.S.E. horizon. Isolated streamers up to 10° in the N.W. A curtain extending from 5° up in the N.N.W. across the sky to the E.S.E.
- 06-40 A series of curtains rising from the W.N.W. and extending across the zenith to the E.S.E. A faint glow up to 10° from N. to E.
- 07-00 Faint streamers rising from the W. and W.N.W. sky at elevations up to 60° .
- 07-30 A faint streamer 45° up in the W. sky.
- 07-45 The aurora has disappeared.
- 17-05 Fog and drift obscured the sky to a height of 40° . No aurora visible.
- Sky now obscured until 20 h. on 22nd inst.
- 22-20-20 Sky partially obscured. No aurora visible.
- 21-00 Ditto.
- 22-40 The sky clearing in patches in the N.E. A medium bright nebulous auroral band seen between the clouds 4° above the N.N.E. horizon.
- 24-00 Sky obscured.
- 23-02-00 Ditto.
- 02-35 Sky clear. A patch of auroral nebula 6° up in N.W.
- 03-00 The nebulous patch persists in the N.W.
- 03-30 A nebulous arc from 6° up in N.W. to 14° up in N.N.E.
- 03-55 An arch in the same position but showing faint streamers.
- 04-10 Faint streamers in the E.S.E. rising from a nebulous patch 10° above the horizon.
- 04-20 Faint streamers apparently portion of a disjointed curtain appeared in W.N.W., in the zenith, and to E.S.E. The arch to the N. still very faint, stretched from 6° in the N.W. to 10° in the E.S.E.
- 04-34 The curtain through the zenith has moved bodily northwards and now has greatest altitude about 70° in the N. by E.
- 04-38 A bright luminous patch appears about 45° up in the S.E.
- 04-40 The luminous patch referred to in the last entry sent up a bright streamer which at 3 h. 40 m. to formed a brilliant display in the zenith lasting about 30 seconds. Then a curtain rapidly unfolded from the zenith down to the E.S.E. horizon. This curtain then moved N. a few degrees and faded away.
- 04-50 Faint streamers apparently part of a curtain stretching from N.W. to S.E.
- 04-52 Faint streamers apparently part of a curtain stretching from N.W. to S.E.
- 05-09 Ditto.
- 05-30 The detached streamers are now even fainter.
- 06-00 Sky clear. Only one faint streamer visible about 20° up in W.
- 16-00 Sky overcast.
- 18-00 Ditto.
- 20-00 Sky obscured up to 20° . No aurora visible.
- 21-00 Sky obscured up to 45° . No aurora visible.
- 21-30 Sky clear up to 55° . No aurora visible.
- 22-15 No aurora visible.
- 23-15 A faint arch with indistinct streamers in the N.E. sky 45° up.
- 23-30 The arch has extended to the N.N.W. A faint curtain 50° up in the E.N.E. The moon shining brightly in the N.W.

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- 23-23-45 No aurora visible.
 24-00 A clear moonlight night. No aurora visible.
- 24-00-30 No aurora visible
 00-55 A faint nebulous arch from N. to N.E.
 01-10 The arch had faded.
 01-45 A nebulous band 40° up in the N.W. A faint curtain between 40° up and 80° up in the N.W. The direction of movement appears to be from W. to E. This formation faded almost completely in a few minutes. The moon is now setting in the W.
 01-55 A faint nebulous patch 40° up in the N.W.
 02-35 A feeble curtain in the N.W.
 02-55 No aurora visible.
 03-35 Ditto.
 04-05 Ditto.
 04-35 Ditto.
 05-05 Ditto.
 05-35 Ditto.
 06-00 A faint auroral glow in the N.E.
 06-30 Two detached hazy streamers at an altitude of 45° in the N.E. sky. Also a glow on the N.E. horizon.
 07-00 An indistinct curtain extending from the N.N.W. to N.E., fading quickly.
 07-20 A few faint streamers still persist from the N.N.W. to N.E. at 45° to 50° in altitude. A nebulous patch in the zenith.
 10-00 Fine drift obscuring the sky.
 16-30 A faint band 18° up, extending from N. to W.N.W., brightest in the N. This soon faded. A glow over a cloud bank 5° up in the N.W. Bright moonlight.
 17-35 Light drift. No aurora visible.
 18-00 Ditto.
 19-18 Ditto.
 20-05 Ditto.
 21-45 Sky obscured by drift below 40° in altitude. No aurora visible.
 22-55 Sky quite clear. A faint auroral patch 4° up in the N.N.E.
 24-00 No aurora reported. Sky clear excepting near the N. horizon.
- 25-06-00 Ditto.
 08-00 Drift obscures the sky so that only largest stars can be seen in the zenith. No aurora visible.
 16-45 A clear moonlit sky. No aurora visible. Dense fog along the N. horizon.
 18-00 Clear moonlit sky. No aurora visible.
 18-20 Ditto.
 19-55 Ditto.
 20-15 Continuous observations to 23 h. 30 m. No aurora visible.
 24-00 Clear sky. No drift. Bright moonlight. No aurora visible.
- 26-00-30 Ditto.
 01-15 Ditto.
 02-00 Ditto.
 02-30 Ditto.
 03-05 Ditto.
 03-30 Ditto.
 04-05 Ditto.
 04-30 Ditto.

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- 26-05-20 A greenish yellow glow over clouds in the N. and E. may be auroral; otherwise no indication of aurora.
- 06-00 Moon has set. No sign of aurora.
- 07-20 Isolated streamers of a discontinuous curtain appear in the sky on an arch line from the W. horizon to 25° up in the N.W. The trend of the arch apparently slightly S. of W. to N. of E.
- 07-30 Ditto, but fainter. Twilight appearing in the N.E.
- 07-46 Several discontinuous curtains commence to appear in the zenith and to the W.N.W., in which direction they trend. These are faint and nebulous, but twilight is making itself felt.
- 07-56 Several streamers in the W.N.W. and W. by N.
- 18-00 Clear sky. No aurora visible.
- 19-45 Ditto.
- 20-45 Ditto.
- 22-15 No aurora visible.
- 23-15 Strong moonlight. Distinct nebulous auroral band from E. by N. to 10° up in the N.
- 24-00 Nebulous aurora arch from E. to N.E. by N., 11° up; not very bright.
- 27-01-30 No aurora visible.
- 02-30 Ditto.
- 04-00 Ditto.
- 05-00 Ditto.
- 06-00 Ditto.
- 18-00 North sky clouded. Zenith clear. No aurora visible.
- 20-15 Lower north sky hazy. Bright moonlight. No aurora visible.
- 21-25 A bank of cirrus cloud 40° to 50° up from N. horizon. No aurora visible.
- 24-00 Sky conditions as at 21 h. 25 m. No aurora visible.
Frequent observations of the sky have been made throughout the evening hours, but no aurora noted.
- 28-04-30 Sky clear. Bright moonlight. No aurora visible.
- 05-45 Ditto.
- 06-00 Ditto.
- 18-00 No aurora visible now or earlier this afternoon. Bright moonlight.
- 20-23 No aurora visible. Sky clear.
- 22-50 Sky partly clouded over. Moonlight. No aurora visible.
- 23-00 Ditto.
- 24-00 Ditto.
- 29-01-00 Ditto.
- 01-30 Ditto.
- 02-30 Ditto.
- 03-30 Ditto.
- 04-30 N. sky hazy to 30° up, otherwise sky clear. No aurora visible.
- 06-00 Ditto.
- 06-30 Ditto.
- 07-00 Ditto.
- Sky now obscured by cloud until midnight.
- 24-00 Sky partly clear. No aurora visible.

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- 30-01-30 Sky clear. Brilliant moonlight. No aurora visible.
 02-45 Ditto.
 06-00 Ditto.
 16-00 No aurora visible.
 18-00 Sky clear. Bright moonlight. No aurora visible.
 20-08 A faint nebulous arch 5° up, extending E. to N. Bright moonlight.
 20-47 Nebulous arch from E. hor. to 6° up in the N. by E., strongest in the N. by E.
 20-50 Arch now distinctly brightening. Luminescence travelling to the E.
 20-52 Arch much brighter and more active. The lower border is of a reddish tint. Phenomena seen in full moonlight.
 21-05 Aurora in three distinct bands close together between 12° and 15° up, extending N.W. to E., highest in the N. by E. Brightest in the N.E.
 21-20 Nebulous arch extending from E. to N.W., and rising in centre to 14° up.
 21-35 A faint nebulous arc 5° up from N.E. to N.W.
 22-03 A medium bright arc 9° up from N.E. to N.W.
 22-20 Ditto.
 24-00 Bright moonlight. No aurora visible.

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- 1-00-40 Sky for the most part clear; bright moonlight; no aurora visible.
 01-25 Ditto.
 02-15 Ditto.
 03-00 Ditto.
 04-00 Ditto.
 05-25 Ditto.
 19-50 Sky much obscured by cloud, but clearing as the evening advances; no aurora visible.
 23-17 A powerful aurora in operation. Curtains stretching from W.N.W. to E.N.E., 30° up in the N.; very rapid travel of excitation from W. to E.; Faint colour phenomenon showing, in vertical formation, whereby the streamers appear crimson on one side. The exhibition was most strong to the W. of N. The display waned rapidly at 23 h. 19 m. Bright moonlight reduced the brilliance, and only strong effects visible.
 23-23 The aurora no longer visible in the moonlight.
 23-33 A faint arch 6° up, between N.E. and N.W.
 23-50 The arch has extended to the W., and is somewhat stronger.
 24-00 Auroral curtains in the N.W., N., and E. low on the horizon.
 2-00-10 No aurora visible.
 00-30 Ditto.
 01-00 Ditto.
 02-00 Ditto.
 04-30 Ditto.

Sky now obscured until the afternoon of the 3rd inst.

- 3-16-25 A faint curtain fading in the zenith. The main portion trending E. and W., but trending E.S.E. at the E. extremity.
 16-35 Clear sky; dull twilight; no aurora visible.
 17-10 A streamer from 10° to 20° up in the W., also two similar ones appeared in the N.W. for a moment.
 17-15 A shaft reaching from the S.W. to the zenith and fading immediately.

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- 3-18-00 A faint auroral glow, strongest in the N.N.W.
 19-25 No aurora visible.
 19-55 Ditto.
 21-38 A faint nebulous arch 7° up from E.N.E. to N.E., with faint streamers in the N.E. Luminescence travelling to the E.
 21-40 A very faint arch 8° up, from E.N.E. to N.E.
 21-56 A faint glow 5° up in the N.E.
 22-10 No aurora visible.
 22-25 Ditto.
 22-52 Ditto.
 23-12 Ditto.
 24-00 Ditto.
- 4-00-33 A faint arch 8° up from E.S.E. to N.
 01-01 No aurora visible.
 01-30 Ditto.
 02-15 Ditto.
 02-56 Ditto.
 03-45 Ditto.
 04-29 Ditto.
 05-14 Ditto.
 06-00 Two faint bands from the S.E. almost to the zenith.
 06-17 Two bands from S.E. across the zenith to the N.W.; also a faint band from the E. to near the zenith, and streamers 15° up in the W.
 06-29 Several faint bands from E.S.E. to zenith and westward.
 06-43 A very faint band in the zenith trending S.E. to N.W.
 07-09 No aurora visible.
 07-28 Ditto.
- 17-00 A nebulous aurora 15° up, between N.W. and N.E.
 17-40 Ditto, between N.N.E. and N.W.
 18-00 Sky becoming overcast from the N. No aurora visible.

Sky now obscured by cloud and drift until the late morning of the 5th inst.

- 5-08-00 Clear sky and no drift. Isolated streamers of a curtain appear from a point 45° up in the S.E., past the zenith to 70° up in the N.W.; seen in bright moonlight and twilight.
 16-30 Sky practically clear; no aurora visible.
 17-00 A strong glow with streamers rising on N. horizon between E.N.E. and W.N.W. A few minutes previously, aurora was absent.
 17-30 A curtain reaching 9° in altitude, between N.N.W. and E.N.E. Below this a nebulous arch on the horizon.
 17-45 A very faint glow over a cloud bank on the N. horizon.
 18-00 A faint glow from N.E. to N.W. Very bright streamers rising to an altitude of 20° between E.N.E. and S.E.
 18-15 A very bright display in the E. A curtain in the S.E., looped; also a faint band on the N. horizon.
 18-20 The display is strong, reaching from N.E. to S.E., and showing a tendency to become more southerly. It consists of a large recurved curtain of a general elevation of 8°, with streamers reaching as much as 25° up.
 18-30 Now contracting in to a nebulous bunch in the N.E. A glow is growing along the horizon from N.E. to N.

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- 5-19-00 A bright curtain from E.S.E. to N.E., 10° up; also a broken nebulous arch from E.N.E. to N.E., 5° up.
- 19-50 An exceptionally brilliant display. A curtain about 10° up, from N. by W. strongest in the N.E., where streamers are dancing about rapidly and the lower edge of a definite reddish tinge. One streamer in the N.N.W. rising to 6° .
- 19-51 Display now fading fast.
- 20-00 Very brilliant again; a curtain from the W.N.W. to E.N.E. 12° up in the centre; curtain curved in the W.
- 20-01½ Display now in the form of a continuous nebulous arch. The luminescence is travelling from the W.
- 20-05½ A second curtain now unrolled from the W.; a degree higher up; also, the original one become brighter and showed a pink lower border.
- 20-07 Now four concentric curtains from E.N.E. to N.W., the lowest 4° up; streamers from the highest up to 25° . Pink lower border.
- 20-10 Display has now reached one of the maxima stages. The highest curtain reaches 35° up; sheets of lilac colour appear, and streamers chase each other with extreme rapidity.
- 20-13 Activity now concentrating in the W., and lilac streamers chasing each other rapidly to the E.
- 20-14 All the N. sky suffused with a nebulous aurora.
- 20-17½ A large zigzag curtain concentrated towards the W.; it has commenced to increase.
- 20-19 A complete curtain unravelled across the sky in about 15 seconds. Excitation travelling from W. to E.
- 20-20 To complete curtains 10° apart, rising to an altitude of 60° , from E.N.E. to N.W.
- 20-26 Display now confused nebulous mass scattered throughout the lower northern sky.
- 20-27 Now resolved into one distinct curtain from the E. to N.W., convoluted between N. and N.N.W., and reaching a maximum elevation of 12° .
- 20-39 Curtain from E. by S. to N.N.W., maximum elevation of 30° ; travel bodily to the S.; pink below shading into green tints above.
- 20-47 The main curtain extends from E. by S. to 45° up in the N., where it is recurved. Nearer the N. horizon are a confused mass of curtains.
- 20-52 A curtain between E. and N., reaching 45° up, and travelling bodily to the N. Below are two curtains, and nearer the horizon a confused mass.
- 20-56 A bright curtain from the E. by S. to a confused mass in the zenith, from which it trends towards the N.W., terminating 10° above that horizon.
- 20-59 Fading at the W. extremity, and retreating towards the N. Besides the main curtain a confused mass of curtains occupy the sky nearer the N. horizon.
- 21-02 The display waning.
- 21-12 The intensity has commenced to increase again. A faint curtain extends from near the zenith to the E. by S.; also, a long bright curtain from E. to W. in the N.
- 21-13. The curtains are brightening in the N.W.
- 21-21 A confused mass of curtains from the E. to 20° up in the N.W., and from 5° above the N. horizon to the zenith. The central area dull.
- 21-30 An extremely bright curtain from a point 20° up in the E. by S., passing northward of the zenith to the N.W. Pink lower border.
- 21-37 Display rapidly fading.
- 21-45 Two faint curtains, the top one 10° up in the N., extending from E. to N.N.W.; lower curtain N.E. to N. by W.
- 21-55 Very faint; position unchanged.
- 22-12 Three very faint bands from E.N.E. to N.N.W., between the horizon and 10° up.
- 22-22 A faint arch 6° up in the N.; also a bright curtain patch just above it in the N. by W.
- 22-35 Aurora nearly invisible; two bands about 5° up from N.E. to N.N.W.
- 22-53 Ditto, a little brighter in the N. by W.

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- 5-22-57 Fragments of nebulous curtains in the sky up to 6° in altitude, from N. to W.N.W.
 23-06 Weak nebulous curtain bands 10° up in the N., from N.W. to N.E.
 23-10 Very strong curtains rising from the N., extending from W.N.W. to E.N.E. Curtains all more or less curved. A rapid travel of luminescence from westward towards the east; colour showing; intensity increasing.
 23-15 An intense curtain showing brick-red, rose-pink, lilac, and green tints, reaching a maximum elevation of 40° . A faint curtain at an elevation of 80° .
 23-17 The colour effects have now disappeared.
 23-23 Very little remains compared with what appeared a few minutes ago. The curtains bent and curved, one branch running away to the N. by E. horizon.
 23-29 The display which has been steadily waning has suddenly brightened up in the form of two curtains 14° up in the N.; these extended from the N. to the N.W. and began to rise rapidly.
 23-34 A rapid motion of luminescence from W. to E.; pink colour.
 23-41 Curtains still bright over the N.W.; pink colour.
 23-44 Curtain still bright in the N.W., though moonlight.
 24-00 Ditto.
- 6-00-06 Curtain from N. to N. by W. still remaining. Sky rapidly clouding.
 00-30 No aurora visible; sky largely overcast.

Frequent observations at intervals recorded no aurora visible until 6 h. 55 m.; during this time bright moonlight prevailed, and the sky remained largely overcast.

- 06-55 A curtain 7° up extending from N.E. to N.W.; pinkish and greenish colours visible.
 07-00 The curtain has faded at the W. extremity and colour has gone.
 07-04 Fading rapidly in the N.; a bright streamer in the N.E.
 07-07 A faint nebulous patch 8° up in the N.N.W.; streamers rising from 7° up in the N.E.
 07-14 Three streamers in the E. between 7° and 40° up.
 07-21 No aurora visible.
 07-30 A faint curtain from near the horizon in the E. to a similar position in the W.N.W., and reaching a maximum height in the N. of 50° ; also streamers near the N. and N.W. horizons.
 07-35 A broken curtain 5° north of the zenith extending from E. to W., moving rapidly.
 07-45 A broken curtain from the W. horizon to a point 70° up in the E.; also one from the W. by S. horizon to a point 60° up towards the zenith; both moving bodily to the W.
 07-49 The aurora has disappeared.
 07-58 A faint curtain from the zenith to the W. horizon.
- 15-55 Sky clear. No aurora visible.
 16-05 A very faint nebulous bar trending from the zenith to the W.N.W., 70° up in the W.
 16-07 No aurora visible.
 16-19 Curtain now stronger from zenith to E.S.E.
 16-23 Two other curtains now appear to the N. of the original. One 60° , the other 65° , up from N. to E. apparently trending S.E. to N.W.
 16-28 The curtains have travelled bodily to the S. and are now waning.
 16-37 A nebulous glow in the zenith.
 16-45 Faint nebulous patches disappearing and reappearing in the zenith. A faint streamer now in the N.W.
 17-00 Numerous streamers in the W. and N.W. even to the zenith.
 17-05 A bright patch in the zenith. Also a faint arch 10° above the N. and E. horizons.
 17-10 The whole of the E. sky is strewn with faint streamers and patches.

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- 6-17-22 Streamers 16° up in the S.E., and elsewhere in the E. sky.
- 17-26 Display now almost gone.
- 17-34 An arch 10° up in the W. to N.E.
- 17-49 Faint streamers in the W. and N.N.E.
- 18-08 A broken curtain from 15° up in the E. to the W.N.W. Another from the W. to a point 5° E. of the zenith.
- 18-11 An arch from E.S.E. to W.S.W.
- 18-18 Display fading.
- 18-27 An arch 7° up from N.E. to W.N.W. Also a faint curtain 20° up in the S.W.
- 18-32 The above arch now showing up as two, the upper 12° the lower 7° .
- 18-40 An arch 10° up in the N.W., appears of a faint reddish colour.
- 19-00 No aurora visible.
- 19-20 A faint arch commencing from N.E. to N. 15° up.
- 19-45 Ditto.
- 20-03 A very faint arch just above the N. horizon.
- 20-15 Ditto, 4° up from N. to N.N.W.
- 20-43 A brilliant arch 4° up from N. to E. Some streamers reaching to 15° . A reddish lower border.
- 20-46 An extensive array of curtains in four tiers up to 20° in altitude, extending from N.W. to E. Streamers travelling rapidly to the E. A lilac colour at the E. extremity.
- 20-48 Two extensive curtains from the N.W. to N.E. curved at the W. extremities. Streamers moving rapidly to E. Lilac coloured in the lower portions.
- 20-50 A curtain 25° up in the N.N.E. Colour rose to lilac in the E. by N.
- 20-52 Curtains now changing to nebulous arch.
- 20-54 The whole aurora faded considerably.
- 20-56 Ditto.
- 20-59 Two brilliant arches, 5° and 10° up respectively, from E. to N.W.
- 21-02 Three arches now visible.
- 21-03 Arches still show curved outline, very bright in the N., excitation travelling rapidly from W. to E.
- 21-06 Three fine arches up to 30° elevation, extending from E. to N.W. Brilliant lilac coloured curtains in the E.
- 21-11 Ditto, but not so brilliant.
- 21 15 Ditto, with addition of a small fragment of an arch in the zenith.
- 21-20 Four brilliant curtains with very rapid streamer movement to the E. Display becoming much more brilliant and rising toward the zenith. One curtain almost to the zenith.
- 21-21½ Very rapid streamer travel in the zenith curtain.
- 21-23 Now a great mass of nebulous bands and curtains from the N. horizon to the zenith.
- 21-26 A vortex of colour and motion crossed the zenith from W.N.W. to S.E. This corona was quite obviously due to the perspective affect of looking at a convolution of the curtain from directly below.
- 21-28½ A bright curtain extending from the W.N.W. across the zenith to the E.S.E. Showing colour effects, fainter in the E.
- 21-30 For the last minute a curtain has been rising from the N.W. horizon, streamers in rapid motion.
- 21-32 The main curtain is from W.N.W. to E.S.E. at a height of 45° . Brighter in the W. Colour fainter.
- 21-32½ During the last minute the display has become nebulous and with it the dancing of streamers ceased.
- 21-35 Display fainter.
- 21-37 Display concentrated in the W.N.W. Nebulous patches and bands. Colour not showing.

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- 6-21-40 Much fainter and nebulous:
 21-55 Ditto.
 22-10 Three arches from W. to E. in the N., nebulous for the most part.
 22-27 Several faint to medium curtains extending across the N. sky up to 70° , extending from W.N.W. to S. Trending about W.N.W. to E.S.E.
 23-04 An almost continuous arch across the N. sky from W.N.W. to N.E., about 10° up. Brightest in the N.
 23-15 A continuous arch from W. to E.N.E., brightest in the N.E.
 23-30 An auroral arch from N.W. to E.N.E.
 23-40 A nebulous arch 10° above the N. horizon.
 24-00 Ditto.
- 7-00-30 No aurora visible.
 00-50 Ditto.
 00-55 Sky clear. No aurora visible.
 01-26 A faint nebulous patch in the N.W.
 02-00 Sky clear. No aurora visible.
 02-30 Ditto.
 03-00 Ditto.
 03-35 Ditto.
 04-15 Two patches in the N.N.W. and N.N.E. about 30° up. Bright moonlight obscuring delicate effects.
 04-29 Three nebulous arches, the main one extending from the N.W. across the zenith to the S.E., the others parallel and on either side.
 04-32 Display rapidly brightening. Several curtains from N.W. to S.E., at an elevation of 45° . Rapid motion in the N.W.
 04-36 A brilliant display consisting of five parallel arches, the lowest 5° above the N. horizon, the highest past the zenith. Very little movement, but the northern ones show a reddish tinge.
 04-39½ One arch from 60° up in the N.W. to the E.S.E. Brightest in the N.W.
 04-43½ Same arch, very bright, showing pink tinge.
 04-44½ Now much fainter.
 04-45½ Again brightened.
 04-47 Only a few nebulous patches in the zenith.
 04-56 Several faint arches from N.W. to S.E. across the zenith.
 05-15 Several arches from N.W. to S.E. across the zenith. Brighter in the N.W. with a reddish tinge.
 05-30 A faint nebulous arch in the zenith extending from N.W. to S.E.
 05-46 Very faint patches of nebulous aurora in the zenith.
 06-00 Aurora brightening. A strong nebulous arch from the N.W. across the zenith to S.E.
 06-20 Ditto.
 06-37 Very faint patches of nebulous aurora in the zenith.
 06-55 A curtain from N. to E.N.E. 20° up, and showing traces of colour.
 07-08 Two nebulous patches in the N.W.
 07-25 A faint nebulous arch reaching from the W. to the zenith.
 07-40 A trace of aurora visible in the W. The twilight now overpowering the aurora.
- 16-30 A nebulous band from N.E. to N.W., maximum elevation 12° .
 16-40 Arch rising up to 20° . Extending from E. to N.W.
 16-55 A faint band across the zenith, trending E. and W.
 17-03 A glow on a cloud low in the W.N.W.

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- 7-17-22 An arch 15° up, from E. to N.W.
 17-36 Ditto.
 17-56 A very faint arch from W.N.W. to E.N.E., 15° up.
 18-00 Ditto.
 18-12 A faint streamer 12° up in the E.N.E.
 18-18 An auroral arch rising from the E.N.E. horizon to 15° N. by W.
 18-31 A very faint nebulous arch from E. by N. horizon to a point 12° up in the N.
 18-45 Aurora on the E. horizon, up to 12° in the N.E., where it is faint.
 19-12 Sky becoming overcast from the N. No aurora visible.
 19-30 Ditto.
 20-30 Sky completely overcast with a thin veil of cloud, only first magnitude stars visible. No aurora visible.
 21-30 Ditto.
 22-30 Ditto.
 22-50 A faint zigzag band across the sky in the zenith, from S. to E.N.E. The lower sky completely obscured.
 22-54 A nebulous band from the zenith to the S.W. by W.
 23-20 For some time the aurora had practically faded out; now a glow is visible 30° up, between W. and N.N.W. over a fog bank; also a glow in the same position in the N.E. to E.N.E.
 23-35 No aurora visible.
 23-42 A faint band 70° up in the W., trending approximately N. and S.
 24-00 No aurora visible. Cloud again becoming denser.
- 8-06-00 Sky overcast.
 17-00 A curtain in the S. trending approximately E. and W. Maximum altitude 45° . Another from the E.S.E. to near the zenith. Both travelling to the N.
 17-05 The curtains are very steady.
 17-25 An auroral patch 8° up in the W. by N.
 17-45 A very faint curtain in the S. and a glow on the N.E. horizon.
 17-57 A disjointed streamer curtain across the sky in an E. and W. direction, 60° up in the S.; also several fragments from the zenith to the E.
 18-00 Ditto, possibly a little further to the S.
 18-27 Extremely faint auroral nebula in the W.; also a faint indication, in a nebulous haze, of the curtain seen earlier to the S. of the zenith. These appearances suggest that the luminous appearance sometimes seen in the sky is faint distributed auroral haze.
 19-17 A very faint streamer 30° up in the S. by E.
 19-24 Two faint streamers 10° up the W.S.W.
 19-33 Two faint broken curtains 8° up in the W. by N.
 19-43 A faint bar in the W. by N.
 20-10 A nebulous patch 8° up in the W.N.W.
 20-30 No aurora visible.
 21-00 Ditto.
 21-38 A faint curtain from the E. by N. horizon to a point 15° up in the S.
 21-45 A faint nebulous arch 15° up from E. to S. by W.
 22-05 Nebulous patches 10° to 15° up in the E. and E. by S.
 22-40 A patch 5° up from N. to N.E.
 23-23 A curtain 15° up from W.N.W. to N.E.
- 9-00-15 Nebulous patches from the horizon to about 12° up in the N. and N.E.
 01-00 No aurora visible.

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- 9-02-15 A curtain in the form of an arch about 20° up from N.W. to N.N.E.
 02-35 A faint nebulous patch N.W. by N.
 04-20 Faint auroral patches in the N. and W. skies, even up to the zenith.
 04-30 A broken curtain extending across the zenith from S.E. to N.W.
 05-00 Ditto.
 05-30 Ditto.
 06-00 Ditto.
 07-30 The zenith curtain still remains; also a parallel one 65° up in the N., and fragments of others lower down. Between 4 h. 30 m. and 7 h. 30 m. fragmentary curtains continuously in the sky, more concentrated towards the E. than the W.
 07-49 Part of a faint curtain 10° up in the S.W.
 17-18 A nebulous arch up to 10° between N.E. and N.W.
 18-00 Ditto, waning.
 19-35 A bright arch 10° up, from W. by N. to E. by N., waxing and waning at intervals.
 19-52 Two arches between N. by E. and N.W., highest 12° in altitude. Two streamers 3° up in the N.E.
 20-15 Arch from W.N.W. to N.N.E., 10° up.
 20-20 A nebulous arch 12° up, between N. and N.W.
 21-00 Ditto.
 21-40 A curtain 15° up, from E. to N.W.; also a nebulous glow on the N.E. horizon.
 21-45 A moderately bright curtain 6° up, between N.N.W. and W.N.W.; also a curtain 12° up, between E.N.E. and N.N.W.
 21-53 Arches considerably faded; one 12° up between W.N.W. and E.N.E.
 22-08 An arch from E. to W.N.W., brightest in the E. Streamers 40° up in the E.
 22-12 An arch 12° up between N. and W.N.W. A curtain 16° up between E. and N. by W.
 22-30 A broken arch from N.W. to N.N.E., with occasional streamers 12° in altitude.
 23-30 A curtain 15° up, extending from N.E. to N.N.W.; also arch 6° up from N.W. to N.N.W.
 24-00 Curtain 15° up between N. and W.N.W.
- 10-01-10 A nebulous arch from W.N.W. to N.W., average elevation 8° .
 03-00 No aurora visible.
 04-30 An ill-defined curtain passing through the zenith from 60° up in the E.S.E. to the W. horizon. Faint streamers 75° up in the S; also an arch 20° up between N.E. and N.N.W.
 05-25 Several faint curtains extending from the E.S.E. through the zenith to the W. horizon.
 06-30 A number of parallel poorly defined curtains traversing the sky both N. and S. of the zenith from the E.S.E. to W.N.W. horizons.
 07-45 A fragment of a curtain at the zenith trending E. by S. to W. by N.
- 17-01 A nebulous arch 18° up, from N.E. to N.
 18-00 A faint arch on the N. horizon, from W. to N.E.
 18-15 Streamers 15° up, from N.W. to W.
 19-57 Sky clear. No aurora visible.
 20-30 Ditto.
 21-03 Ditto.
 21-27 Ditto.
 22-00 A nebulous arch showing brightly; from N.E. to N. about 8° up.
 22-07 The arch has risen to 10° , and a second is visible at 8° up from N.N.E. to N. by W.
 22-10 Two previous arches now form one continuous arch with traces of streamers.

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- 10-22-18 Arch now brightest in the N.N.E.
 22-22 Arch fainter and lower.
 22-23 Again waxing, commencing in the N.E.
 22-36 The arch remains stationary.
 22-47 Arch somewhat brighter.
 22-48 A second arch visible 6° up, from N.E. to N.N.E.
 23-00 Arch somewhat brighter with a few streamers.
 23-20 A continuous arch 10° up, from N.E. to N.N.W.
 23-48 Arch somewhat fainter.
- 11-00-07 A nebulous arch 10° up, from E.N.E. to N. by W.
 00-20 Arch very faint, brightest at the W. extremity.
 00-40 Arch from N. to N.W.
 01-09 A nebulous arch 10° up, from N.E. to N.W.
 01-33 Arch now 5° up.
 01-55 A luminous patch 15° up in the N.N.E.
 02-10 A nebulous patch 25° up in the E. A faint arch around the N. sky from E. to N.W., reaching a maximum elevation of 20° .
 02-27 Arches have risen, maximum altitude now 45° .
 02-49 Scattered patches now occupy the positions of the former arches.
 03-04 A nebulous patch in the W.N.W., and an arch 8° up between N.E. to N. by W.
 03-30 No aurora visible.
 03-57 A faint nebulous arch 8° up, from N.W. to N.E.; also fragments of a parallel arch through the zenith.
 04-23 Ditto.
 04-45 A glow on the N. horizon; a faint curtain from the N.W. up to 30° in the N.N.E.; a faint patch 30° up in the S.E.
 05-08 Three parallel nebulous bands, the highest 30° up, trending E.S.E. to W.N.W.
 05-15 Streamers scattered irregularly throughout the northern skies; also some faint streamers in the S.S.E.
 05-28 Ditto, brightest patches in the N.W. and W.N.W.
 05-43 Three parallel but broken curtains from W.N.W. to E.S.E., the highest passing through the zenith, the others reaching 60° and 40° in the N. Curtains comparatively dull.
 05-46 Curtains fading, but again waxing within a minute.
 05-47 Curtains now waxing again.
 06-10 Four parallel curtains, running W.N.W. to E.S.E., the upper one through the zenith.
 06-20 Curtains now much convoluted. A body-travel to the S. has carried the upper one a few degrees to the S.; that next to it is now some 10° N. of the zenith. Curtains bright. A slow travel of luminescence to the E.
 06-36 Body movement to the S. continues; trend unaltered; curtains breaking up.
 06-55 Very faint scattered streamers in all directions; one continuous curtain 60° up in the N.
 07-14 Ditto, but fewer scattered streamers.
 07-15 Suddenly a small bright patch appeared in the zenith, and portion of a curtain 55° up in the E. by N. increased in intensity.
 07-40 Approaching dawn obscures all but a few streamers.
- 17-00 A nebulous patch 20° up from W. to N.; another patch in N. sky intermittently visible.
 17-14 Ditto, very faint.

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- 11-18-00 No aurora visible. Clear sky.
 18-15 Ditto.
 18-30 Ditto.
 19-15 Ditto.
 19-35 Ditto.
 20-00 Ditto.
 20-15 Ditto.
 20-30 Ditto.
 20-40 A faint arch 9° up from N.W. to N.E.
 20-55 No aurora now visible.
 21-18 Ditto.
 21-45 A very faint glow from N.W. to N.E.
 22-00 Glow 5° up from N.E. to E.N.E.
 22-25 No aurora visible.
 23-00 Ditto.
 23-25 A faint arch 8° up, from N.E. to N.
 24-00 No aurora visible.
- 12-00-30 No aurora visible.
 01-00 A very faint glow 8° up in the N.E.
 01-30 No aurora visible.
 02-00 Two distinct nebulous patches in the N.W. sky.
 02-30 An auroral arch 18° up, from E.N.E. to N. by W.; streamers at the E. end.
 02-50 Arch fading in the W. and extending to the E.
 03-05 No aurora to be seen.
 03-35 An indistinct curtain in the S.E. sky, from 30° to 45° up. A faint nebulous arch 35° up, from E. to N. by W.
 04-00 No aurora visible.
 04-30 Ditto.
 05-05 A band from 18° up in the W.N.W., passing S. of the zenith to 45° up in the E.S.E.
 05-35 No aurora visible.
 06-00 A few nebulous bands across the zenith from N.W. to S.E., waxing and waning.
 06-25 A few patches still in the zenith, and a faint curtain in the S.E.
 06-50 Nebulous bands and curtains across the sky, both N. and S. of the zenith, in N.W. to S.E. direction.
 07-10 No aurora visible.
 07-25 An arch 35° up from N.W. to E.S.E.; streamers at the E. extremity. Several patches in the zenith.
 07-35 A faint curtain 35° up in the S.E.
 07-45 A faint curved band passing through the zenith, roughly in a N.W. to S.E. direction.
- 17-00 No aurora visible.
 17-05 A faint glow on clouds low in the W.N.W.
 18-00 A bright arch from E.N.E. to W.N.W., maximum elevation 15° , 10° up at the extremities.
 19-25 No aurora visible; lower sky in the N. obscured.
 19-58 Ditto.
 20-17 A bright arch from 4° up in the E.N.E. to 10° up in the W.N.W.
 20-35 No aurora visible.
 21-05 A faint glow over drift bank 4° up in the N.

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- 12-21-50 Arch 7° up, from N.E. to N.W.; brighter in the N.E.
 22-05 A nebulous arch 5° up, from N.E. to N.N.W.; an arch fragment 8° up, between N. and N.E.
 22-35 A nebulous band 10° up, from N. to N.W.
 23-05 A nebulous arch 8° up, from N. by W. to the W.N.W. horizon.
 23-40 A faint glow 4° up, from N.W. to W.N.W.
 24-00 A faint nebulous bar 3° up, between W.N.W. and N.W.
- 13-00-45 A nebulous bar 3° above the W.N.W. horizon; a stronger arch 10° up, between N.W. and N.E.
 01-05 A medium bright arch 20° up, between N.N.W. and N.N.E.
 01-23 A fragment of a nebulous arch 4° up in the N.W.
 02-06 A faint glow 6° up in the N.W.
 02-43 No aurora visible.
 03-17 Several extremely faint patches of nebulous aurora near the zenith, drawn out in a N.W. to S.E. direction.
 03-53 Two faint parallel bars from the S.E. horizon, trending towards the zenith, the longer just falling short of the zenith.
 04-55 A faint bar from the E.S.E. to the zenith.
 05-40 Several faint bars crossing the zenith and trending to the S.E. by E.; one extends from horizon to horizon; density about that of the milky way.
 06-00 A faint broken band across the zenith from the N.W. by W. to S.E. by E.; strongest S. of the zenith. Aurora stronger than any time since midnight.
 06-26 Five nebulous arch fragments between the zenith and the N.W. and W.N.W. horizons; apparently portions of arches trending W.N.W. and E.S.E.
 06-55 Two broken bands from the horizon, between W. and W.N.W., trending towards the E.S.E., or slightly E. of E.S.E.; neither quite reaches the zenith. Also a broken curtain between E.N.E. and N.E., 25° up.
 07-18 A remnant of the curtain remains. Also several patches in the neighbourhood of 75° up in the N.W.
 07-42 Three streamers alligned 50° up in the N.W.; apparent trend W. by N. to E. by S.
- 18-00 Clear sky. No aurora visible.
 20-00 Ditto.
 21-06 A faint nebulous patch rising above the E.N.E. horizon.
 21-30 No aurora visible.
 22-00 Ditto.
 22-45 Ditto.
 24-00 A faint nebulous arch just above the N.W. by W. to N. by E. horizon.
- 14-00-20 A very faint arch in the N.W.
 01-00 A faint arch 5° up, from N.W. to N.E.
 01-40 No aurora visible.
 02-15 Ditto.
 03-00 A very faint glow in the N. and N. by E.
 03-45 A very faint glow 8° up in the N. and N.E.
 04-30 Ditto.
 05-00 Fragments of an arch in the N.W., zenith, and S.E.
 06-00 Broken curtains from the S.E. across the zenith, to the N.W.; brightest in the S.E.
 07-00 Ditto, but now more concentrated in the N.W.
 07 30 No aurora visible.

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- 14-17-30 A clear dark sky. Fragments of the very faintest nebulous band trending towards the zenith from 5° to 30° up in the E.S.E.
- 17-57 A faint to medium-bright curtain of streamers from the E. horizon to 10° N. of the zenith. Also a fragment of a parallel curtain 20° N. of the zenith. These are very steady; and give the impression of being low in altitude.
- 18-00 A very faint arch from E.N.E. to W.N.W., rising to 15° in the centre.
- 18-22 No aurora visible.
- 19-10 Ditto.
- 19-25 Ditto.
- 20-02 A faint arch across the sky 10° N. of the zenith, extending from E. to W. Also fragments of parallel formations appearing to the N.
- 20-17 Only a faint remnant of the main arch now remains, appearing in the E.
- 20-27 No aurora visible.
- 21-15 Ditto.
- 21-45 Ditto.
- 21-50 A faint glow over the N.E. horizon.
- 22-15 A nebulous band 7° up in the E.N.E.
- 22-35 The band has brightened and is spreading to the N. Streamers in the E.N.E.
- 23-00 The band is waning; now appearing only in the N.N.E. 9° up.
- 23-19 A faint curtain in the N.E., extending as a band to the N.
- 24-00 A very faint band extending from N. to N.E. 12° up.
- 15-00-40 Ditto.
- 01-30 A very faint glow 12° up in the N.
- 02-15 Several faint bands in the N.N.E. and N.W. sky, up to 30° in elevation.
- 02-55 A few nebulous patches in the N.
- 03-45 Ditto.
- 04-15 A moderately bright band in the N.W. Also faint patches in the N. and N.E. sky.
- 05-00 Three faint streamers from 35° to 40° up in the E. sky.
- 05-43 No aurora visible.
- 06-00 A number of faint bands traversing the sky from E.S.E. to W.N.W.
- 06-37 A broken curtain of medium intensity traversing the sky from the E.S.E.
- 06-45 Ditto, somewhat brighter; crosses the zenith.
- 07-00 Aurora waning.
- 07-10 Curtain fading; now outlined by disjointed streamers.
- 07-35 Daylight now obscures auroral effects.
- 17-20 A nebulous arch 10° up in the N., extending from E. to W.
- 18-00 A bright arch 5° up, from E. to W.; brightest in the N.E. and E.
- 19-35 The arch remains; now 6° up, and somewhat duller.
- 20-09 A nebulous arch 5° up, between W.N.W. and N.E.
- 20-40 Ditto, fainter.
- 21-10 A glow in the N.E.
- 21-45 Clear sky. No aurora visible.
- 22-10 A nebulous arch from W.N.W. to N.E.; brightest in the N.W.
- 22-25 Ditto.
- 22-45 A luminous patch 5° up in the N.W.
- 23-25 No aurora visible.
- 24-00 A glow in the N.W.

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- 16-01-10 A faint glow on a cloud-bank in the N.E.
 01-50 No aurora visible.
 02-50 Ditto.
 03-20 Ditto. Sky hazy.
 04-10 Ditto.
 05-08 Ditto.
 06-00 Ditto.
 07-10 Ditto.
- 17-38 A nebulous patch 70° up in the N.W.
 18-00 A nebulous band 3° up, from N.E. to W.N.W.
 18-33 A nebulous arch 7° up, from N.W. to N.E.
 19-23 Ditto.
 19-35 A faint arch 7° up, from N.E. to W.N.W.
 20-00 The lower N. sky obscured by cloud. No aurora visible.
 21-30 Sky clouded from the horizon to 30° up. No aurora visible.
 24-00 Sky completely overcast.
- 17-03-45 Sky now clear. No aurora noted.
 04-15 No aurora visible.
 06-00 Ditto.
 07-00 Ditto.
 18-00 Ditto.
- 20-30 Clear in the zenith, hazy lower down. No aurora visible.
 22-45 Ditto.
 22-50 A faint glow on the N.E. horizon.
 24-00 No aurora visible.
- 18-01-46 A faint arch up to 10° , from N.E. to W.N.W.; faint streamers in the N.W.
 02-10 An auroral patch 20° up in the N.
 02-20 No aurora visible.
 05-20 Three bands 5° , 10° , and 15° up respectively, from N.E. to N.N.W. Occasional faint streamers.
 A patch 18° up in the N.W.
 05-45 Two small arches 8° up in the N.E., one curtained. A curtain 30° up, from E. to N.W. Two patches 12° up.
 06-00 A curtain 30° up from E. to N.W.; broken towards the E. Brighter than earlier.
 06-06 A faint curtain 35° up, extending as before-mentioned. Other fragments nearer the horizon, and a patch in the N.E.
 06-14 Three curtain fragments 20° up, and a nebulous band 5° up from N.W. to N.
 06-18 Several detached streamers between 10° and 30° up. A nebulous mass 10° up in the N.W.
 06-30 A band from near the N.W. horizon to that in the E., and rising to a height of 45° on the meridian.
 A faint curtain below this, and occasional patches above.
 06-45 Three curtains in the N.W., and running more or less to the S.E.
 07-00 Two curtains from the N.W. to a point some 12° up on the meridian.
 07-18 Several faint streamers in the N.W. and one in the E.
 07-35 Still faint traces in the N.W., but twilight considerable.
- 17-18 A nebulous aurora 10° up from S.W. to W.
 17-20 A curtain from E.S.E. to S.W., 25° up in the S., apparently trending in a roughly E. and W. direction.

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18-17-55 Streamers in the S.E. and E.

18-00 Curtain from S.W. horizon to E. horizon, reaching a maximum altitude of 45° above the S. horizon. This soon waned and appeared as detached streamers.

19-38 A broken curtain trending W. by S. at the zenith.

19-40 Ditto, from the S.W. horizon to 75° up in the W.

20-04 No aurora visible.

20-28 Ditto.

21-25 Ditto.

23-20 Ditto.

24-00 Clear sky. No aurora visible.

19-01-15 Ditto.

02-20 Ditto.

03-15 Ditto.

04-20 Ditto.

04-55 A very faint nebulous patch 20° up in the N.W.

05-20 Ditto.

06-00 Streamers and patches over the N. sky from the horizon to the zenith and from E. to W.

06-20 Ditto.

07-15 A very faint patch 25° up in the N.

18-00 Sky clear; bright moonlight. There appears to be part of a very faint curtain visible from the E. horizon to 20° up in the E.

18-20 Ditto.

20-15 No aurora visible.

21-05 Ditto.

21-40 Ditto.

22-37 A nebulous band 6° up, from N.E. to N.W.22-50 A broken band from N.E. to N.W., reaching a maximum elevation or 10°

23-04 A band with streamers low in the N. from N.E. to N.W.

24-00 A faint broken band from N. to N.W., 10° up.

20-00-39 A strong display in the N, N.E., and E. A nebulous patch 10° up in the N. Curtains in the N.E., the highest 40° up.

00-50 Curtains have disappeared. A band from E. to N.N.E., 10° up.01-05 A band from the S.S.E. horizon to 30° up, and a patch 10° up in the N.E.01-45 A faint band from 10° to 20° up in the W.

02-10 No aurora visible.

02-40 A band from the W. horizon to a point 50° up. Likewise from the S.E. horizon to a point 40° up towards the zenith.

03-21 No aurora visible.

04-30 No aurora visible.

04-56 A band from near the W. horizon to a point 70° up towards the zenith.05-30 A band from the W. to 30° up towards the zenith.

05-39 No aurora visible.

06-00 Two bands from westerly horizon to part of the way to the zenith.

06-40 No aurora visible.

17-20 A broken arch 5° up from the E.N.E. to N. by W.18-00 A nebulous aurora 7° up in the centre, from E.N.E. to W.N.W. Faint.

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- 20-19-20 A faint nebulous aurora 4° up in the N.E.
 19-40 A faint arch from 4° up in the N.E. to 6° up in the N.
 20-04 A faint arch from 4° up in the N.E. to 6° up in the N.W. The illumination slowly transferring itself to the W.
 20-30 A faint arch from 3° up in the E.N.E. to 8° up in the N.N.W.
 21-00 No aurora visible.
 21-30 A faint arch from 3° up in the N.N.E. to 4° up in the N.
 22-00 A bright nebulous display along the horizon between E. and N., reaching a maximum elevation of 9° .
 22-15 Several bright nebulous arches stretching between N.E. and N.W.; reaching a maximum elevation of 12° , waxing and waning and working gradually to the W. Streamers in the N.E., N.N.E., and N.W. reaching an elevation of 30° .
 22-45 Confused nebulous bands with some streamers from the horizon up to 12° , between E.N.E. and N.W.
 23-14 Two broken bands up to 12° , between E. and N. by W; highest in the N.E.
 24-00 A faint glow between N. and N.E., up to 5° .
- 21-00-30 A faint nebulous patch 4° up in the N.
 01-00 A faint glow 10° up in the N.E.
 01-29 A nebulous band 4° up, between N.E. and N.W., brightest from N.E. to N.
 02-00 A curved curtain up to 45° in elevation from S.E. to N.E., passing into a nebulous band stretching away to the N.W.
 02-30 Two streamers and a patch between E. and E. by S., between 10 and 30 up. Also a glow 10° up in the N.W.
 03-00 Fragments of a curtain 60° up in the E., also between 7° up in the W.N.W. to 25° up in the N.
 03-30 A glow from 3° up in the W.N.W. to 50° up in the N. and down to 10° up in the E.; brightest at the W. end.
 04-00 A broken curtain from the S.S.E. to W.N.W. passing a little N. of the zenith, waxing and waning. Also patches lower in the E.N.E. sky.
 04-30 A curtain passing through the zenith from E. by S. to W.N.W. Faint streamers in the N. and N.W., and a patch in the N.E.
 05-15 A curtain from S.S.E. to W.N.W., passing 30° S.W. of the zenith. A nebulous bar 60° up in the N.N.E., and another 6° up.
 06-00 A bright curtain through the zenith from S.E. to W.N.W. A nebulous arch from S.S.W. to W.S.W., 40° up.
 06-30 A faint broken curtain extending through the zenith from E. by S. to W.N.W.
 07-00 Ditto, but fainter.
 07-30 No aurora now visible.
- 17-15 Two faint nebulous arches, rising from the E. horizon.
 17-20 A nebulous arch, 5° up, from W. to N.W.
 18-0 The northern sky, obliterated by a bank of cloud to a height of 20° . No aurora visible.
 19-30 Sky hazy, so that only a few stars visible. No aurora visible.

The sky now became overcast, and did not clear until shortly before midnight on the 23rd inst.

21-23-55 A faint broken arch 45° up, from E. to W.

24-00 Ditto. Bright moonlight.

24-00-25 No aurora visible.

00-55 A curtain 12° up above the N.N.W. horizon to the E.

01-20 Ditto.

Sky now obscured by drift and cloud until the evening of the 28th inst.

1912.

July.

28-18-00 Sky clear. No aurora visible.

19-40 Ditto.

20-00 Ditto.

21-05 Ditto.

22-00 Ditto.

23-00 Ditto.

23-20 Ditto.

24-00 Ditto.

Sky now overcast until the morning of the 30th inst.

30-03-00 Sky now almost clear. Bright moonlight. No aurora visible.

04-00 Ditto.

05-00 Sky quite clear. No aurora visible.

06-00 A few patches near the zenith.

06-30 No aurora visible.

07-00 A faint nebulous band in the zenith.

07-35 No aurora visible.

18-00 Sky clear. Bright moonlight. No aurora visible.

19-30 Ditto.

20-15 Ditto.

21-45 Ditto.

22-48 A small patch of aurora near the zenith.

23-15 No aurora visible. Much cloud in the sky.

24-00 Ditto.

31-00-45 Clouds clearing. No aurora visible.

01-45 Ditto.

02-45 Sky now clouding over. No aurora visible.

Sky remains overcast until the evening of the 2nd August.

August.

2-17-45 The lower sky in the N., N.W., and W. clouded. A nebulous band 10° up in the E.N.E.

17-50 Very faint auroral streamers in the N.

18-00 No aurora visible.

19-00 Ditto.

19-15 Ditto.

19-55 Ditto.

20-00 The lower sky obscured. No aurora visible.

20-40 Ditto.

21-12 Sky obscured, excepting in the immediate zenith. No aurora.

21-46 The sky is now clearing. No aurora seen.

22-05 Banks of cloud low on the horizon. No aurora visible.

22-36 No aurora visible. Moonlight.

23-20 Clouds again rising. No aurora visible.

24-00 Sky completely overcast.

The clouds cleared away after 2 h. on the 3rd inst., and thereafter a clear sky and bright moonlight prevailed. No aurora noted until 6 h. 20 m.

1912.

August.

- 3-06-20 A very faint curtain in the zenith.
 06-35 No aurora visible.
- 18-00 A faint nebulous arch, 5° up in the centre, from N.E. to W.N.W. Brightest in the N.N.E.
 18-30 A uniform nebulous arch 5° up, from N.E. to N.W.
 19-10 Ditto, rising slightly.
 19-25 Ditto.
 19-40 A faint glow on the horizon between N. and N.W.
 20-30 A very faint fragmentary arch 6° up in the N.
 21-00 No aurora visible.
 22-00 Part of an arch 15° up in the N.N.W.
 22-50 Display much stronger. A curtain rising to 40° in the N., and reaching from the E. horizon to near the W.N.W. horizon. Long streamers in the E., confused curtains in the N., and bright and nebulous in the N.W.
 22-56 Display almost faded. A faint curtain from E. to N.W. Bright and confused in the N.W., 30° above the horizon.
 23-05 Display fainter. Visible only from W. to W.N.W. and elevated 20° . The sky now became overcast, accompanied by dense drift until 4 h. 20 m. in the morning.
- 4-04-20 Sky clearer. No aurora seen.
 06-05 A bright curtain from 20° in altitude in the S.E. through the zenith to 30° in altitude in the N.W. to In 5 minutes it began to fade rapidly, leaving a bright patch of corona type a little to the
 06-13 N.W. of the zenith. Simultaneously with this curtain a fainter parallel one started in the E. and rose to 45° . At 6 h. 13 m. the whole faded.
 06-27 A faint curtain from a little to the S.S.E. of the zenith, through the zenith to the N.N.W., just perceptible.
 06-40 No aurora.
 06-55 Ditto.
- During the evening and early morning hours, sky clear, moonlight. No aurora seen.
- 5-06-00 Faint detached auroral patches seen in the S.E. and N.W. Bright moonlight.
 18-00 Sky clear. No aurora visible.
 19-25 Ditto.
 20-20 Ditto.
 20-40 A faint nebulous arch 8° up, between W.N.W. and N.E.
 21-03 Ditto, brightest in the N.E.
 21-35 Ditto, brighter.
 22-20 No aurora visible.
 22-40 A faint nebulous patch 7° up in the N.
 24-00 A fragment of a curtain 16° up, between N. and N.N.W.
- 6-00-15 A patch 12° up in the N.N.W.
 00-40 A nebulous arch 10° up, between N. and W.N.W.
 01-25 Faint nebulous patches along the northern sky 8° up, between N. and N.W.
 01-50 Ditto, somewhat fainter.
 02-40 Ditto, now about 15° up.
 03-45 Faint bands extending from N.W. to S.E. through the zenith.
 04-15 Ditto.
 05-20 A curtain from the N.W. to 60° up in the S.E. Brightest in the N.W.
 05-45 Only a few patches between 6° and 20° up in the N.W.

1912.

August.

6-06-30 A streamer 10° to 30° up in the N.W.

16-30 A bright curtain seen in daylight, 4° up between E. and N.E.

17-00 Ditto, but more intense. The colour appears yellowish to pinkish-green; probably apparent colour affected by the daylight.

17-36 A bright nebulous arch 2° or 3° up between E. by S. and E.N.E.

18-06 Ditto.

19-11 A nebulous arch 3° up between E. and N.N.E., with a very bright patch in the N.E.

19-26 A very intense double nebulous arch 5° and 8° up between E. and N.

19-36 Ditto, more fragmentary.

19-42 The arches are very steady, reaching 4° altitude, extending from N. to N.E.

20-11 A bright nebulous band 2° up, between E. and N.N.E.

20-36 Ditto, somewhat broken.

20-39½ A curtain 6° up, from N.E. to N.N.W.; bright.

20-51 A nebulous band 6° up, from N. to E. Bright in the N.E.

21-00 A double band in the same place; somewhat brighter.

21-15 Three broken bands in the same place; fainter.

21-20 Bands from E.N.E. to N.N.W.; brightest in the E. An upper arch now appears to be beginning to spread from the E.

21-30 Ditto.

21-32 Fairly bright curtains up to 12° in the N.N.E.

21-49 Ditto; excitation travelling to the E.

21-56 Aurora now waning; now only 4° in altitude.

22-02 Ditto.

22-21 Ditto.

22-34 Aurora not visible.

22-38 Ditto.

22-44 A curtain 5° up, from N. to E.

22-48 Ditto, somewhat brighter.

22-51 A curtain 8° up, from E. to N. by W. Waxing and waning at intervals. Excitation travelling to the E.

22-56 Ditto, but stronger.

23-05 Streamers appear on the E. and N.E., also N. and N.W. horizons, reaching a height of 10°.

23-09 Display brightest in the N.

23-16 A continuous curtain now appearing from E. by S. to N.N.W., up to 12° in altitude.

23-21 Arch remains; streamers not so evident.

24-00 A faint band from N.E. to N., 6° up. Another from N.W. to N.N.W., 7° up.

7-00-15 A very faint band, low in the N.W.

00-51 Aurora absent.

01-22 A bright curtain, 15° up, between N.W. and N.E.

01-25 A nebulous arch remains in place of the curtain.

01-30 Four fragmentary arches remain.

01-44 Aurora fainter and working to the W.

01-50 The arch broken in six pieces.

02-00 A curtain 15° up in the N. Faint patches 10° up in the N.W., N., and E.

02-15 Two curtains in the N.

02-36 Faint patches in the N.W., N., and N.E.

02-50 Ditto.

1912.

August.

- 7-03-20 A band 3° up, from E. to N.E. Also a nebulous patch 10° up in the N.N.W.
 03-55 Display now more in the W. A short arch 3° up, and streamers 10° up.
 04-25 A very faint nebulous aurora from N.W. to W.
 04-45 Very faint aurora in the W.
 05-05 Streamers in the W., and one in the zenith.
 05-30 An arch from the W. over the zenith to the S.E. Also two parallel fragments between W. and N.
 05-40 A broken arch in the W. sky.
 05-50 Two parallel arches from the W. to S.E.
 05-55 The arches have now broken into detached fragments.
 06-00 Ditto.
 06-20 Arch over the zenith fading. A new curtain commencing in the W.
 06-28 Aurora working more to the S.W.
 06-43 No aurora visible.
 06-54 Ditto.
- 18-00 A very faint arch 4° up, between N.E. and N.
 19-25 No aurora visible.
 19-48 Ditto.
 20-00 Ditto.
 20-22 A nebulous patch 10° up in the N.N.E.
 20-25 A faint arch from the E. horizon to 14° up in the N.
 20-45 No aurora visible.
 21-30 Ditto.
 21-55 A faint arch across the northern sky.
 22-26 No aurora visible.
 23-00 Ditto.
 24-00 Ditto.
- 8-01-00 Ditto.
 01-30 A faint streamer in the N.E.
 02-00 No aurora seen.
 03-00 Ditto.
 04-00 Ditto.
 05-00 A single streamer 15° up in the N.W.
 05-30 Two faint arches rising from the W. horizon.
 06-00 A faint curtain in the N.
 06-30 No aurora visible.
- 18-00 Ditto.
 20-00 Ditto.
 20-44 Ditto.
 21-45 Ditto.
 22-01 A nebulous arch extending from the N.E. to the N.N.W., about 6° up.
 22-10 Ditto, brighter in the N.E.
 22-16 An auroral glow in the N.N.E.
 22-20 A very faint glow 4° up in the N. to N.E.
 22-25 Ditto.
 22-33 Ditto.

1912.

August.

- 8-22-44 A very faint glow 5° up in the N.E.
 22-51 A very faint glow 4° up in the N.N.W.
 23-21 A faint arch 5° up, from N.N.E. to N.N.W.; brighter in the N.N.W.
 23-38 No aurora visible.
 24-00 A faint auroral glow 5° up in the N.
- 9-00-20 Ditto.
 00-37 A curtain 5° up from N. to N.W.; excitation travelling to the E. Streamers reaching to 8° in altitude.
 00-50 A nebulous arch 6° up, from N. to N.W.; stronger in the N.W.
 01-09 A nebulous arch extending from a point 7° up in the N. to a point 3° up in the N.N.W.
 01-28 No aurora visible.
 01-46 A very faint glow, 6° up in the N.
 02-14 A faint nebulous arch 6° up from N. to N.N.W.
 02-44 No aurora visible.
 03-14 A faint curtain 30° up, from N.N.W. to S.E.
 03-34 A fragment of a curtain in the N., and streamers in the S.E.
 03-48 Three faint parallel curtains from N.W. to S.E. between 30° and 60° up.
 04-12 A faint shaft in the N.N.W.
 04-29 A faint arch 25° up, from N.N.W. to S.E. Streamers rising from the S.E. horizon.
 04-44 A very faint streamer low in the N.N.W. Several streamers in the S.E.
 05-12 Streamers in the N.N.E. and S.E.
 05-33 A fragment of an arch rising above the W. horizon, and two others from the S.E. horizon to the zenith.
 06-00 A fragment of a very faint arch up to 15° in the S.E.
 06-24 No aurora visible.
 06-47 A very faint band in the zenith, and a streamer in the S.E.
 07-14 A faint band in the zenith, trending S.E. to N.N.W.
 07-23 No aurora visible.
- 18-00 Ditto.
 18-15 A faint arch from 2° up in the E. to 12° up in the N.
 19-15 No aurora visible.
 19-25 A faint nebulous arch just above the horizon, between N. and E.
 19-57 No aurora visible.
 20-15 A faint arch in the N.E.
 20-45 A faint arch 5° up, from N. to E.
 20-47 An indistinct arch from N.E. to N.W., 4° up; brighter at the E. extremity. Indistinct streamers rising from the N.E.
 20-52 Arch from the E.N.E. to N. by E.
 21-00 A glow from N.E. to N.N.W., about 4° up.
 21-15 An arch 8° up, from N. to E.
 21-26 Ditto, with a few faint streamers showing.
 21-36 A nebulous arch, E.N.E. to N.W., brightest at E. extremity. Also several faint streamers.
 21-55 An arch 7° up, from N. to N.E.
 22-20 Ditto.
 22-45 A faint arch in the N.E.
 23-30 A faint arch 6° up, from N.E. to N.W.

1912.

August.

- 10-00-10 A glow in the N. about 6° up.
 00-40 A glow in the N.E., with streamers.
 01-30 A faint band, 6° up, between N.N.E. and N.N.W.
 02-25 No aurora visible.
 03-30 Ditto.
 04-05 Three arches extending from N.E. to N.W., the highest about 14° up.
 04-20 Two faint arches from N.W. to E., the lower 6° up, the higher 14° up. A faint curtain formation in the N.W. Nebulous streaks extending from the S.E. to the zenith.
 04-50 Faint arches in the N. and N.E., about 18° up. Brighter curtains in the N.W., extending towards the zenith. Faint streamers in the S.E.
 05-00 The display is fading.
 05-20 Four fine curtains in W., N., and N.W., also S.E., extending towards the zenith.
 06-00 Remnants of curtains visible in the N. and S.E. skies.
 06-30 Faint fragments of arches in the N. sky.
 17-00 No aurora visible.
 18-00 A faint auroral glow 15° up in the W.N.W., and 20° up in the N.N.W.
 19-20 No aurora visible.
 19-40 Ditto.
 19-52 Ditto.
 20-45 Ditto.
 22-00 Faint auroral patches between 5° and 8° up in the E. and N.
 22-30 A moderately bright arch 5° up, between N. by W. and N.E. A faint curtain from the N.E. over the zenith to the S.W.; brighter in the S.W. This curtain faded in the zenith within 10 minutes, but the extremities remained visible.
 22-50 A very faint glow, 4° up, between N.N.E. and N.N.W.
 23-20 A faint arch 2° up in the N.N.W.
 24-00 A faint arch, 5° up, between N. by W. and N.W.
- 11-00-30 Arch 6° up, from E. to N.W.
 00-40 Arch fainter, but rising in the N.W. portion.
 00-45 The N.W. extremity now 10° up; bright at intervals.
 01-00 The curtain now extends from the E. to W.N.W., elevated 20° in the N.E. and 15° in the N.W. Streamers travelling to the E. The whole faded about half an hour later.
 02-15 Very faint patches high in the S.E.
 04-15 A very faint arch, with streamers at either extremity, 25° up, extending from N. by E. to S.E.
 06-00 A faint arch, 8° up, between N. by W. and E.N.E.
 07-10 No aurora visible.
 18-00 Ditto.
 18-30 A faint arch from E. by N. to N.N.E., highest in the N., where 10° up.
 19-30 A moderately bright band from a point 15° up in the N. to the E.N.E. horizon.
 20-00 No aurora visible.
 20-12 A glow 10° up in the E.
 20-20 No aurora visible.
 21-00 Ditto.
 21-30 Ditto.
 21-40 Ditto.
 22-20 Ditto.
 22-55 Ditto.
 23-20 Ditto.

1912.

August.

11-23-50 A fairly bright curtain, 5° up, from N.W. to N.E.

24-00 Aurora less bright, but several fragments of parallel arches up to an elevation of 10° between N.W. and N.E.

12-00-30 Arches now very faint.

00-45 Only an exceedingly faint glow remaining in the N.

01-50 Sky clear. No aurora visible.

02-50 Ditto.

03-50 Ditto.

04-50 Ditto.

06-00 Ditto.

18-00 Sky clear. No aurora visible.

19-43 Very faint nebulous arch, 7° up, from N.E. to N.N.W.

20-30 Ditto, from N.E. to N., 3° up.

21-00 A bright arch, 5° up, from N.E. to N.W.

21-30 Ditto, 4° up.

22-15 Arch, 2° up, from N.E. to N.

22-50 A bright arch, 4° up, from N.E. to N.

23-40 A faint band, 5° up, in the N.E.

23-50 A faint arch, 5° up, from N. to N.E.

24-00 A moderately bright arch, 6° up, extending from E.N.E. to N.N.E.

13-00-45 A nebulous band from 5° up, in the N.W., to 15° up in the E.N.E.

01-35 A faint streamer rising from a patch 15° up in the N.N.W.

02-20 No aurora visible.

03-20 Ditto.

04-30 A faint arch, 4° up from N. to N.E. Also a curtain rising from the N.W. horizon to a point 25° up in the N.

05-25 A bright curtain extending from the N.W. horizon, across the zenith to the S.E.

05-40 A bright curtain extending past the zenith, but now very faint in the S.E.

06-00 A faint arch, up to 45° in the W., and a curtain up to the zenith from the N.W.

06-35 No aurora visible.

Sky obscured by cloud and drift until the morning of the 15th inst.

15-01-00 Sky overcast.

04-00 The northern sky overcast up to 30° in altitude. A faint auroral band 50° up in the N.W.

04-08 No aurora visible.

04-35 A curtain from the N.W. to the zenith.

04-55 A faint band from S.E. to N.W. through the zenith.

05-20 Several patches in the zenith.

06-00 A faint nebulous patch S.E. of the zenith.

06-40 No aurora visible.

18-00 Sky clear, but obscured by drift low down. No aurora visible.

20-00 Ditto.

20-25 Ditto.

24-00 A dull, nebulous arch, 3° up from E.N.E. to N.N.W.

1912.

August.

- 16-02-10 A fragment of a curtain in the N.N.W., extending from the horizon upwards for about 9°, apparently part of an arch, with a N.N.W. to S.S.E. trend. Also a faint patch 10° up in the N.E.
- 03-00 A faint patch 8° up in the N.W. Also a faint auroral haze along the N. horizon.
- 06-00 No aurora visible. Faint auroral effects would now be obliterated by the first rays of dawn.
- 18-00 A moderately bright curtain from the horizon in the E. to 10° up in the E.N.E.
- 20-00 Clear sky. No aurora visible.
- 20-10 A nebulous band, 5° up, from N.E. to N.N.W.
- 20-45 No aurora visible.
- 21-15 A faint arch, 5° up, from E.N.E. to N.N.W.
- 22-00 A bright arch, with streamers from E.N.E. to N. by W., low on the horizon.
- 22-20 A bright arch, with some streamers 6° up, from N.E. to N.N.W.
- 22-25 A brilliant curtain from E.N.E. to N.W., with convolutions in the N.W. and streamers in the E.N.E. 10° in altitude in the N.
- 22-28 Curtain now extended to the due E.
- 22-35 A bright confused arch, between 7° and 10° up, extending from N.E. to N.W.
- 22-45 An auroral glow in the N.
- 23-40 A faint glow in the N., about 4° up.
- 24-00 A curtain from N. to N.W. 4° up.
- 17-02-03 No aurora reported.
- 02-53 Ditto.
- 04-15 Ditto.
- 05-15 Ditto.
- 06-00 A moderately bright auroral glow, 5° up, in the N.E.
- 18-00 Sky overcast.
- 19-24 Ditto.
- 20-30 Sky clearing, but hazy. A faint arch 12° up, in the E.N.E.
- The sky now became more densely overcast, and did not clear until the evening of the 20th inst.
- 20-18-00 Drift partially obscures the lower sky. No aurora visible.
- 19-40 Ditto.
- 20-00 Ditto.
- 20-50 Ditto. Drift lighter.
- 21-10 Ditto. Sky clear to within 10° of the horizon. Moon shining.
- 22-00 Drift practically ceased. Two nebulous bands between the horizon and 10° up, extending between N.W. and N.E.
- 23-10 Display fainter, now extending as far as E.
- 24-00 A very faint glow on clouds 6° up, between N. and E.N.E.
- 21-00-50 A very faint auroral glow over a cloud bank to the N. and E.
- 02-20 Ditto.
- 03-20 Ditto.
- 04-30 Ditto. Also a faint band across the zenith from W.N.W. to E.S.E.
- 05-10 A very faint band across the zenith trending N.W. and S.E.
- 06-00 No aurora visible.
- 18-00 Sky almost clear. Bright moonshine.

1912.

August.

- 21-20-20 A bright nebulous arch 5° up, between N. and N.E. Colour bright yellow with a pink lower edge.
 20-48 Curtain 8° up, from N.E. to N.N.E.; excitation travelling from W. to E.
 21-11 Sky becoming misty from the N. No aurora visible.
 22-15 Ditto.
 23-48 Ditto.
 24-00 Ditto.

Sky obscured by cloud and dense drift until the evening of the 25th inst.

- 25-20-00 Sky commencing to clear. No aurora visible.
 22-00 Ditto.
 24-00 Ditto.

- 26-03-00 Ditto.
 06-00 Ditto.

- 18-00 Sky clear. No aurora visible.
 20-00 Ditto
 20-40 Ditto.
 21-40 Ditto.
 22-50 Ditto.

Sky obscured by cloud and drift until the evening of the 28th inst.

- 28-20-27 Sky clear. Light drift. No aurora visible.
 21-05 Ditto.
 21-57 Ditto.
 22-24 Ditto.
 24-00 Ditto.

- 29-01-20 Ditto.
 02-20 Ditto.
 03-20 Ditto.
 04-25 Drift thicker. No aurora visible.
 06-00 Ditto.

- 20-30 Sky practically clear. Light drift. No aurora visible.
 22-00 Ditto.
 24-00 Sky becoming hazy. No aurora visible.

- 30-02-00 Sky practically clear. No aurora visible.
 06-00 Ditto.

During the evening sky clear. Light drift. Bright moonlight, and no aurora reported.

- 31-00-45 No aurora visible.
 01-00 Ditto.
 01-30 Ditto.
 02-05 Ditto.
 02-30 Ditto.
 03-15 Ditto.
 03-30 Ditto.

1912.

August.

- 31-03-45 No aurora visible.
 03-55 Ditto.
 04-40 Ditto.
 05-30 Ditto.

Sky overcast during the evening.

September.

- 1-00-45 A pale arch 5° up in the N.
 01-30 Arch in the N.E. 7° up.
 02-40 No aurora visible. Sky partly overcast.
 03-30 A small nebulous patch in the N.N.W.
 05-00 No aurora visible.
 06-00 Ditto.

Sky much overcast in the late afternoon, clearing in the early evening, and again becoming overcast after 23 h.

- 20-00 No aurora visible.
 21-00 Ditto.
 22-00 Ditto.
 23-00 Ditto.

Sky overcast throughout the 2nd and 3rd inst.

- 4-01-15 Sky clear in the zenith and to within 20° of the horizon. No aurora visible.
 03-00 Ditto.
 04-30 Ditto.
 06-00 Sky almost clear. No aurora visible.
 20-45 Sky clear except close to the horizon. A bright curtain extending from the horizon in the E. to the horizon in the W., reaching an elevation of 15°, the streamers reaching another 15°. Waxing and waning; brightest in the E.N.E.
 21-50 A good curtain 5° up in the N., between W.N.W. and N.E.
 22-05 Ditto. Streamers less obvious. Becoming more nebulous in the W.
 22-10 Ditto, with a second short upper arch.
 22-14 The curtain has risen to 9° up, and shows streamers.
 22-25 Curtain now 6° up, extending from W.N.W. to E.N.E.
 22-52 Curtain 12° up, extending from W.N.W. to E.N.E.
 24-00 A faint arch dimly seen through the drift near the horizon from N. to N.E.

- 5-00-45 Considerable drift. No aurora visible.
 01-30 Ditto.
 02-40 Sky clearer. A faint glow along the N.W. horizon.
 03-15 No aurora visible.
 04-15 Ditto.
 04-35 A faint nebulous arch passing somewhat E. of the zenith and trending from N.W. to S.E.
 05-18 No aurora visible. Daylight now sufficiently strong to obscure all but the strongest effects.
 20-15 A nebulous aurora 4° up, extending from N.E. to N. by E.
 22-00 A glow on the N. horizon between N.E. and N. by W.
 24-00 No aurora visible.

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6-02-30 No aurora visible.

03-30 A faint glow between N.E. and N.N.E.

04-45 No aurora visible.

18-20 A nebulous aurora between the bars of a cloud radiant 3° up in the N. by W.

20-20 A nebulous arch 5° up, extending between N.E. and N.

21-00 No aurora visible.

22-00 Sky partially overcast. No aurora visible.

23-00 Ditto.

24-00 Ditto.

7-01-00 Sky clearer. No aurora visible.

02-00 Ditto.

03-00 Ditto.

04-00 Ditto.

05-00 Ditto.

20-00 No aurora visible.

21-40 An auroral glow along a cloud top, showing from the E. horizon to a point 12° up in the N.

22-30 A curtain partially hidden by a cloud, extending from the E. horizon to a point 15° up in the N.

24-00 Northern sky completely overcast. No aurora visible.

8-02-00 Ditto.

03-30 Sky clearer. No aurora visible.

04-30 Sky overcast.

20-08 An auroral glow 10° up in the E.N.E. seen between clouds.

20-33 A faint glow 10° up in the E.

21-00 Aurora absent.

21-15 A faint glow 15° up in the E.

22-00 Glow somewhat stronger 15° up in N.E.

22-15 Ditto.

22-45 No aurora.

24-00 A very faint glow 15° up in the N., on a cloud bank.

9-01-00 Faint streamers above a cloud bank 15° up in N.

02-00 A faint glow over the cloud bank in the N.

03-00 No aurora visible.

04-00 Ditto.

Sky densely overcast in the evening hours and early morning.

10-04-10 Sky commencing to clear from the S. No aurora visible.

20-15 Northern sky partly overcast. No aurora visible.

The sky becomes densely overcast, not clearing until the following evening.

11-19-15 Sky clear. No aurora visible.

20-14 A faint arch 4° up, from N.E. to N.W.

21-14 A glow about 5° up, extending from the E. to the N.N.W. horizon; brightest in the N.E.

21-50 A glow 7° up in the N.E.

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11-22-30 No aurora visible.

22-45 A glow 4° up, between the E.N.E. and N.

23-14 A glow 7° up, between N.N.E. and N.; partly obscured by cloud.

24-00 No aurora visible.

12-01-00 Ditto.

02-00 An arch with streamers extending from the S.E. to N.N.W. across the zenith.

02-33 No aurora visible.

03-05 A very faint glow in the N.N.W. with one faint high streamer.

03-45 No aurora visible.

04-30 Ditto.

18-00 Ditto.

19-55 Ditto.

20-05 An arch with streamers 2° above the horizon, between N. and E.N.E.

20-26 Two bright arches with streamers 5° up, from E.N.E. to N.W.; showing faint reddish tint below

20-37 The arch remains steady.

20-55 Arch steady but fainter.

21-10 Two arches between E.N.E. and N.W.; the upper 6° and the lower 2° up.

21-20 The phenomenon somewhat fainter. It consist of a branched arch extending from E.N.E. to N.W., chiefly centred at an elevation of 3°, but reaching 6°. Streamers rising at intervals.

21-45 A very faint arch with streamers, extending from E.N.E. to N.N.W. at an elevation of 4°.

22-30 A faint glow 2° up, between N.E. and N. by W.; brightest in the N. and N.E.

22-44 A faint glow over a cloud bank 1.5° above the horizon between E.N.E. and N.N.W.

23-20 A faint arch 2° up between E.N.E. and N.N.W.

24-00 A faint nebulous aurora extending from E.N.E. to N.W.; 2° up in N.W. and 6° up in the E.N.E.

13-00-45 A nebulous glow 6° up, extending from N. to N.W.

01-30 Sky clear. No aurora.

02-15 Ditto.

03-00 A very faint glow in the N.

03-45 Sky clear. No aurora.

04-45 Ditto.

19-30 No aurora visible.

19-45 Ditto.

19-55 A curtain reaching 12° up in the N.E.; faint on account of moonlight.

20-05 A faint curtain extending from 7° up in the N.E. to 9° up in N.W.

20-15 A very faint arch 5° up, between N.N.E. and N.

20-22 No aurora visible.

20-45 Ditto.

21-00 A bright nebulous arch 2.5° up, between N.E. and N.N.W.

21-26 Ditto, between N.E. and N. by W.

21-55 The arch now faint and extending between N. and N.E.

22-36 The arch has risen and brightened. Now extending from the N.W. horizon to a point 5° up in the N.N.E.

23-12 A nebulous arch 4° up, between N.E. and N.W.

23-30 Moderately bright arch from the N.W. horizon to 3° up in the N.W.

23-51 The arch continues, very faint however towards the E.

24-00 Aurora absent.

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- 14-00-27 A faint nebulous arch 2° up, from N.E. to N.W.
 01-00 A moderately bright arch from 5° up in the N.E. to 2° up in N.N.W.
 02-50 A curtain from 15° up in the N.E. to 3° up in the N.W. Fainter at the W. extremity. Also a nebulous arch crossing near the zenith from N.W. to S.S.E. The curtain in the north was seen in the same position at 3 h. 35 m.
 03-10 Sky clear. No aurora visible.
 03-28 A faint arch from 15° up in the N.E. to 7° up in the N.N.W.
 03-45 No aurora visible.
 04-00 Ditto.
 04-23 Ditto.
 04-52 Ditto. Now considerable daylight.
- 19-35 Ditto.
 20-00 A faint nebulous arch 7° up, between N. and N.E.
 20-05 Arch somewhat brighter, extending from N.E. to N. by W.
 20-24 A nebulous arch 5° up, between E.N.E. and N. by W., brightest towards the E.
 20-41 Arch now much fainter.
 21-00 A faint glow 5° up, between N.E. and N.
 21-16 Ditto.
 21-35 Ditto.
 22-00 A nebulous wavy arch 4° up, between E.N.E. and N. by W.
 22-30 Ditto, somewhat fainter.
 23-00 A faint glow 5° up in the N. by E.
 23-20 No aurora visible.
 23-30 A faint glow 5° up in the N.
 24-00 A bright nebulous arch 4° up, between N.E. and N.
- 15-00-30 Sky clear. No aurora visible.
 01-30 Ditto.
 02-00 A faint nebulous arch, extending from a point 30° up in the N.E. to 4° up in the N.W.
 02-40 A faint nebulous arch from the zenith to 5° up in the N.W.; also a fainter parallel fragment a few degrees E.
 03-20 A bright steady nebulous arch from 30° up in the N.W., passing through the zenith to a point 10° beyond to the S.E.
 03-40 No aurora visible.
 04-00 Two faint streamers 10° high situated 30° up in the N.E.
 04-30 No aurora visible.
 04-45 Ditto, now considerable daylight.
- 19-30 A very faint auroral glow 4° up in the N.W.
 19-50 Sky clear. No aurora visible.
 20-38 Ditto.
 21-00 Ditto.
 21-14 Ditto.
 21-50 A nebulous arch 4° up, between N. and N.N.W.
 22-10 An arch 5° up, between N.E. and N.N.W.
 23-10 No aurora visible.
 24-00 Ditto.
- 6-01-10 Sky clear. No aurora visible.

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16-02-15 A faint glow 3° up in the N. by W.

03-15 A faint arc 5° up in the N.N.W.

04-00 No aurora.

19-43 A faint nebulous arch 4° up, between N.E. and N.N.W.

20-10 Ditto.

20-40 Ditto.

21-00 An arch from N.W. to N.E., maximum height 5° in the N.N.E.: Moonlight sufficient to obliterate weak effects.

21-15 Arch 3° up, between N.E. and N.W.

21-26 Ditto.

21-35 Very faint arch 2° up, between N. by W. and N.N.W.

22-00 Arch dimly seen from N. to N.E.

22-05 No aurora visible.

22-35 A faint curtain 4° up, between N. and N.N.E.

23-05 Ditto.

23-35 A very faint nebulous arch 5° up, between N. and N.E.

24-00 A faint nebulous patch 6° up in the N.N.E.

17-00-40 No aurora visible.

01-40 Faint streamers 8° up in the N. by W.; also 15° up in the E.N.E.

01-45 A faint patch in the N. by E., between 8° and 20° up.

02-00 Ditto, but fainter.

02-40 Faint patches 10° up in the W. by N., N. by W., N.E., and almost in the zenith: Moonlight now almost gone.

02-42 All now faded but the patch in the W. by N.

03-04 A faint arch from the N. horizon to 15° up in the N.E.; also a brighter curtain from the zenith to 40° up in the N.W. These curtains wax and wane, but never brilliant! Also a mass of faint detached curtain 10° up in the W. by N.

03-07 Detached curtains in the N. by W. A nebulous patch in the S.W.

03-30 Four broken curtains crossing the zenith from N.W. to S.E.; continuous N. of the zenith, patchy to the S.E.

03-45 Two of the above curtains near the zenith remain.

04-15 A single curtain trending N.W. by W. through the zenith to the S.E. by E. Masked by daylight.

04-40 No aurora visible: Daylight considerable.

20-30 Sky for the most part overcast. No aurora visible.

21-00 Sky somewhat clearer. No aurora visible.

22-00 Ditto.

23-25 Sky almost clear. No aurora visible.

24-00 A faint glow from the N. by W. to N.N.E., some 4° in altitude.

18-00-30 No aurora visible.

01-30 A nebulous arch 5° up, between N. and E.N.E. A faint streamer in the E.N.E.

02-20 A sinuous curtain extending from N.E. to W.N.W. at a mean altitude of 5°.

02-40 The curtain is still faint, but has risen to a height of 10° at the eastern extremity and 5° at the western end.

03-00 Nebulous patches and streamers in the position of the above curtain.

03-30 A faint curtain 15° up in the E. Also an indistinct arch 4° up in the N.W.

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18-04-00 A curtain from low in the W.N.W. reaching almost to the zenith. Also a nebulous patch in the N. sky.

04-28 Nebulous bars passing through the zenith from N.W. to S.E. A faint curtain formation in the S.E. sky. Dawn appearing.

20-00 Sky almost clear. No aurora visible.

21-09 A bright curtain waxing and waning between E.N.E. and W.N.W. Maximum altitude 15° in the N. Active streamers.

21-20 The display is now very bright and active, and shows colour. This is one of the maxima points. In eight minutes the curtain rose from 15° to an altitude of 50° .

21-25 $\frac{1}{2}$ Curtain now crossing the zenith towards the S. Trending E. and W. A coronal vortex in the zenith. A second arch 25° below the curtain towards the N.N.E. now appearing; fairly bright.

21-30 The curtain now reached a maximum southerly position, about 10° south of the zenith, and began receding to the N. It is now faint and only one band remains.

21-35 Curtain has now receded to about 10° north of the zenith. Though now strong it is not so strong as when advancing.

21-37 $\frac{1}{2}$ The curtain has broken down into a faint one at 60° up in the N., and another 40° up in the N. The upper one has brightened up considerably at this moment.

21-41 The main curtain is now 30° up in the N. The dominant direction of trend of the curtain during the strong phases was E. by S. and W. by N., and it remained fairly straight.

21-50

The display was very bright, almost next to the great one of early July. The corona effect at the zenith as the curtain passed over was well illustrated. The colour was chiefly rose-pink and emerald green. When in its most active phases, the onward travel of the luminescence took place in successive surgings, which appeared to be always reddish on the advancing face grading off into greenish tints on the rear side of the waves of light. Amplifying this statement is the fact that the southern side of the curtain appeared reddish, the northern greenish when advancing to the south. The colour did not show on its retirement to the N. The luminescence raced chiefly from the W. to E. On one occasion it was seen to be flowing into a knot in the zenith from both directions; a few seconds later, however, it was seen to all travel east through the swirl. At times the general outline of the curtain was comparatively faint, but repeatedly traversed by waves of excitation kindling it successively from west to east with a brilliant light. This produced the appearance of bars of light flitting along the curtain.

21-57 A small curtain 15° up, between N. and N.W.

22-03 A nebulous glow 10° up in the N.

22-13 No aurora.

22-45 Ditto.

22-57 No aurora. The moonlight would obscure weak effects.

23-10 Ditto.

24-00 No aurora seen, but sky becoming increasingly more overcast.

No aurora seen during the early morning hours, the sky soon becoming completely overcast.

19-19-55 Sky almost clear. Bright moonlight. No aurora visible.

20-37 A faint nebulous arch 4° up in the E.N.E. to 6° up in the W. by N.; brightest towards the E.

20-50 No aurora visible.

21-07 Ditto.

21-37 Ditto.

21-58 An auroral glow faintly seen through the moonlight 3° up in the N.

22-15 Ditto, but somewhat stronger.

22-44 No aurora visible.

23-05 Ditto.

24-00 Ditto.

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- 20-01-28 A bright curtain 9° up in the N., extending from the N.W. by W. to N.E. by N.
 01-37 The curtain is now 12° up, extending from W.N.W. to N.E. by N.
 01-50 A curtain 12° up, from N. to W.N.W., waxing and waning.
 02-19 A broken curtain extending from N. to W. by N., reaching maximum elevation of 14° in the N.W.
 The curtain appears to be swinging around towards the W.
 03-00 The aurora has faded.
 03-20 No aurora visible.
 03-50 Ditto.
 04-00 Ditto.
 04-35 There is now too much daylight to note aurora.
- 20-00 Sky clear. Bright moonlight. No aurora visible.
 20-30 Ditto.
 21-00 Ditto.
 21-30 Ditto.
 23-00 Ditto.
 23-50 An auroral curtain from W.N.W. to N. by W. 10° up; also another from N. by E. to E. 14° up
 in the N.E. Fairly bright, even in strong moonlight.
 24-00 An auroral curtain in the W.N.W. to E. highest, 15° in the N. by E.
- 21-00-15 A broken curtain from the N.W. to N. by E. 10° up in the N.
 01-15 A nebulous arch from the N.W. to N. by E. 5° up.
 01-40 Clear bright moonlight. No aurora.
 02-40 A faint nebulous auroral band in the N.W. 6° up.
 04-00 No aurora visible.
 04-30 Ditto.
- 19-55 Clear sky. Bright moonlight. No aurora visible.
 20-25 Ditto.
 21-15 Ditto.
 21-35 Clouds rising from the N. horizon. No aurora visible.
 22-10 Ditto.
 22-45 Considerable cloud. No aurora visible.
 23-25 Sky largely clouded over. No aurora visible.
 24-00 Ditto.
- The clouds began to clear away at 3 h., but no aurora seen during the early morning hours.
- 22-19-45 Clear sky. Bright moonlight. No aurora visible.
 20-30 Ditto.
 24-00 Ditto.
- 23-20-19 A nebulous arch from a point 30° up in the S.W. through the zenith to a point 60° up in the N.E.
 Appears faint seen in moonlight.
 20-25 A faint curtain extending from 5° up in the N.E. to 28° in the N.
 20-40 No aurora visible.
 23-05 Ditto.
 23-15 A patch of aurora 15° up in the N. by W.; apparently part of a curtain whose outline is obscured
 by the bright moonlight.

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23-34 A faint curtain in the northern sky, trending N. and S. extending from 33° up to 30° up in the N.

24-00 No aurora visible.

Bright moonlight. No aurora seen during the early morning hours.

24-19-30 An arch 2° up in the N.

20-03 An arch 8° up in the N. Bright moonlight obscures details.

20-10 Arch just visible in the N.

20-20 Ditto.

20-33 No aurora visible.

20-54 Ditto.

21-00 Ditto.

21-35 Ditto.

22-00 Ditto.

22-40 Ditto.

24-00 Ditto.

25-02-20 Ditto.

04-45 Ditto.

19-30 Bright moonlight. No aurora visible.

20-00 Ditto.

20-30 Ditto.

21-00 Ditto.

21-30 Ditto.

22-10 Ditto.

22-25 Ditto.

23-05 Ditto.

24-00 Ditto.

26-00-40 Ditto.

01-25 Ditto.

02-05 A faint auroral band in the zenith masked by moonlight.

02-25 No aurora visible.

03-05 Ditto.

03-35 Ditto.

04-00 Ditto.

04-30 Ditto.

20-00 Bright moonlight. No aurora visible.

20-45 Ditto.

21-45 Ditto.

22-30 Ditto.

23-30 Ditto.

24-00 Ditto.

Throughout the early morning hours no aurora seen, but the sky much covered with cloud and moon shining brightly.

27-20-00 Sky clear. No aurora visible.

20-35 Ditto.

21-19 A faint nebulous aurora 5° up, between N.E. and N.

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- 27-21-40 A very faint nebulous patch 6° up in the N.E. rendered obscure by bright moonlight.
 22-10 No aurora visible.
 22-53 Ditto.
 23-50 Ditto.
 24-00 Ditto.

Clear sky and bright moonlight maintained throughout the early morning hours, but no aurora seen.

- 28-20-20 Sky clear. No aurora visible.
 20-45 Ditto.
 21-30 Ditto.
 22-10 Sky clear: a faint nebulous arch 2° up in the N. between N.E. and N.N.W.
 22-40 A faint arch 2° up in the N.
 24-00 No aurora visible.

29-04-00 Ditto.

19-40 Sky for the most part clear. No aurora visible.

20-00 Ditto.

20-40 Sky clear. No aurora visible.

22-00 Ditto.

22-20 A dark clear sky; no aurora visible.

22-40 A faint curtain trending E.N.E. to W.S.W. through the zenith; stretching between the zenith and 60° up in the E.N.E.

23-10 A faint glow on the E.N.E. to N.W. horizon.

24-00 An auroral band about 12° up, between E. and N.N.W.

30-00-10 A faint arch 15° up, between E.N.E. and N.W.

01-45 Ditto, between N.E. and N.W.

Later there was reported an appearance of aurora in the northern sky, low down, but uncertain on account of the dim extraneous light. During the evening the sky was obscured by drift.

October.

Sky completely obscured by drift until the evening of 3rd October. During the evening hours of the 3rd inst. cloud and light drift almost obscured the sky; no aurora visible. On the 4th inst. the sky much overcast with cloud during the morning hours; no aurora seen; also sky almost completely overcast in the evening hours, and no aurora visible, excepting for a glow on the upper side of cloud bars 45° up in the N.N.E.; on the 5th inst. the same obscure conditions prevailing during the early morning hours, and by 4 h. 30 m. dawn so far advanced that any but strong auroral effects would be obscured. The sky continued obscured by cloud or dense drift until the evening of the 10th instant.

10-20-00 Clouds low on the N. horizon; no aurora visible.

20-37 Ditto.

21-28 Ditto.

23-26 Sky clear; a medium bright curtain 2° up in the N. by E. to N. by W.

24-00 A nebulous arch between N.E. and N.W., some 2° or 3° up.

25-00-35 A nebulous band 3° up, between N.E. and N.W.; also fragments of arches in the N., one 2° the other 3° up.

05 A nebulous arch 3° up, from N.E. to N.W.

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October.

11-01-36 Aurora gone.

02-35 No aurora.

21-30 Sky clear; no aurora seen.

22-47 A curtain 6° up in the N., between N.W. and N.N.E.

22-56 A curtain 5° up, between N. by E. and N. by W.

23-10 Aurora practically gone; a faint glow over a cloud bank 3° up in the N.

23-25 No aurora visible.

23-45 Ditto.

24-00 Ditto.

12-02-00 Ditto.

02-30 Ditto. Dawn now obscures all but first magnitude stars.

03-30 Ditto.

20-00 Drift obscures the lower sky; no aurora visible.

21-00 Ditto.

22-00 Ditto.

23-15 Ditto.

24-00 Ditto.

13-01-05 Ditto.

02-00 Ditto.

03-00 Ditto.

03-45 Ditto.

20-30 Sky clear; twilight; no aurora.

21-00 Ditto.

21-20 Still twilight; several stars visible; also a young moon. No aurora visible.

21-45 No aurora visible.

22-30 Ditto.

23-00 Ditto.

24-00 Ditto.

14-01-00 Ditto.

02-00 Ditto.

03-00 Ditto.

20-15 Sky almost clear; no aurora visible; twilight.

20-50 A nebulous arch 14° up from N.E. to N.; also a lower arch 10° up in the N. Twilight; only a few stars visible.

21-10 The upper arch has now moved round to occupy a N. to N.N.W. position.

21-20 The aurora has faded.

21-35 No aurora visible; sky clear.

22-00 Nebulous patches 3° up; one in the N., another in the N.N.E.

22-20 A series of streamers rising to altitude of 12°, between E. and N.N.W.

22-29 Streamers much brighter; travel of excitation from W. to E.

22-37 A curtain 10° up, between N. and N.N.E.; trend W.N.W. to E.S.E.

22-44 Ditto, fading.

23-16 A curtain rising to 10°, between E. and N.N.W.

23-45 A patch of streamers 5° up in the N. by W.

24-00 A faint nebulous patch 5° up in the N.

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15-00-35 Sky clear; no aurora visible.

01-14 Ditto.

01-55 Ditto.

02-45 Ditto; twilight now strong.

21-58 A curtain 10° up in the N.W. and N.E.

22-02 The curtain extends and brightens, rising to 15° in the N.E. A reddish colouration appears on the lower border.

22-06 Aurora has faded so as to be scarcely discernible.

22-10 Aurora now brightened up considerably; it has extended as a curtain from W.N.W. to N.E., and even to E. in broken fragments. The outline contorted in the N. and reaches a height of 14°. The display is active and a faint reddish colour appeared below for a moment.

22-15 It is now stronger, and has reached a height of 18°. A flash of green and red appeared; strongest in the W.

22-18 Since the last observation the aurora has been comparatively dull, with one or two revivals. It remains about the same height. Now it again revives slightly, but soon commences to fade.

22-36 Two very faint nebulous arches now remain; one 8°, the other 6° up in the N. During this display, medium moonlight and considerable twilight prevailed.

22-55 No aurora visible.

23-06 Ditto.

23-20 Ditto.

24-00 Ditto.

16-01-00 Ditto.

01-30 Ditto.

02-30 Ditto.

03-20 Ditto.

Sky overcast in the evening, and during the early morning hours of the 17th inst.

17-21-40 A nebulous arch 14° up, between N.E. and N.W.

21-45 The arch has risen to 20° and is developed more to the E., extending from N. to E. A faint reddish tinge on the lower border; considerable twilight.

21-55 Aurora almost disappeared; faint glow in the N.E.

22-00 Ditto.

22-15 A broken arch between 6° and 10° up in the N., N.E., and N.W.

22-19 A curtain 8° up, between N.N.E. and N.E.; brightest in the N.N.E.

22-30 An arch 10° up between N. and N.E.; appears more greenish than usual, probably due to the presence of twilight.

22-45 No aurora visible.

23-05 Ditto.

23-30 Ditto.

24-00 Ditto.

Frequent observations during the early morning hours of the 18th inst. failed to report auroral phenomena. From the 18th October onwards to the end of the year, no further appearances of aurora were observed. This was partly due to the waxing moon after that date, and to the frequency of overcast skies, but, perhaps more than anything else, the increasing twilight which began to assert itself even at midnight.

1913.
March.

Continuous daylight during January and February precluded the possibility of auroral records during those months. The sky was obscured by cloud and drift during the first days of March until the evening of the 5th inst.

- 5-23-15 A faint curtain centred in the N.N.E., about 10° up. Sky clear, but view curtailed by drift.
24-00 No aurora visible.
- 6-22-00 Considerable cloud in the sky. No aurora visible.
22-45 An arch extending from the W.N.W. horizon to a cloud bank 3° up in the N.; changing slowly. Faint streamers.
23-10 Curtain from the W.N.W. horizon to 4° up in the N.W.; streamers.
24-00 A strong auroral glow in the N.; stronger in the N.W.
- 7-01-00 Sky clear. No aurora visible.
03-00 Ditto.

Sky overcast till the evening of the 9th instant.

- 9-22-00 Faint auroral glow near the N.E. horizon. Sky clear.
22-20 A very faint glow in the N.E.
23-00 Ditto.
23-37 A very faint glow on the N.N.E. horizon.
- 10-00-30 Faint streamers from a discontinuous curtain in the N.
00-40 No aurora visible.
00-55 Faint aurora in the N.
01-30 No aurora visible.
02-15 A curtain in the W.N.W., across the zenith to the E.S.E.; also a fainter band trending approximately N. and S.

Sky now obscured until the evening of the 11th inst.

- 11-22-00 Sky clear, except for cloud low in the N. No aurora visible.
23-00 Ditto.
24-00 A faint curtain 1° up, between N.E. and E.N.E.
- 12-01-00 No aurora visible.

Sky now obscured by cloud until the early morning hours of the 16th instant.

- 16-01-30 Sky clear in the S.W. only. A faint auroral glow in the S.W.
02-30 A strong curtain from near the N. by W. horizon to a point 20° W. of the zenith, waxing and waning actively. Cloud now largely cleared away. Sky obscured by cloud and drift almost without a break until the evening of 1st April. No aurora noted on the rare occasions when more or less clear, probably partly owing to moonlight.

April.

- 1-21-00 Sky clear. A faint auroral glow on the N.E. horizon, and a faint nebular band in the W.S.W. from 10° to 30° in altitude.
21-50 An auroral glow 2° up, between N. and N.E.
24-00 Faint auroral band 2° up in N.W.
- 2-01-00 No aurora visible.
20-00 Cloud on the N. horizon only. Two nebulous bands from E. to N. by E. up to 5° in altitude.

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2-20-25 Faint arch 5° up, between N. and N.E.

21-00 No aurora visible.

22-15 A patch 10° up in N.E.

22-45 Faint band 10° up, between N.E. and N.W.

22-55 Faint arch 12° up, between W.N.W. and E.N.E.

23-30 A faint arch 8° up in N. to W.N.W. horizon.

3-01-00 A very faint glow on the N.N.W. horizon.

02-00 No aurora visible.

03-00 Ditto.

04-00 A faint curtain 10° in length, from zenith towards the S.E.

05-00 Daylight obscures any auroral effects.

20-07 Sky partly overcast. No aurora visible.

21-00 Clouds for some distance above the N. horizon. A faint glow above clouds low in the N.E.

23-00 A glow over clouds low in the N.N.E.

23-20 No aurora visible.

23-30 A glow low down from N. by W. to N.N.W.

24-00 An auroral band low down from N. to N.W.

4-02-15 A faint curtain extending from near the horizon in the N.W. to 5° N.E. of the zenith, and fading away in the E. sky.

03-00 A faint curtain up to 40° from the N.W. horizon. Two streamers near the S.E. horizon.

03-30 A curtain from 5° up in the N.W., through the zenith, to within 5° of the S.E. horizon. Steady and waning. Brightest in the N.W.

04-00 The curtain has swung around to the N.W. by W. and S.E. by E., but fainter. Two additional very faint broken curtains parallel to the main curtain.

05-00 No aurora visible. Twilight appearing.

20-15 Sky clear. No aurora visible.

20-38 A faint curtain 20° up, from N. by E. to N.N.W.

20-45 A faint curtain 15° up from N. to N.W.

21-15 No aurora visible.

21-45 Ditto.

21-55 Ditto.

22-30 Ditto.

23-00 A very faint glow 4° up, from N. to N.E.

23-38 A very faint glow 4° up, from N. to N.W.

24-00 No aurora visible.

5-01-00 Ditto.

03-00 Ditto.

Sky overcast until the evening of the 9th instant.

9-21-00 The sky appears to be clear, but thick drift obscures the view. No aurora visible.

24-00 Ditto.

10-02-00 Drift clearing. Glows in the N.W., N. by W., and towards the E.N.E., about 5° up. A streamer 3° up in the N. by E.

03-00 No aurora visible.

04-00 Ditto.

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10-05-00 A bright but broken curtain between the N.W. and N. horizons, reaching a maximum height of 6° .

21-00 A faint arch along the horizon from N. to E. about 2° up.

21-48 No aurora visible.

22-30 Ditto.

22-50 Ditto.

23-10 Ditto.

24-00 Ditto.

11-00-23 Ditto.

01-04 A low band 4° up in the N.W.

03-00 A glow on the N.W. horizon.

06-00 No aurora visible.

20-36 A faint curtain 10° up in the N.N.E.

21-00 No aurora visible.

21-25 A faint streamer in the E.N.E.

21-50 An auroral band 10° up in the N.E.

22-14 No aurora visible.

22-30 A glow and faint streamers showing above a cloud bank 10° up in the N.

22-40 A bright glow along the top of an extensive cloud bank 22° up from the W.N.W. to E.S.E. There is apparently a considerable aurora going on to the N. of us.

22-53 The glow has now disappeared.

23-17 No aurora visible.

24-00 No aurora visible. Considerable cloud in the lower N. sky.

12-01-30 Ditto.

03-30 Ditto.

04-30 Ditto.

Sky now overcast until the evening of the 14th instant.

14-20-50 A glow 4° up in the N.

21-06 A bright convoluted curtain 10° up, from N.N.W. to N.E.

21-14 A fairly strong curtain 20° up, between N.E. and N.N.W., waxing and waning.

21-25 Aurora now fainter and nebulous, 30° up from N. to E.N.E. Trend more or less E. and W.

21-42 A comparatively dull arch 10° up, from N. to N.E.

22-19 Ditto, between N. by W. and N. by E.

23-04 No aurora visible.

24-00 Ditto.

15-01-00 A faint arch across the N. sky, from W. to E.N.E., 6° up in the centre.

02-30 A faint curtain 20° up in the N.W., extending towards the zenith.

05-00 Several very faint parallel bands across the sky from W.N.W. to E.S.E. Faint twilight.

06-00 No aurora visible. Twilight now strong.

19-35 A glow from E. to E.N.E., up to 3° .

20-45 A faint auroral haze in the N.

21-25 No aurora visible.

22-40 A strong band 3° up from N. to N.E.

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- 15-23-00 A faint band from N. to N.E.
 23-15 An arch 6° up, from E.N.E. to N.N.E., with a few streamers.
 23-30 A faint glow above a cloud bank 6° up in the N.E.
 24-00 No aurora visible.
- 16-00-30 A nebulous glow in the N.N.W.
 01-00 No aurora visible.
 02-07 A curtain from the S.S.E. horizon to near the N.N.W. horizon; brightest S. of the zenith. A faint curtain from 3° up in the N.N.W. to 5° up in the N.W.
 03-00 No aurora visible.
 04-00 Ditto.
 05-00 Ditto.
- 18-30 A clear sky and three-quarter full moon. No aurora visible.
 19-10 Ditto.
 19-30 Ditto.
 20-00 Ditto. Lower sky obscured by drift.
 21-00 Ditto.
 22-15 A nebulous arch 30° up from N.N.W. to S.S.E., largely obliterated by the moonlight.
 22-25 A bright curtain with high streamers up to 40° in the E. sky; extending from the N.N.W. to S.S.E.
 22-26 Aurora now faded.
 22-27 Aurora now waxing.
 22-31 Aurora faded; fragments in the E. and N.E.
 22-35 A contorted fragmentary curtain from N. to N.E., 20° up.
 22-54 No aurora visible. The drift is now thicker.
 23-15 No aurora visible.
 23-45 Ditto.
 24-00 Ditto.
- 17-00-30 An arch 12° up, from N. to N.W.
 02-00 A curtain 10° above the S. horizon.
 02-30 Ditto, somewhat faded.
 03-00 Aurora barely visible through the drift in the N.W.
 04-00 No aurora visible.
 06-00 Ditto.
- Sky obscured by cloud and drift until the evening of the 18th instant.
- 18-20-00 Clear sky and a bright moon. No aurora visible.
 20-55 Ditto.
 21-00 Ditto.
 21-15 Ditto.
 24-00 Ditto.
- 19-03-00 Ditto.
 04-00 Ditto.
 05-00 Ditto.
 06-00 Ditto.
 18-00 Sky obscured by drift.

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19-20-00 Lower sky obscured by drift; bright moon shining. No aurora visible.

21-00 Ditto.

22-00 Sky almost completely clear. No aurora visible.

23-00 Ditto.

24-00 Ditto.

20-03-00. No aurora visible.

05-00 Ditto.

Sky obscured until the evening of the 21st

21-18-00 Sky practically clear. Bright moonlight. No aurora visible.

20-00 Ditto.

21-00 Ditto.

21-30 Ditto.

22-44 Ditto.

24-00 Sky partly clouded over. No aurora visible.

Clouds soon covered the sky and it remained overcast until the late morning of the 24th.

24-18-00 Sky nearly clear, but twilight and bright moonlight would obscure any but strong effects. No aurora visible.

19-50 Ditto.

20-45 Ditto.

21-00 Ditto.

21-40 Ditto.

22-20 Ditto.

22-55 The sky obscured by clouds.

The sky remained obscured until the evening of 25th inst.

25-18-00 Sky practically clear. No aurora visible.

18-20 Ditto.

19-15 Ditto. Moon rising.

19-35 Ditto.

20-32 Ditto.

21-33 Ditto. A thin cloud formation commencing.

21-48 Ditto.

22-07 Ditto.

22-35 Ditto. Cloud formation denser.

23-28 Ditto.

23-50 Ditto. Half the sky now obscured by cloud.

Sky overcast, clearing on the forenoon of the 29th.

29-17-40 No aurora visible. Sky clear except low in the N.

18-00 A strong glow on the horizon between N.E. and N.N.W.

19-55 A nebulous arch across the whole N. sky up to 9° above horizon.

20-15 Ditto up to 5°.

20-20 Waxing and waning.

20-40 The arch now 4° up, more steady.

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- 29-21-00 A glow on a cloud bank 4° up in the N.
 21-20 A nebulous glow 4° up, between N.E. and N. by E.
 22-05 No aurora visible.
 23-05 Ditto.
 23-34 Ditto.
 24-00 Ditto.

30-05-00 No aurora visible.

06-00 Ditto.

Sky obscured until the following morning.

May.

- 1-04-45 Sky now for the most part clear. A nebulous streak curving upwards from the N.N.W. towards the zenith, apparently a faded curtain.
 05-25 Two arches, one extending from N. to N.N.W. 12° up, and waxing and waning rapidly; the other fainter 15° up from N. to W.N.W.
 05-40 Faint remnants of the second arch still remain.
 06-00 No aurora visible. Dawn commencing.
 17-45 Sky clear. No aurora visible.
 17-58 Ditto.
 18-00 Ditto.
 18-15 Two very faint detached streamer curtains. One from E.N.E. near the horizon up to 60° towards the zenith; the other between N. and N.W. 6° up.
 18-30 An auroral haze arch 7° up in the N.
 18-40 An arch from the E.N.E. horizon to 10° up in N.
 18-50 Practically faded.
 19-12 No aurora to be seen.
 19-50 Streamers rising from the E.N.E. horizon.
 20-20 No aurora visible.
 21-15 A bright curtain 5° up between N. by W. and N.N.E., shows a reddish tinge below and a considerable flow of luminescence.
 21-20 Arch 7° up from W.N.W. to E., excitation travelling to the E. from W.
 21-31 A large bright sweeping curve of aurora in the N.E. sky and thence in a straighter direction to the W. Total extension from N. by W. to due E., the highest altitude 20° .
 21-35 Ditto, fainter.
 21-50 Nothing now remains but an auroral haze between N. by W. and N.N.E.
 21-56 A strong arch from W.N.W. to E., up to 3° .
 22-03 As at 21 h. 50 m.
 22-10 A faint arch 10° up between N. and E.
 22-23 Arch bright between N.E. and E.N.E., very faint between N. and N.E.
 23-15 No aurora visible.
 23-30 Ditto.
 23-45 Ditto.
 24-00 Ditto.
 2-00-30 Ditto.
 01-00 Ditto.

Sky became overcast clearing on the evening of the 5th.

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May.

- 5-17-30 No aurora visible.
- 18-00 A strong glow on clouds near the N.E. horizon.
- 19-34 No aurora visible.
- 20-15 A broad, bright, evenly illuminated nebulous arch, with a reddish lower border and faint streamers rising above; situated in the N. and reaching 6° in elevation.
- 20-20 The arch is extending and rising. A streamer curtain appears almost parallel but nearer the zenith, the tops of the streamers of which reach 40° above the horizon. Display concentrated in the N.E. Curtain slightly concave to the N.
- 20-25 Display has waned somewhat. Only a broad nebulous sheet from horizon to 8° up remains.
- 20-31 Curtain now of medium brightness centred in N. by E. Highest point 12° .
- 20-41 Waned, nebulous patches remaining between N. by W. and E.N.E. Maximum elevation, 6° .
- 21-10 A nebulous patch near horizon between N. and N. by E.
- 21-50 A glow 3° up from N. to N. by W.
- 22-15 A glow 4° up from N. to N. by E.
- 22-25 Ditto.
- 22-50 Glow 2° up in the N.N.W.
- 23-20 A very faint glow in N.E.
- 23-40 Ditto from N.E. to N.W.
- 24-00 Ditto in the N.

Sky now becomes obscured, clearing on the evening of the 9th.

- 9-18-00 Sky clear except for cloud around the N. horizon. No aurora visible.
- 18-15 Ditto.
- 19-30 A glow 5° up from N.N.E. to E.N.E.
- 19-57 An arch 10° up from N. to E.N.E.
- 20-15 No aurora visible.
- 21-10 Ditto.
- 21-27 Arch extending from N.N.W. to E.N.E., highest 14° up in N.N.E.
- 21-50 A curtain from 30° up in the N.N.W. to the S.E. horizon, reaching a maximum 50° up in the N.E. Fairly active, waxing and waning rapidly. Has risen considerably during the preceding few minutes.
- 22-17 A nebulous arch highest in the N.N.E. where it is 45° up.
- 22-30 Aurora for the most part faded. A patch 12° up in the N. remains.
- 22-55 Faint nebulous patches up to 10° between N. and N.E.
- 23-04 A fine circular curtain up to 45° in the N. sky, chiefly to the E. of N.
- 23-13 A curtain now up to 45° in the N., extending from W.N.W. near horizon to the E.S.E. horizon. This evening the curtains have all trended from N. of W. to S. of E.; and if there has been any swinging motion it has been in an anti-clockwise direction. The display has extended to the W. as the evening advanced.
- 23-30 A curtain trending E. and W. extending from 15° up in the W.N.W. to 15° up in the E.N.E., reaching 40° altitude in the N.
- 24-00 Two curtained arches 12° and 16° up in the N.E.
- 10-00-05 No aurora visible.
- 00-16 A faint arch 15° up in the N.W.
- 00-40 A very faint arch 18° up in the N.W.
- 01-15 No aurora visible.
- 02-15 A faint arch 10° up in the N.W.
- 03-25 An arch 10° up in the N.; another 15° up in the N.W.; two curtains 45° up. All very faint.

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10-04-00 Faint curtains. One from 10° up in the S.E. through the zenith to within 60° of the N.N.W. horizon; a second 7° up between E. and N.; another in the W. sky between points 40° and 60° up.

05-00 A faint glow 15° up in the E.N.E.

06-00 Sky hazy near the horizon. No aurora visible.

07-00 Ditto.

Sky becomes overcast, clearing on the afternoon of the 14th.

14-18-00 Sky almost clear. No aurora visible.

19-20 Ditto. Moon half-full.

20-30 Ditto.

21-30 Ditto.

22-45 Ditto.

Sky now overcast or obscured by drift until the afternoon of the 23rd.

23-18-00 Sky practically clear. No aurora visible.

18-25 Ditto.

19-30 Sky clear except for a gauzy cloud near the horizon between N. and E. No aurora visible. Moon three-quarter full.

20-35 Ditto.

21-00 Ditto.

21-30 Ditto.

22-45 Ditto.

23-45 Ditto.

24-00 Ditto.

24-03-00 Ditto.

06-00 Ditto.

24 7

18-00 No aurora visible. Sky practically clear.

18-30 Ditto.

20-15 Ditto.

22-45 Lower sky obscured by drift. No aurora visible.

23-39 A nebulous arch 12° up, from N.N.W. to N.N.E.

23-55 A faint nebula 10° up in the N.W.

24-00 No aurora visible.

25-01-15 No aurora visible.

02-45 Ditto.

04-00 Ditto.

05-00 Ditto.

06-00 Ditto.

16-30 Twilight sufficiently dark to see several stars. No aurora visible.

17-15 An auroral glow 5° up, from N.E. to N.W.

17-38 A patch 3° up, from N. by W. to N.N.E.

18-00 A nebulous band 3° up, from N. by W. to E.N.E.

18-23 A nebulous band 6° up, from N.E. to N.

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25-19-32 Hazy in the lower N. sky. No aurora visible.

20-07 Ditto.

20-45 Ditto.

21-00 Ditto.

21-50 Ditto.

22-42 Ditto.

22-49 A curtain 10° up from N.W. to N.E.

22-54 Ditto.

23-10 A faint, nebulous patch in the N.W.

23-24 No aurora visible. Sky clear; half-moon.

23-32 Ditto.

24-00 A band 10° up in the N.W.

26-00-03 A band with faint streamers 10° up in the N.W.

01-00 No aurora visible.

02-00 Ditto.

03-00 Ditto.

05-00 Ditto.

06-00 Ditto.

Clouds and drift obscure the sky until the afternoon of the 29th.

29-18-00 A faint glow over horizon between N.E. and N.N.W.

18-15 Clouds along the N. horizon. No aurora visible.

18-28 A glow on the horizon clouds, between E.N.E. and N. by E.

19-30 No aurora visible.

21-00 Ditto.

21-23 Ditto.

21-45 A dull band 5° up, from N. to N.E.

22-05 Ditto.

22-27 Ditto.

22-30 Ditto.

22-43 A faint glow on the N.E. horizon.

23-12 A nebulous band 3° up, between E.N.E. and N. by W., brightest in the N.N.E.

23-24 A sheet of nebulous aurora up to 15° between E. and N.N.E., tailing off low down on the N.N.W. horizon. Streamers rising in the E. a few minutes earlier.

23-37 The display appears to be now nearing the maximum. First there is a poorly defined curtain reaching a maximum elevation of 70° in the N.N.E. and from thence sweeping away to the N.W. and E.N.E. Below is a broad, bright, nebulous sheet 45° up of band-like form following the same outline. The whole a sweeping curve, concave to the N.E.

23-41 A great sheet of nebulous luminescence over the N. to E. quadrant, and somewhat to the W. of N. It has now just about risen to the zenith. The lines are tortuous. Strong, nebulous bands follow on faint curtains. Looked at from below the luminous nebula is seen to pass from W. to E. in cloud-like masses, resembling nothing so much as denser clouds of drift snow passing through a light drift-filled atmosphere.

23-48 Still in the zenith, but diminishing in point of brilliance.

23-53 Remains as last recorded.

23-58 Aurora considerably diminished. Faint nebulous matter in the zenith and 30° up in the N.W. Scattered curtain fragments also.

24-00 Display brighter. Two curtains from a point 5° up in the N.W.; one to the zenith and thence to the S.E., the other across to the E. at 30° up.

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- 30-00-06 Ditto waning. The travel of luminescence has been from W. to E.
 00-14 Now considerably less. A confused nebulous mass in the N.W.
 00-28 Two bands 10° and 15° up in the N.
 01-00 A long, nebulous band, 6° up, from W.N.W. to N.E.
 01-15 Ditto.
 02-00 No aurora visible.
 02-30 Ditto.
 03-00 Ditto.
 03-40 Faint indications of a curtain from the zenith to the horizon in the W.N.W., where it shows as a nebulous mass.
 04-06 Very faint band from 8° up, in the N.W., to 20° up in the N. by E.
 04-30 Two faint bands, one 10° , the other 15° , up in the N.W.
 04-45 One faint band, 10° up, in the N.W.
 05-30 An indication of a curtain in the zenith, trending N.W. to S.E.
 06-00 Bright moonlight. A faint curtain in the N.W. from 10° to 70° up; also a faint patch 20° up in the E.N.E.
 06-30 Faint streamers to the E. barely visible.
 07-05 Faint streamers in the W. up to the zenith. Daylight appearing in the E.
 18-00 Very faint streamers in the N. sky, above clouds, from 25° to 45° up.
 18-15 No aurora visible.
 19-10 Ditto.
 19-30 Ditto.
 19-45 Ditto.
 20-37 Ditto.
 20-45 A faint glow to the N.E.
 21-15 No aurora visible.
 21-35 A faint glow between 2° to 3° up, from N. to E.
 21-50 A bright glow from N. to E.
 22-20 A bright, broad, nebulous band from N. to E.N.E. up to 20° . Broad, blunt streamers are rising in part. This exhibition is of the same class as last evening.
 22-24 Waning.
 22-35 A straight, nebulous band, 14° up, from N. to N.E.
 22-47 A moderately bright band, 14° up, from N. to N.E.
 23-08 A faint auroral haze, 8° up, in the N.
 23-33 An auroral haze band, 5° up, from N. to N.N.E.
 24-00 Dull auroral haze and nebula, 6° up, from N. to N.N.E.
 31-01-00 A faint auroral glow, 3° up, in the N.N.E.
 02-30 A faint arch, 45° up, from N.W. to N.N.E.; some streamers at the W. extremity.
 02-45 An arch rising to 25° up, between N.E. and N.W.; and a curtain up to 30° in the N.W.
 03-00 A faint curtain passing through the zenith from N.W. to S.E., terminating in the S.E. at an altitude of 45° .
 04-10 A few very faint, nebulous patches around the zenith and to the S.E.
 04-25 A faint curtain from N.W. to W. in an oblique line reaching near the zenith.
 05-00 A few faint, nebulous bands passing through the zenith from N.W. to S.E.
 05-35 Isolated bands in the zenith and to the southward.
 06-00 Three bright curtains. One extending from the S.E. towards the N.W., terminating at the zenith; another from E.S.E. through E. to N. some 30° up; a third one intermediate between these two.

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- 1-06-10 A cluster of faint curtains forming a mass in the zenith, from which several curtains extend to the S.E. horizon; rippling movement well marked, no colour effects.
- 06-25 A few faint curtains remain, trending S.E. to N.W. through the zenith.
- 07-00 Very faint, nebulous patches in the N.W. and about the zenith.
- 16-47 No aurora visible.
- 17-00 Faint curtain from N.E. to N.W., 20° up; the N.W. end rising towards the zenith.
- 17-04 A faint band of auroral haze, apparently trending from the W.N.W. to E.S.E.; visible between W.N.W. and E.N.E., and reaching a maximum elevation of 40°.
- 17-18 No aurora visible.
- 17-31 Ditto.
- 17-48 A very tenuous band 20° up, between N.W. and N.E.
- 18-00 Light drift practically obscures the lower sky; no aurora visible.
- 18-24 Ditto.
- 19-00 Northern sky below 40° obscure; no aurora visible.
- 19-30 Ditto.
- 19-57 Ditto.
- 20-26 Ditto.
- 20-31 Ditto.
- 21-00 Ditto.
- 21-30 Ditto.
- 22-15 Ditto.
- 22-55 Ditto.
- 23-09 Ditto.
- 23-16 A faint curtain 45° up, from N. to N.E.
- 23-20 No aurora visible.

June.

Both during the morning and evening hours of the 1st inst. the sky was very much obscured by drift. Occasional observations of the zenith recorded no aurora.

- 2-01-00 A strong auroral display. A curtain from N.W. to N. reaching up to 45°. A band 10° up, from N. to E.
- 01-30 Part of a faint curtain near the zenith to the W.N.W. A nebulous patch near the E. horizon, and a glow on horizon cloud in the N.
- 02-07 Part of a faint curtain a little E. of the zenith. A glow on a cloud bank 3° above the N. horizon.
- 02-25 The glow remains in the N.
- 03-00 A glow above horizon clouds in the E.
- 03-30 Ditto.
- The sky now remained overcast until the evening.
- 18-00 Sky much obscured by drift and cloud near the N. horizon. An auroral glow on clouds 4° up, between E.N.E. and N. by W.
- 18-14 An auroral band, bright, 5° up from N.W. to N.E.
- 19-30 Aurora seen glowing through the drift 5° up and 10° up in the N.E.
- 20-22 Aurora glowing through the drift in the N.
- 21-00 A nebulous aurora 5° up, between N. and E.N.E.
- 21-30 An arch 6° up in the N.E.
- 22-00 A faint glow 5° up in the N. by E.
- 22-25 A bright arch 5° up, between N.E. and N. by W.
- 24-00 No aurora visible.

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June.

- 3-00-47 A long nebulous band 8° up in the N.E.
 02-09 A small nebulous patch 25° up in the N.
 03-18 Several faint nebulous bands in the sky E. of the zenith trending roughly S.E. to N.W.
 03-56 Ditto; especially in the N.E.
 04-30 Five dull curtains in the zenith and to the eastward, trending from the zenith slightly more to the W. than N.W.
 05-00 Several faint nebulous bands located as last recorded.
 05-37 A few nebulous patches and streaks in the zenith and elsewhere, directed roughly to the W.N.W.
 06-00 A long band 40° up, extending between E. and N. and trending roughly to the W.N.W. Also other minor fragments in the sky.
 07-12 Nebulous streaks and patches in the zenith and elsewhere, trending about W.N.W.
 07-48 Twilight suffuses the sky. No aurora visible.
 08-00 Ditto.
- 17-00 Aurora glowing through the drift, 5° up, between N. and N.E.
 18-00 Ditto, between N. and E., strongest in the E. by N.
 20-15 Glow 5° up in the N. to N.E.
 20-25 Glow 5° up in N.E.
 21-00 No aurora visible, horizon obscured by drift.
 22-09 Ditto.
 22-25 Ditto.
 22-45 Ditto.
 23-07 Ditto.
 23-34 Ditto.
 23-43 Glow above clouds 25° up between N. and N.E.
 24-00 No aurora visible.
- 4-00-50 A very bright band 15° up, from N.W. to N.E.
 01-15 Aurora showing through the clouds in the N.
 03-00 No aurora visible.
 05-00 A faint curtain 60° up, trending E. and W. Small faint detached curtains in the zenith.
 05-30 No aurora visible, but much drift and cloud.
 06-00 All the lower sky obscured excepting near the zenith. No aurora visible.
 06-29 Auroral curtains extending from N.W. to N.E. about 50° up. Also a bright glow all along the N. horizon, a maximum in the N.N.E.
- Sky now overcast until the morning of the 5th.
- 5-02-00 Sky now clearing; clear in the S. No aurora visible.
 02-45 Clouds now only to 15° above the N. horizon. No aurora visible.
 04-00 A faint glow from behind clouds 10° up in the N. Also a very faint arch in the zenith, trending N.N.W. to S.S.E.
 04-35 A very faint arch from the zenith to the S.S.E. horizon.
 05-10 A glow behind clouds up to 20° up between N. and E.
 05-40 Sky hazy with thin cloud. A glow low in the E.
 06-00 Sky hazy. No aurora visible.
 06-50 Detached curtains in the zenith, others to the N.W.; all faint.
 07-30 Dawn appearing; sky hazy. No aurora visible.

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- 5-17-20 Sky clear. No aurora visible.
- 17-43 Ditto.
- 18-00 Ditto.
- 18-30 Ditto.
- 19-30 A curtain of weak intensity rising from the E. horizon, traceable across the whole sky, trending W.N.W. to E.S.E.; reaches a maximum elevation of 35°. Towards the W. it becomes gradually fainter, passing into the state of an auroral haze. Also another haze arch 15° up in the N.E.
- 19-38 The main arch somewhat brighter, especially in the E.
- 19-49 The main arch remains, maximum elevation 14°. From the E. to the N. it is nebulous, further W. only of haze intensity.
- 19-53 A second arch fragment now appears in the E. above the former.
- 20-10 A main arch as before 15° up; also a short fragment up to 45° in the E. The luminescence is gradually extending to the W.
- 20-25 The main band remains.
- 20-35 The band as before is faintly outlined across the whole sky in auroral haze, with nebulous patches in the N. and E.N.E.
- 20-45 The band remains, nebulous between N.W. and E.N.E.
- 21-00 The band still remains.
- 21-12 The phenomenon has now practically gone; there is but the merest trace in the W. outlined by auroral haze.
- 21-23 A faint auroral haze 12° up from N. to N.N.W.
- 21-35 A haze arch can now be traced across the whole sky, trending about W.N.W. and E.S.E., maximum height 35°. These haze formations are exceedingly tenuous, much less distinct than the Milky Way. They would pass unobserved except in a most critical examination.
- 21-44 Ditto. The sky appears darker below it.
- 21-58 An extremely faint trace now remains between N. and N.W. The whole sky is becoming distinctly darker.
- 22-11 Practically no trace of auroral phenomena.
- 22-35 No aurora visible. A little light snowdrift in the air perhaps impairs the view.
- 22-52 A very faint nebulous band from N. to W.N.W., highest 12° up in the N.
- 23-06 A very faint nebulous arch, trending about W.N.W. to E.S.E. across the sky, with a maximum elevation of 20° up.
- 23-20 A moderately bright nebulous band, with occasional streamers from N. to N.W., highest 15°. Excitation travelling to the E.
- 23-34 A continuous faint arch across the sky, highest 12° up. Trending about W.N.W. to E.S.E.
- 23-44 Ditto.
- 24-00 Ditto.
- 6-00-25 Ditto. Brightest in the N.N.E.
- 02-00 No aurora visible.
- 03-15 A faint band E. to N.E., 15° up.
- 04-00 A faint curtain low in the S.E., and faint nebulous bands in the zenith passing to the N.W.
- 05-30 A few nebulous patches in the W.N.W. at an altitude of 35°.
- 06-00 No aurora visible.
- 07-00 A few streaks in zenith trending N.W. to S.E.
- 16-35 Very faint twilight only; sky covered with gauzy cloud. No aurora visible.
- 16-43 A moderately bright nebulous band across the whole N. sky, trending about E. and W., reaching from the W.N.W. horizon to the E.N.E. horizon, maximum elevation 25°.
- 16-48 Now there two parallel bands with part of a third; maximum elevation 35°.
- 17-03 Only one faint band remains; maximum elevation 25°.

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- 6-17-32 The arch remains, but is very faint even in the E., where it is brightest; to the W. it is nothing more than a haze.
- 17-40 A faint arch 15° up, between E.N.E. and W.N.W.
- 17-43 Practically no aurora left; just the merest haze of arch not readily seen.
- 18-00 The merest trace of auroral haze band detectable 10° up in the N., in the form of an arc. This is so faint that it would ordinarily escape notice.
- 18-15 A very faint arch, 10° maximum elevation from N.E. to W. by N. The trend appears to be about E.N.E. to W.S.W.
- 18-30 An arch from E.N.E. to N.W., brightest at the E. end.
- 19-00 An arch from the W.N.W. to E.N.E. horizons, 10° up in the centre, brightest in the E.
- 19-15 Ditto, becoming somewhat brighter at the W. end.
- 19-30 Arc remains, slightly lower, 8°. Now very bright from the N.E. to the E.N.E. horizon.
- 19-45 Arch 6° up; a nebulous patch 15° up in the E.N.E.
- 20-02 A continuous dull arc about 6° up.
- 20-24 An arch from E.N.E. to W.N.W. horizons; moderately bright between N.N.W. and E.N.E.; scarcely visible towards its western extremity. 12° in elevation.
- 21-00 Aurora as at 20 h. 24 m.
- 21-25 A dull arch from N. to E.N.E., 6° up; brighter in the E.N.E.
- 21-40 Ditto, with a large nebulous mass at the E.N.E. extremity.
- 22-00 Ditto, the band becoming broader.
- 22-09 The eastern half of an arch showing, from the E. horizon to 20° up in the N.; brighter towards the E.
- 22-20 Part of a nebulous arch visible; brightest in the N.N.E., where a few streamers are rising.
- 22-42 A moderately bright, nebulous mass centred 25° up, between N.N.E. and N.N.W., faint streamers rising above it; the tops of some rising from the highest portions reach 45°. The whole phenomenon is behind an isolated mass of alto-stratus cloud, and so closely follows it that the cloud, it would appear, has a controlling influence on the aurora.
- 22-55 Two nebulous bands in the N. sky reaching 30° up, extending from the W.N.W. to E. horizon; brightest in the N.E.
- 23-10 The display is contracting to the W.; it is now faded out in the E., and brightest in the N.
- 23-24 A curtain 15° up from N.N.W. to E.; faint towards the E. end.
- 23-50 Aurora nearly gone; a trace of nebula between N.W. and W.N.W.
- 24-00 Atmosphere foggy; no aurora visible.
- 7-00-50 Patches of very faint aurora in the S., S.E., and zenith.
- 01-40 No aurora visible.
- 02-30 Ditto.
- 03-00 Ditto; cloud bank low on the N. horizon.
- 03-30 A fragment of a very faint arch 15° up in the N.W.
- 05-30 A very faint arch 30° up dipping to the E. horizon.
- 06-00 A streak 30° up in the W.N.W.
- 07-30 No aurora visible.
- 16-10 Daylight sunset tints sinking in the N.W.; only very strong auroral effects would be visible. No aurora seen.
- 16-33 No aurora visible.
- 16-47 Ditto.
- 17-02 Now quite dark; no aurora visible, except perhaps a trace of a haze arch near the E. horizon
- 17-26 An even, nebulous haze arch from the E. horizon, gradually fading towards the W.; auroral nebula from the E. to N.N.E.; auroral haze from N.N.E. to N., becoming invisible further to the W.

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- 7-17-53 An arch now visible to the N. by W.
 18-00 An nebulous arch from E. to W. horizons, 10° up in the N.; brighter at the E. end.
 18-18 Arch as at 17 h. 26 m.
 18-29 No aurora visible; moderate drift somewhat obscures the view.
 19-05 Arch now visible, between E. and N.N.E. The max. elevation, were the arch completed, would be about 35° .
 19-20 A haze arch right across the N. sky, largely obscured by drift.
 19-52 No aurora now visible.
 20-12 Ditto.
 20-47 An arch in the original position from E.N.E. as far as N.
 21-20 No aurora visible.
 21-25 Drift somewhat obscures the N. horizon; no aurora visible.
 21-50 Ditto.
 22-15 Ditto.
 22-45 Ditto.
 23-15 Ditto.
 24-00 Ditto.
- 8-01-00 No aurora visible.
 02-00 Ditto.
 03-00 A fragment of a band 5° up in the N.W.
 03-30 Two small faint arches 45° up in the N.E.
 04-00 A very faint band 45° up from N. to E.
 04-30 No aurora visible.
 05-00 A very faint band from near the N.W. horizon to the S.E. horizon, passing a little to the N. of the zenith.
 05-30 No aurora visible.
 06-00 A faint auroral band trending N.W. and S.E., passing through the zenith to 45° towards the horizon on each side.
 06-40 A nebulous patch 5° up from the horizon in the N.W., from which a very faint, nebulous band stretches in the E.S.E. horizon, reaching a maximum altitude of 45° .
- During the late afternoon and evening the sky became densely clouded over, and though clear in the zenith for part of the time no aurora was noted. At midnight the cloud had retreated to near the N. horizon, but still no aurora visible.
- 9-00-40 A nebulous band between E. and N., 5° up.
 01-00 A faint nebulous aurora 7° up in the N.E.
 02-00 No aurora visible.
 03-00 Ditto.
 04-00 A faint curtain extending from a point 30° up in the N.W. to 70° up in the S.E.; highest point 75° in the N.E.
 05-00 Two parallel faint curtains 2° apart, extending from a point 10° up in the S.E. to 90° up in the N.W.; also a faint patch 60° up in the E.N.E. sky.
 06-00 Two curtains extending from 10° up in the E.S.E. to 30° up in the W.N.W.; also several short fragments to within 45° of the zenith.
 07-00 Three auroral curtains extending from a point 15° up in the E. by S. to 25° up in the W. by N. Three short fragments also within 45° of the zenith on both sides.
 08-00 Dawn appears; stars still visible. No aurora seen.
 15-50 Sky free from cloud, except 15° up from the N. horizon. No aurora visible.

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9-16-20 No aurora visible.

16-45 Ditto.

Sky now overcast until late in the evening.

22-45 Sky now clear to within 6° of the N. horizon. A nebulous band 8° up in the N. between N.N.E. and N.N.W.

23-43 A nebulous band behind bars of cloud, between N. and N.E., 15° up.

24-00 A faint glow on cloud 15° up in the N.N.W.

10-00-38 No aurora visible.

01-38 Ditto.

Sky now becomes overcast, clearing on the morning of the 11th.

11-04-10 Sky becoming clearer; a faint glow 30° up in the N.W.

04-30 No aurora visible.

05-00 Sky obscured by drift below 10° up; a faint glow 10° up in the N.E. and E. by S.

06-00 Sky obscured below 6° up in the N. ; very faint broken curtains in the zenith; trending N.W. and S.E.

07-00 Ditto.

08-00 Clouds up to 16° in the N. ; no aurora visible.

16 09 Sunset tints still visible ; no aurora to be seen; moon, almost a half-full, helps to obscure auroral effects.

17-00 No aurora visible. Sky clear.

17-40 Ditto.

18-00 Ditto.

18-33 Ditto.

19-20 Ditto.

19-45 Ditto.

20-12 A very faint arch 10° up from N. to N.E.

20-52 No aurora visible.

21-05 A faint arch 8° up between N.E. and N.

21-45 No aurora visible.

22-07 An auroral glow behind the clouds on the N. by E. horizon.

22-30 A nebulous arch from the N.N.W. horizon to a point 12° up in the N.N.E.

22-54 A bright curtain with a tinge of red below extending from W.N.W. to E.N.E. ; brightest towards the W. end.

23-10 The curtain has waned somewhat, now 18° up.

23-25 A fragment of an arch, 8° up between N.N.W. and N.E.

23-53 An auroral display between N.W. and N.E., near the horizon; partly obscured by cloud.

24-00 An auroral arch largely hidden by a cloud bank ; N.W. and E.N.E. extremities visible near the horizon.

12-00-30 A faint band 10° up in the N.E.

01-00 No aurora visible.

02-30 Ditto.

03-00 Ditto.

03-40 Ditto.

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- 12-04-00 A faint, nebulous arch 10° up, N. to N.E.
 05-00 A faint curtain 40° up from E. through N. to N.N.W.; also a faint curtain reaching from low in the N.W. to near the zenith.
 05-25 The faint curtain from the N.W. still persists, extending in curving bands to the zenith.
 06-00 A faint curtain from the N.W. passing through the zenith towards the S.E.; low in the E.S.E. is a fragment of another curtain.
- 16-02 Cloud on the N. horizon up to 15° altitude; no aurora visible.
 16-35 Cloud 10° up in the N.; moon half-full. No aurora visible.
 17-00 Ditto.
 17-30 A faint glow on a cloud near the N.N.E. horizon.
 18-00 Light drift somewhat veils the northern horizon; no aurora visible.
 19-22 Ditto.
 19-30 Ditto.
 19-40 Ditto.
 20-26 Bright moon; cloud along the north horizon; no aurora visible.
 21-05 Ditto.
 21-35 Cloud spreading from the north; no aurora visible.
 20-00 Half the sky clouded over; no aurora visible.
 22-30 Ditto.
 23-00 Ditto.
 23-30 Ditto.
 24-00 Sky clearing; no aurora visible.
- 13-00-25 Sky clear except near the E. horizon. No aurora visible.
 01-00 Ditto.
 01-55 A faint arch in the N. between 10° and 30° up, trending N. and S.
 02-30 No aurora visible; sky clear.
 03-00 Ditto.
 04-30 Ditto.
 05-30 Ditto.
 06-00 Ditto.
 06-30 Two faint fragmental arches from 10° to 50° up in the W.N.W.
 07-04 No aurora visible.
 07-34 Ditto.
- Sky now overcast until the evening of the 14th.
- 14-16-30 Clouds obscuring sky for 25° above the N.E. horizon; moonlight. No aurora visible.
 17-17 Ditto.
 18-00 Ditto.
 20-00 Ditto.
 21-00 Ditto.
 21-10 Ditto.
 21-30 Ditto.
 22-10 Ditto.
 23-00 Ditto.
 24-00 Ditto.

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- 15-01-00 Sky clear, hazy on the N. horizon. No aurora visible.
 02-00 Ditto.
 03-00 Ditto.
 04-00 Ditto.
 05-25 The moon now set; faint, short broken bands from the zenith to within 25° of the N.W. horizon.
 06-00 A faint broken curtain from the zenith to within 30° of the W.N.W. horizon; also a few short streamers in the N.E. sky about 50° up.
 07-20 A faint broken curtain extending from the zenith to 40° in the W.N.W.
 08-00 Dawn appearing. No aurora visible.
- 16-45 Sky clear; bright moonlight. No aurora visible.
 17-00 Ditto.
 17-20 Ditto.
 17-40 Ditto.
 18-00 Ditto.
 18-30 Ditto.
- 15-19-25 A faint nebulous band 15° up, from N. to E.N.E.
 20-08 No aurora visible.
 20-33 Ditto.
 21-00 Ditto.
 21-30 Ditto.
 22-00 Ditto.
 22-15 Ditto.
 22-45 Ditto.
 23-17 Ditto.
 24-00 Ditto.
- 16-01-30 Ditto.
 03-00 Ditto.
 06-00 Ditto.

Sky now obscured until the evening of the 17th.

- 17-17-40 Cloud low on the N. horizon; bright moonlight. No aurora visible.
 18-00 Ditto.
 18-20 Ditto.
 19-00 Ditto.
 19-15 Ditto.
 19-45 Ditto.
 20-45 Ditto.
 21-00 Ditto.
 21-45 Cloud near the N. horizon. No aurora visible.
 22-30 Ditto.
 23-00 Ditto.
 24-00 Cloud now considerable. No aurora visible.

Sky overcast until 5 h. on the 18th inst.

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- 18-05-00 Considerable cloud. No aurora visible.
 06-00 Ditto.
 07-00 Ditto.
 08-00 Ditto.
 16-40 Ditto.
 16-50 Ditto.
 17-15 Ditto.
 18-00 Cloud to 45° in the N. moonlight. No aurora visible.
 18-25 Ditto. The sky becomes almost completely overcast until near midnight.
 24-00 Cloud low in the W. only. No aurora visible.
- 19-01-00 Ditto.
 02-00 Cloud low in the N. No aurora visible.
 03-00 Ditto. Sky obscured until the evening.
 17-00 Sky quite clear. No aurora visible.
 17-30 Ditto.
 18-00 Ditto. Bright moonlight.
 18-20 Ditto.
 19-15 Ditto.
 20-05 Ditto.
 21-00 Ditto.
 21-37 Ditto.
 22-00 Ditto.
 22-30 A nebulous band 8° up, between N. and N.N.E.
 23-04 A very brilliant curtain reaching as high as the zenith; curved in outline, with the main body trending towards the E.; the body of the display centred in the N. to N.W.
 23-16 A very great exhibition near the zenith. The main band 70° up, showing colours; and a swirling motion along it.
 23-22 Rapidly waning just now.
 23-25 All that is now visible is a comparatively faint remnant of the original main curtain, now low in the W.N.W.

This display has been brilliant, notwithstanding the light of an almost full moon. Good colour effects and much motion have been a feature of it. A very rapid, clearly defined translational movement of the streamers (flickering) has been marked; the most rapid rate cannot have exceeded about an angular distance of 45°, as seen from the observer along the arch—in one second the arch being at an elevation of 70°. The dominant movement has been to the E.; in other cases a movement to the W. in places where the band was curved in that direction—actually the direction of motion appeared not to change from that of a travel from the W. end of the curtain to the E. end. However, in a few cases there appeared to be a definite back surge to the W. over a limited length.

The display appeared in one dominant curtain, with some minor parallel fragments. The main curtain commenced much contorted in the N. and N.W., but extended in a more direct line further to the E. and W.; it straightened out as the display progressed, but at all stages showed minor bends. The general trend of the main curtain when it straightened out was about W.N.W. to E.S.E. The maximum elevation noted in the case of the main band was 75°, though at 23 h. 4 m. a recurved portion touched the zenith. The maximum may have occurred before 23 h. 4 m. and been unobserved; if after that time, 23 h. 16 m. was probably the maximum, though two other bright intervals occurred between 23 h. 4 m. and 23 h. 16 m. At one period the display crossed the face of the moon, which, during all the evening, had been showing a faint corona. As the broad auroral band came up into the glare of the moonlight, it faded out, reappearing again at an equal distance on the other side. No coronal effect whatever was produced by the aurora.

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- 19-23-38 A faint nebulous band 8° up, between W.N.W. and N.W.
- 24-00 No aurora visible.
- 20-00-33 An irregular bright arch from the W. horizon to the N.E. horizon; reddish tint below. Remained stationary for some time, waxing and waning slightly at intervals. Maximum elevation 12°.
- 01-00 The arch much fainter and broken. Patchy in the N.W., becoming more prominent towards the E.
- 01-30 No aurora visible. Clear sky; bright moonlight.
- 02-00 No aurora visible.
- 02-30 Ditto.
- 03-00 Ditto.
- 03-30 Ditto.
- 04-00 Ditto.
- 04-30 Ditto.
- 05-00 Ditto.
- 05-30 Ditto.
- 06-00 Ditto.
- 08-00 Ditto.
- 15-45 Twilight in the N.W.; many stars visible. No aurora visible.
- 16-20 Sky quite clear and dark. No aurora visible.
- 16-48 Low in the east; a faint cloud, which may be a nebulous aurora.
- 17-12 The same cloud patch low in the E.N.E., and the same doubt as to whether it is auroral or merely a cirrus cloud seen in the moonlight.
- 17-45 What appears to be a large body of auroral nebula in the zenith and E. and W. of it. Part of it cut by parallel bars trending N.E. by N. Is it cirrus cloud?
- 17-51 A gauzy mackerel cirrus in the zenith, where the appearance of auroral nebula showed a few moments ago. Also three small nebulous patches to the N. 20° up; these latter look more like auroral nebula than cloud nebula.
- 18-20 A faint auroral glow 20° up, between N. by W. and N. by E.
- 18-29 Faint patches of nebula low in the N.; probably cirrus cloud.
- 19-30 No aurora visible.
- 20-00 Ditto.
- 20-35 Ditto.
- 21-00 Ditto.
- 21-35 Ditto.
- 22-00 Ditto.
- 22-30 Ditto.
- 23-05 A nebulous auroral band 10° up, N.N.W. to E.N.E.
- 23-15 The band now 15° up.
- 23-30 No aurora visible.
- 24-00 Ditto.
- 21-01-00 Ditto.
- 02-00 Ditto.
- 03-00 Cloud rising from the N. No aurora visible.
- Sky now overcast with cloud until morning.
- 15-40 Low cloud from the N.E. round to W. No aurora visible.

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- 21-16-15 Dark now, except for very faint twilight on N.W. to W.N.W. horizon. No aurora visible.
 16-40 Now quite dark. A haze bar 20° up between N.W. and W.N.W.; apparently auroral.
 17-05 Moon now appearing. No aurora visible.
 17-25 Ditto.
 18-00 Ditto.
 18-30 Hazy cirrus cloud forming in patches over most of the sky. No aurora visible.

Sky remained overcast until 22 h. on the 23rd.

- 23-22-13 A fairly active arch up to 35° , from W.N.W. to E.N.E. View obscured by drift. The lower northern sky obscured by cloud.
 22-30 A faint nebulous arch 20° up.
 23-00 No aurora visible.
 24-00 Northern half of the sky now covered by cloud.

- 24-01-15 Most of the northern half of the sky covered by cloud. Moonlight. No aurora visible.
 02-30 Ditto.
 03-00 Ditto.
 04-15 Ditto.
 05-00 Cloud decreasing. No aurora visible.
 06-00 Cloud low in the north. No aurora visible.
 07-20 Ditto.
 08-00 Ditto.
 16-00 Sky hazy on the horizon. Dense drift. No aurora visible.
 17-00 Ditto.
 17-05 During a lull in the drift a faint streamer seen up to 25° in the E.N.E.
 18-00 Lower sky obscured by drift. No aurora visible.
 18-10 Ditto.
 18-30 Ditto.
 18-45 Ditto.
 20-30 Sky mostly overcast. No aurora visible.

Sky now obscured by cloud and drift until the evening of the 25th.

- 25-19-45 Sky obscured below 10° along the N. horizon. No aurora visible.
 21-00 Ditto.
 21-14 Sky clear. A band 5° up in the N.E.
 21-35 A band from 2° up in the E.N.E. to 5° up in the N. by W.; moderately bright.
 22-02 A faint nebulous arch 7° up, from N.W. to N.E.
 22-28 A faint nebulous arch 9° up, from W.N.W. to E.N.E.
 22-50 An auroral arch, from due east through N. to N. by W., 5° up; faint.
 23-15 A faint nebulous band, reaching as high as 35° .
 23-40 A faint nebulous arch 40° up from N.W. to E. The moon just rising in the N.E. by E.
 24-00 A nebulous arch, from E. to W.N.W.; very faint in the W.; curved and bright in the E.N.E. Maximum height 45° .
 26-00-30 A nebulous band from W.N.W. to E.; tops of streamers reaching 50° in elevation. Moderately bright in the E.
 01-00 A faint nebulous patch 5° up in the W.N.W.

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26-01-30 No aurora visible.

02-00 Ditto.

02-30 Ditto.

Sky obscured until the afternoon.

15-54 About a third of the sky covered with light cloud. No aurora visible.

16-00 Ditto.

16-20 Ditto.

17-00 Sky somewhat clearer. An auroral haze band along the upper limit of a cloud, about 40° up in the N.; trend about E. and W.

17-05 The haze band has brightened in patches until it appears as a faint nebula, especially in the N.N.W. and at the E. end. It is a very quiet type of aurora, and its distribution makes it appear to be associated with cloud patches.

17-42 An auroral curtain in the E.; appears to be moving in a northerly direction.

17-45 The display in the E. is waning; remains as a nebulous bar 20° up between N. and N.E. Also a faint curtain just commencing, extending from a point 20° up in the S.E. to 20° up in the W.S.W., and reaching a maximum elevation of 60° in the S.17-52 An auroral haze band, 45° up in the S., trending E. and W.18-00 Several faint haze arches across the sky. One most distinct is 45° up in the S., the western half only visible. Another is 30° up in the N.; all of it visible. Fragments of another are seen near the zenith. They very clearly converge to the W. by S. horizon.18-20 A broad haze arch 35° up in the N. The whole sky is now clearer and more stars to be seen.

19-30 No aurora now visible, but light drift prevents the observation of the most delicate effects.

19-50 Ditto.

20-20 Ditto.

21-00 Ditto.

21-22 Becoming overcast. No aurora visible.

Sky becomes completely overcast, remaining so for some hours.

27-04-00 Cloud from the N. horizon for a height of 30° . No aurora visible.

05-00 Ditto.

06-00 Ditto.

07-00 Ditto.

Sky now overcast until the afternoon of the 29th.

29-15-00 Most of the N. sky clouded over. No aurora visible.

16-00 Ditto.

17-00 Cloud now between the N. horizon and 30° up. Faint streamers of a detached curtain extending from the horizon to a point 70° up towards the zenith.18-00 Cloud low in the N. A faint auroral curtain across the sky from the horizon in the N.E. to the horizon in the W.S.W., rising to an altitude of 75° .

18-10 An extremely faint detached curtain, segmental in shape, almost reaching to the zenith, so faint as to be seen only by looking sideways at it.

18-30 Auroral haze patches and odd faint streamers in several places in the sky, notably in the N.W., 60° up, and in the S.E. The latter is part of a high arch across the southern sky from S.E. to S.W. up to 40° up; very faint streamers rising from it at the S.E. end.

19-10 A faint curtain from the S.S.W. curving towards the zenith, then away to the N.E.; also other patches near by. The general trend is somewhat to the S. of W.S.W. to E.N.E.

19-25 A faint curtain from the horizon in the S.W. to somewhat S. of the zenith. Another portion with the same trend in the N.E.

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- 29-19-55 The N. horizon obscured up to 25°. No aurora visible.
- 20-34 A glow behind cloud low in the N.E.; evidently aurora.
- 21-10 Ditto.
- 21-48 No aurora visible.
- 22-27 Cloud increasing somewhat. A faint glow through cloud 10° up in the N. to N.E.
- 22-43 A nebulous bar 10° up in the W.N.W., and another fragment at the same altitude in the N.
- 23-07 No aurora visible.
- 23-43 A faint, somewhat broken curtain from the S. horizon, round by E., to N. horizon. Also a fragment 20° up in the N.N.W. Rises to a maximum in E., reaching 35° altitude. Brightest in the E.S.E. 30° up, where some faint and long streamers. The general trend would be almost N. and S.
- 24-00 The N. and S. trending haze arch remains, now terminating on the N. horizon in a faint nebulous patch, and visible southward as far as a point 40° up in the E. Another nebulous patch on the N.N.W. horizon.
- 30-01-20 A very faint nebulous patch 4° in the N.N.W.
- 02-00 A broken curtain extending between N.E. and N.W. and reaching 5° up. A rippling movement marked from W. to E.
- 02-30 A faint arch from N.E. to N.N.W.; maximum altitude 4°.
- 02-45 A faint arch still persists.
- 03-15 A very faint nebulous patch in the N.E.
- 03-50 Two bright curtains. One at 30° altitude between due E. and N.; the other passing closer to the zenith with the same limits. An active rippling movement seen.
- 04-00 The aurora almost disappeared; a hazy glow in the N.E. and several hazy patches near the zenith.
- 04-35 No aurora visible.
- 05-00 A faint curtain 8° up in the N.E.; also a few nebulous patches around the zenith trending N.E. to S.W.
- 05-30 A faint detached curtain 30° up in the N.
- 06-00 A fine display of curtains from the S.E. to N.W., some passing through the zenith; others filling the whole N.E. sky with curving lines of curtains.
- 06-15 Two bright curtains curving up to a point a little to the N.E. of the zenith, from which point on the luminescence becomes feeble, hardly visible in the N.E., E., and S.E.
- 06-30 A single bright curtain from the N.W. to point a little S.W. of the zenith; also several indistinct curtains to the N.E. of the zenith.
- 06-50 A few faint detached curtains in the N.W. sky trending roughly towards the zenith; also faint detached curtains 30° up in the N.E.
- 07-20 Faint curtains scattered in the N.W. sky. One faint continuous one 30° up, extending from N.N.W. to E.S.E.; also some nebulous patches around the zenith.
- 07-50 No aurora visible; dawn in the N.E.
- 15-30 Drift fairly dense; no aurora visible.
- 16-22 A faint nebulous band from 60° up in the W.N.W. to 30° up in the E. by N.
- 17-30 Lower sky obscured by drift; no aurora visible.
- 18-00 No aurora visible.
- 18-47 An arch from N.E. to N.N.W., at an altitude of 8°.
- 19-14 A bright nebulous band from the E. by N. horizon to 4° up in the N.N.W. Brightest in the E., where it is from 4° to 10° up. A few faint streamers showing above the band in the N.E.
- 20-50 A bright band 30° up in the N. to the N.E. horizon, curved concave to the N.
- 21-03 A bright nebulous band from N.N.E. to E., maximum elevation 35°.
- 21-25 A bright nebulous band extending from 20° up in the E.N.E. to 30° up in the N.; confused in the N. by E., where reaches altitude of 40°.

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- 30-21-30 A nebulous band N. by E. to N.E., 20° up.
 21-36 A nebulous band 40° up between N. and E.N.E.
 22-00 A moderately bright nebulous band with several streamers rising, extending N. to N.N.E., rising to altitude of 35°.
 22-43 A very faint nebulous band 15° up, between N. and N.E.
 23-45 A very faint nebulous band 20° up, from N. to N.N.E.
 24-00 An extremely faint band 20° up, from N. to N.N.E.

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- 1-00-30 A dull arch 30° up, from W.N.W. to E.N.E.; most bright at the western end.
 01-05 An unusually clear star-lit night. Several faint curtains and nebulous bands from W.N.W. to E.; the highest 20° up. An auroral haze over all the northern sky.
 01-20 A long, moderately bright band 20° up, extending from N. by E. to E.; trend appears to be about N.W. to S.E.; also other fragments in the E. and N. sky. There is an auroral haze over most of the lower sky in the E.; some of this extends down to the ice-barrier horizon in the S.E. to E.S.E.; this is distinctly noticeable by comparison with other parts of the plateau horizon. A westerly wind blowing.
 01-46 The northern end of the long band still remains, but is now very faint.
 02-00 An auroral band from E. to N. 10° up, faint.
 02-40 An auroral band 20° up from N.N.E. to E.N.E.; also a lower fainter band and fragments in the N. and E.S.E. The trend appears to be about W.N.W. to E.S.E.
 03-00 An auroral band from the W.N.W. horizon through N. to E., highest point 15° up; trend approx. N.W. to S.E.; also another fragment lower down in the E. sky.
 03-30 As at 3 h., but faded somewhat.
 04-05 A nebulous patch just E. of the zenith; also other nebulous fragments of curtain in a rough N.W. to S.E. direction, in the lower sky between E. and N.W.
 04-30 A number of parallel nebulous bars in the zenith and to the E., all more or less broken; none very bright; trend about E.S.E. to W.N.W.
 05-00 A bright curtain, for the most part even nebulous, from the W.N.W. to E.S.E.; greatest elevation 60°; also scraps of others, especially in the E.N.E. The luminosity seen to be slowly travelling along the band to the E., but shows no flickering.
 05-10 Now very bright, trending W.N.W. to E.S.E. The main curtain is now 70° up. Streamers seen distinctly rippling from E. to W., noted for several minutes together. A part of a parallel curtain over the zenith. Two other parallel ones lower in the N.E. This appears to be about the maximum period of the display.
 05-20 Auroral bands now comparatively faint and somewhat lower.
 06-00 An auroral exhibition of about six faint bands; the main one about 40° up in the N.N.E.
 06-29 A main band from the W. by N. horizon to the E. by S. with a maximum elevation of 60°; also three other concentric bands extending over portions of the sky lower in the E.N.E. All are faint and nebulous.
 06-55 Faint nebulous bands trending W. by N. to E. by S. The main one is 30° up in N.N.E. Fragments of others higher and fainter to the zenith. Another lower. Some streamers near the W. horizon.
 07-12 Four parallel moderately bright curtains lying between the zenith and the N. horizon; stretching from 45° up in the E. to the W. and W. by N. horizon. They are all fragmentary. The trend from the E. to the zenith is in an E. and W. direction, further to the W. it runs to the W. by N. Also a patch 30° up in the W. by S.
 07-29 Two nebulous bands rising from near the W. by N. horizon, reaching to near the zenith; trend W. by S. to E. by S. Dawn appearing in the E.N.E.
 07-50 Patches of nebulous aurora in the zenith and towards the W. by N.
 08-05 Sunrise tints in the N.E. A very faint nebulous auroral streak trending W. by N. to E. by S., in the W. by N. sky between 30° and 60° up.

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1-08-25 No aurora now visible.

Sky now overcast until the morning of the 3rd.

3-03-35 Sky now clear down to the altitude of 40° . An auroral band 70° up from E. to N. by E.; trend S.E. to N.W.

04-00 Cloud as at 3 h. 35 m. No aurora visible.

04-30 Ditto.

05-00 Ditto.

06-00 Cloud as at 3 h. 35 m. Two short auroral bands; one 70° up from E. to N. by E., the other between 45° and 70° in the W.N.W. Both trend about W.N.W. to E.S.E.

07-00 Cloud as previously. No aurora visible.

18-00 Cloud low on the N. horizon. Auroral glow along the cloud edge, strongest in the N.E. and N.W. fainter between.

19-39 A bright curtain from E. to W.N.W. at an elevation of 2° .

20-00 An even bright arch 25° up, between N.W. and E.N.E.; trend probably W.N.W. to E.S.E.

20-18 Ditto, somewhat fainter.

21-00 The arch remains, 9° up, very faint.

21-35 Ditto, 10° up, very faint.

22-00 A faint nebulous band 20° up, from N. to E.

22-37 A bright band with some streamers, 35° up, between N. by W. and N.E.

22-50 Band now further to the E., fainter, and 45° up.

23-20 A faint band, 30° up, between N.N.E. and E.N.E.

23-40 A moderate bright band 15° up, between N.E. and E.

24-00 No aurora visible.

4-00-30 Lower sky obscured by drift. No aurora visible.

01-15 There appears to be a faint auroral glow in the N.

02-20 No aurora visible.

03-00 Ditto.

03-30 Ditto.

03-45 An arch 20° up in the N.W., rising zenithwards.

04-20 Aurora now brighter, extending from N. to E.; also another smaller band below.

04-55 No aurora visible.

06-00 Ditto.

06-30 A short band in the northern sky, high up.

17-07 Lower sky hazed with drift; sky practically clear. No aurora visible.

17-40 Ditto.

18-00 Ditto.

20-10 Ditto.

21-00 Ditto.

22-00 Part of a nebulous arch from 20° up in the N. down to near the N.E. horizon.

22-15 No aurora visible.

23-00 A bright band 25° up from N. by E. to N.W.; also a faint one from N.E. to E., 10° up.

23-30 A faint band 15° up from N. to N.W.

24-00 A moderately bright nebulous band 12° up, between N. and N.W.

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- 5-00-30 No aurora visible.
 01-00 A faint nebulous band 8° up, between N.N.W. and N.E.
 01-35 No aurora visible.
 02-05 A very faint band 8° up, between N. and N.E.
 02-30 Ditto, now scarcely visible.
 03-00 No aurora visible.
 03-35 Ditto.
 04-10 Ditto.
 04-45 Northern horizon obscured up to 10° . No aurora visible.
 05-15 Ditto.
 06-00 Ditto.
 07-11 A nebulous band from the N.W. to E. by S., rising to 60° at the highest point; brightest towards the E. extremity.
 07-21 No aurora visible.
 07-44 A faint broken curtain from 40° up in the N.W. by N. to 60° up in the E., passing about 20° N. of the zenith.
- Sky obscured until the morning of 6th July.
- 6-04-45 Lower sky obscured by drift. A faint band passing through the zenith from N.W. to S.E.
 05-15 No aurora in the vicinity of the zenith.
 06-00 Two faint bands 50° up in the N., extending from N.W. to S.E.
 06-25 A faint curtain S.W. of the zenith, trending N.W. and S.E.; also another 30° up in the E.N.E.
 07-00 Indistinct curtains in the N.W. sky up to 40° , trending N.W. to S.E.
 07-30 A faint curtain 15° up in the N.W.
- 16-30 Faint twilight in the N.W. sky. No aurora visible.
 16-35 An auroral curtain 30° up in the N. to 20° up in the E.N.E., moderately bright seen in the twilight.
 16-45 No aurora visible.
 17-08 Ditto.
 17-34 Drift sufficient to obscure delicate effects. No aurora visible.
 18-00 Ditto.
 18-22 A faint auroral curtain 20° up in the due W.
 18-30 No aurora visible.
 19-04 A very faint band from the N.E. horizon to the zenith.
 19-41 An extremely faint band from the horizon 6° N. of W. and extending to a point just to the N. of the zenith.
 20-01 A very faint nebulous patch 10° up in the W. by N.
 20-16 A fragment 25° up in the W. by N.
 20-40 The appearance of a very faint glow between 30° and 60° up in the N.N.W. sky.
 21-00 Sky clear. No aurora visible.
 21-30 Ditto.
 22-00 Ditto.
 22-14 A very faint band from the zenith to 45° up in the N. by E.
 22-27 No aurora visible.
 22-47 Ditto.
 22-56 A moderately bright curtain from the S.S.W. horizon up to a point 20° E. of the zenith. Brightest in the S.S.W.

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- 6-23-00 The curtain has faded, leaving only a bright patch 10° up in the S.S.W.
- 23-18 No aurora visible.
- 23-33 Ditto.
- 23-45 Sky now very clear. No aurora visible.
- 24-00 No aurora visible. More meteors than usual observed to-night.
- 7-01-00 A faint glow 3° up in the N.
- 02-00 No aurora visible.
- 03-00 A faint curtain stretching from the zenith to the N.W. The brightest part 10° up.
- 04-10 No aurora visible.
- 05-21 Two arches lying from E. to N.W., the upper one showing some streamers; both faint.
- 05-35 Ditto, with a third but fainter arch ranging from the zenith to the N.W.
- 06-00 The arch passing through the zenith is the stronger of the three.
- 07-15 Three faint patches 15° up in the N.W.
- 16-39 Sky clear. No aurora visible.
- 16-49 Ditto.
- 16-54 Ditto.
- 17-24 The E. half of an E. and W. arch is visible, rising from the E. horizon, and reaching a maximum elevation in the N. of 50° ; very faint. The intensity is merely that of a haze, stronger near the E. horizon, where it merges into a faint nebulous band.
- 17-36 The arch remains, but is fainter, though now reaching a little more towards the W.
- 18-14 Three faint haze bars between 35° up and the N. horizon. The general effect near the N. horizon is in appearance like the luminous haze seen after sunset under certain conditions.
- 19-02 A broad faint nebulous bar 60° up from N. to N.E.
- 19-24 A faint nebulous arch from N.E. by E. to S.W. by W., extending across the whole sky.
- 19-54 Two extremely faint nebulous arches; one 50° up, the other 30° up. In trend they have just noticeably swung round anti-clockwise. Watched for a few minutes they occasionally strengthened until faint vertical detached streamers could be seen, at other times they pass into the very faint nebulous type and haze arches.
- 20-19 A very faint arch rising from the N.E. horizon, fades out before reaching the N., where, however, its projected elevation attains a maximum of 30° . Another band comes into visibility near the N.E. horizon and crosses the zenith, trending to the S.W. and dying out at a point 45° up in that direction. In the zenith it is broad and distinct, where it is about the same density as the milky-way, which is showing up well. Where the band crosses the zenith a rough cross cleavage shows up.
- 20-39 A bar of faint nebula from the zenith to 40° up towards the N.E. by N.
- 20-54 No aurora visible.
- 20-59 A faint nebulous band stretching from N. to N.E., maximum elevation 25° .
- 21-19 A haze arch 20° up in the W.N.W. Portion of another rising from near the N.N.E. horizon; but fading out very soon. The trend of these appears to be about N.E. by N. to S.W. by S. They are very faint.
- 21-54 A moderately bright nebulous arch 4° up from N.N.E. to E.
- 22-09 A moderately bright nebulous band 10° up between N. and E. It disappears behind the rocky ridge to the E., where it appears to be specially active as streamers are rising there.
- 22-31 A wavy moderately bright nebulous band 12° up from N. to N.E. by N.
- 22-43 A long low arch 2° up in the N., moderately bright.
- 22-53 A bright arch from E. to N. by W.; confused in the N. by W.; altitude 4° .
- 23-08 A long bright curtain from E.N.E. to N.W.; maximum elevation 25° ; much motion at the E. end, where it is red below.
- 23-12 Curtain now very bright again; red below; extending slightly to the W.; maximum elevation 35° .

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- 7-23-15 Again very brilliant and much colour; rippling noticeable; seen most at the E. end; it has risen somewhat higher.
- 23-18 Another bright period. The western ends curve round uniformly as if all the bands are the visible portions of concentric cylinders of rays, the southern side too faint to be seen. The rippling appears to take place around the cylinder; from E. to W. along the northern side as seen from the hut. Colour effects; pinkish tints again noticeable on the side towards which the luminescence is travelling, greenish tints away from that direction. Flashes below are always redder.
- 23-20½ Another minor maximum. Now all noticeably rippling to the E.
- 23-26½ Now strong, bright, even-nebulous. Mostly in the W.
- 23-29 Ditto, much fainter. In intensity and colour resembles the greenish-yellow last traces of twilight.
- 23-31 Still fainter and receded to the N.
- 23-39 Very faint nebula scattered along the N. horizon in odd patches; maximum elevation 15°.
- 23-54 A very faint nebula and haze arch only remains; maximum elevation 20°.
- 8-00-29 A nebulous band all round the N. horizon; very faint in the W.; moderate in the E.
- 01-00 A portion of a nebulous arch rising from the W.N.W. horizon, visible as far as N; where 25° up. A faint haze arch parallel low in the N.E. sky.
- 01-30 Three very faint bands, one in the zenith, the others more to E.; the zenith band trends to the S.S.E. horizon; towards the N. horizon they swing round more W.N.W. to E.S.E.
- 02-00 Several faint haze patches. One on the N.W. horizon, another 30° up in the N., a third 45° up in the E.S.E.
- 02-31 No aurora visible.
- 03-00 Ditto.
- 04-00 Ditto.
- 04-30 Ditto.
- 05-00 Traces of an arch rising from the W.N.W. horizon passing near the zenith to the E.S.E.; nebulous near the W.N.W. horizon, then a haze to just past the zenith, beyond which it becomes invisible. Two more parallel arches seen towards the N.E.; one 30° up, the other 15° up. Along the N.E. horizon there is a belt of auroral haze, apparently due to packing of very low haze arches. Compare this effect with the luminous horizon noted at other times.
- 05-30 A slight increase in drift prevents very delicate effects being seen. A nebulous bar from the zenith to the S.E.; faint to moderately bright.
- 06-06 Lower sky obscured by drift and haze. No aurora visible.
- 06-30 Ditto.
- 07-00 Sky clear. A faint to moderately bright nebulous arch from near the W. by N. horizon; past the zenith. A parallel haze arch 60° up in the N.; rising from the same point.
- 07-35 Streaks of auroral nebula across the zenith trending somewhat to the N. of W. Along the N.E. to N.N.E. horizon is a twilight tongue, reminding one of a broad, intensified auroral haze.
- 08-00 No aurora visible. Twilight strong now.
- 18-00 A clear dark night. A little cloud low on the N. horizon. No aurora visible.
- 19-45 Ditto.
- 20-04 Ditto.
- 20-33 An exceedingly faint haze arch, between N.E. and N.W., about 15° in maximum elevation.
- 21-00 No aurora visible.
- 21-30 There appears to be a haze arch of the very faintest type between the N.E. horizon and N. 10° up.
- 22-00 Ditto.
- 22-32 A moderately bright curtain in the form of an arch, extending from N. to E.N.E.; maximum elevation 25°; trend (if straight) W. by N. to E. by S.
- 23-00 A faint nebulous arch from N. by W. to N.E.; streamers at intervals; maximum elevation 20°

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- 8-23-33 A very faint nebulous band 10° up, from N. by W. to N. by E.
 24-00 A faint nebulous band from N.N.W. to N.N.E., 10° up. Also a very faint haze extension to the N.E. horizon. Meteors frequent to-night.
- 9-01-00 A very faint nebulous band, 6° up, between N. by W. and N.N.E.
 02-00 No aurora visible.
 03-00 A very faint nebulous band from N. by W. to N.N.E.
 04-00 Lower N. sky hazy. No aurora visible.
 05-00 Ditto.
 06-00 A faint curtain from 20° up in the E.S.E. through the zenith to within 30° of the W.N.W. horizon. Also two faint shorter ones, one 70° in the N.E. sky and about 40° long, the other 30° up in the W. sky and about 30° long; all trending W.N.W. to E.S.E.
 07-00 No aurora visible.
 08-00 Ditto.
- 21-00 Sky has been overcast since 8 a.m. until now; still remains clouded for 35° above the N. horizon. No aurora visible.
 21-30 Ditto.
 22-05 Cloud now low in the N. No aurora visible.
 22-35 Cloud almost disappeared. A glow on cloud 5° up, between N. and N.W.
 22-50 No aurora visible.
 23-15 A nebulous band from near the N.N.W. horizon to 7° up in the N.
 23-20 The faintest possible haze arch from 10° up in the N. to the N.E. horizon.
 24-00 A faint nebulous band 10° up, between N.E. and N.W.

Special circumstances prevented observations during the early morning hours of the 10th inst.

- 10-15-50 Cloud low on the N. horizon. No aurora visible.
 16-29 Ditto.
 16-43 A faint auroral patch 14° up in the W. by N. Bright moonlight.
 16-44 No aurora visible.
 18-10 Ditto.
 18-32 Ditto.
 19-32 Sky now clear. Half-moon. No aurora visible.
 21-00 Ditto.
 21-35 A faint nebulous band 2° up, from W.N.W. to E.
 22-00 A bright nebulous arch from E. horizon to 16° up in the N. by W. Also a lower nebulous band.
 22-15 A moderately bright nebulous band between N.N.W. and N.E., ranging from 20° to 30° up.
 22-25 A nebulous band 35° up, between E. and W.N.W.
 22-53 A bright nebulous band 35° up, from N.N.W. to E.N.E.; shows a tinge of red below in places.
 22-59 A bright band from E.N.E. to N., highest in the N.E. where 18° up.
 23-04 Ditto, fainter.
 24-00 A bright band 30° up, from N.E. to W.N.W. Also several fragments lower down.
- 11-00-20 A bright curtain from the N.W. horizon to the E. by N. horizon up to 15° .
 00-21 Streamers on the curtain moving to the E.
 00-28 Bright nebulous band W. by N. to E.; maximum elevation, 30° .
 01-04 A bright nebulous band from N.W. horizon to 15° up in the N.N.E.
 02-03 A moderately bright curtain from the N.W. horizon to 20° up in the N. Faint patches 30° up in the N. by E.

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11-02-38 Two very faint arches from N. to N.E., 10° to 20° up. Also one still fainter from 10° up in the N.W. to the zenith.

03-23 A faint nebulous patch from 10° up in the N.W. to 30° up in the N.

04-17 No aurora visible.

05-03 Ditto.

Sky now overcast, clearing on the morning of the 12th inst.

12-01-00 The lower sky obscured. A faint curtain from 10° up in the N.W. to 20° up in the N. by W. Also a bright glow on a cloud 8° up in the N.N.W.

01-30 Ditto.

02-05 A faint nebulous patch 45° up in the N.E.

02-10 A nebulous band 20° up in the N.W. to 30° up in the N.E.

02-40 No aurora visible.

03-00 No aurora visible. Sky clear, but slightly hazed.

03-45 Ditto.

04-10 Ditto.

04-40 Ditto.

05-10 Ditto.

06-00 Ditto.

06-40 Ditto.

07-25 Ditto.

Sky now obscured by cloud until 06-00 of the 17th inst.

17-06-00 Sky practically clear. No aurora visible.

07-15 Ditto.

17-15 Cloud low in the E. and N. Bright moonlight. No aurora visible.

17-38 Ditto.

18-00 Ditto.

18-15 Ditto.

18-30 Ditto.

19-18 Ditto.

19-47 Ditto. Cloud now up to 20° in the N., between E. and N.W.

20-30 Ditto

21-00 Ditto. Moonlight.

22-00 Ditto.

23-08 Ditto.

24-00 Ditto. Clouds now almost to the zenith from the N. horizon.

18-00-30 Sky mostly obscured. No aurora visible.

02-30 Sky clearing, but greater part of the northern sky still overcast. No aurora visible.

Sky now obscured until the evening of the 20th.

20-21-00 Cloud obscuring the lower N. sky. Thick drift generally obscuring the lower sky. Moonlight. No aurora visible.

22-17 Ditto.

Sky now obscured until the evening of the 22nd.

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22-20-00 Sky now clear in the zenith and to the south. Patches of faint auroral haze in the northern sky.

20-20 A strong auroral glow low in the N.

21-00 No aurora visible.

21-12 An auroral glow on a bank of clouds 5° up in the N.

21-55 Ditto.

22-27 Sky clear, except along the N. horizon. Moon just coming up. A faint nebulous band 8° up in the N.

23-22 A bright nebulous curving band concave to the N., reaching 30° up. Chiefly in the N., but extending between N. and N.E.

23-41 The band is fainter and straighter. Extends from W.N.W. to N.E. Maximum elevation, 30° .

24-00 A faint nebulous band 30° up between N.N.E. and N.N.W.

23-00-35 A nebulous band 20° up in the N.N.E. to 15° up in N.W. Must be fairly strong to show up in the bright moonlight.

01-12 No aurora visible.

02-00 Ditto. Clouds up to 15° above the N. horizon.

03-00 Ditto. Cloud has risen considerably.

04-00 Ditto.

05-00 Ditto. Cloud diminishing.

06-00 Sky clear, except low in the N. No aurora visible.

07-00 Ditto.

07-30 Dawn appearing.

Dense drifting snow obscures sky until evening of 24th.

24-19-18 Sky obscured below 30° by drift. Top of drift cloud, glowing faintly with auroral light.

20-00 Conditions the same. No aurora visible.

21-00 Ditto.

22-00 Ditto.

23-00 Ditto.

24-00 Sky clear as far down as 15° up in the N., where obscured by drift. The moon just rising. No aurora visible.

25-00-30 No aurora visible.

01-00 Only very light drift. Moonlight bright. No aurora visible.

02-00 Ditto.

03-00 Hazy in the N. No aurora visible.

04-00 Ditto.

05-00 Ditto.

06-00 Ditto.

Sky obscured by drift during the evening hours.

26-03-00 Sky becoming less obscured. A little cloud in the northern sky. Light drift. Half moon. No aurora visible.

04-00 Atmospheric conditions the same. Two parallel curtains 30° apart, extending from the horizon in the W.N.W. to 45° past the zenith towards the E.S.E. A strong effect.

04-30 Clouds extending over most of the northern sky. A portion of a faint curtain visible in the zenith, trending N.W. to S.E.

Sky overcast during the remainder of the early morning hours.

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- 26-17-28 At about this time faint streamers rising from the horizon to 30° in the E. by N.; also a nebulous patch 10° up in the W.N.W.
- 17-36 A very faint curtain from the W. by S. horizon to 20° N., of the zenith.
- 17-51 A faint nebulous arch, 25° up, between W.N.W. and N.E.
- 18-00 Sky clear, hazy on the N. horizon. A faint auroral arch from near the E.N.E. horizon to 8° up in the N. by W. Also a faint curtain from 10° up in the N. by E., extending almost to the zenith, and a second faint curtain from 5° in the W. by S. to 60° up in the W. by S., the latter a continuation of the former.
- 19-26 Sky clear. No aurora visible.
- 19-45 An arch from the E. by N. horizon to 7° up in the N.
- 20-26 A haze arch between N.E. and N.W., highest point 15° up in the N.
- 21-06 A continuous arch from the E. horizon to W. horizon, maximum elevation 12° . Moderately bright and nebulous in the E., fading out towards the W.
- 22-07 Ditto. a little stronger in the W.
- 23-07 The faintest possible trace of auroral haze in the position of the former arch.
- 27-00-07 Sky quite clear. No aurora visible.
- 00-43 A faint curtain 10° up, between W.S.W. and N.W. Also a bright nebulous band 2° up between N.E. and N. A nebulous patch 15° up in the E.N.E.
- 00-55 A faint nebulous band waxing and waning 6° up in the W.N.W. Also a moderately faint nebulous band 3° up in the N.E. to the N.N.W. horizon.
- 01-08 A faint nebulous band 3° up between N. and N.E.
- 01-38 A very bright band from the horizon in the N. to that in the E. by N., reaching altitude of 6° in the N.E.; showing a very few faint streamers.
- 01-39 A band between E. by N. and N.E. suddenly faded whilst the western end increased in brightness.
- 01-44 No aurora visible.
- 01-45 A few isolated faint streamers in the N.E.
- 01-46 A nebulous band from the N. by W. horizon to 8° up in the N.E.
- 02-07 A faint nebulous band from N. to N.E., 3° up.
- 03-00 Three curtains. The upper extending from the W. by N. to N.W., waxing and waning. The other two curtains shorter. All moderately bright.
- 03-02 The lower curtain has disappeared and the upper curtain became brighter with streamers 8° long. The latter now 6° up between W. by N. and N. by W. Also a faint glow in the N.E. 12° up.
- 04-00 Three faint broken curtains extending from near the W.N.W. horizon, through the zenith to 10° up in the E.S.E., the W.N.W. end brightest. Also a faint glow 18° up in the N.E. sky.
- 05-00 A broken curtain from 6° up in the W.N.W. sky, through the zenith, to 10° up in the E.S.E. The curtain to the N. of the zenith bright, the other faint.
- 06-00 A broken curtain as at 5 h., with two shorter faint broken curtains, from E.S.E. horizon to the zenith; the latter to the E. of the main curtain.
- 07-00 A faint broken curtain and a few odd parallel fragments, extending from near the E. by S. horizon to 10° up in the W. by N.; general trend E. by S. to W. by N.
- 17-18 Clear sky. No drift. A bright arch from E. by N. horizon to 15° up in the N. by W.
- 17-30 An even nebulous arch from E. to W. horizons, maximum elevation, 20° ; very faint to the W. where it enters the twilight zone.
- 18-00 A very bright nebulous band from E. horizon to 10° up in the N.W.
- 18-15 Bright nebulous band 15° up in N.W. to E. horizon. Also a very faint band, 10° up in the W. by N. to N.N.W.
- 18-32 Two moderately bright nebulous arches from E. by N., near horizon to near W. by N. horizon. Maximum elevation of upper band, 15° ; of lower, 9° . Brightest at the eastern ends.
- 19-08 A faint nebulous arch from E. to W., maximum elevation, 25° .

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- 27-19-30 A faint nebulous arch from near the E.N.E. horizon to near the W. by N. horizon; maximum altitude, 15°.
- 20-00 A moderately bright curtain with short streamers; position as at 7h.
- 20-30 A moderately bright nebulous arch from E.N.E. to W.N.W. horizons; maximum altitude, 8°.
- 20-40 Ditto, with a few short streamers at the E. end.
- 21-00 Nebulous arch from near the horizons in E.N.E. to W.N.W.; bright at the E. end, fading to the W. end.
- 21-30 A nebulous arch from near the E. by N. horizon to 4° up in N.W.; maximum altitude, 8°. E. end brightest.
- 22-00 A broken nebulous arch from N.E. to N.W.; maximum altitude 8°; brightest at the E. end.
- 22-30 A moderately bright nebulous arch 4° up in the E.N.E., to 4° up in W.N.W.; maximum altitude, 7°.
- 23-00 A very faint nebulous patch 15° up in the N. by W.
- 23-19 A faint patch 8° up in the N.N.W.
- 23-30 Faint nebulous patch 35° up in N. by E. Also a faint nebulous band extending from 8° up in the N. to near the zenith.
- 24-00 No aurora visible.
- 28-00-35 A bowed curtain, concave to the S.W.; extending from the zenith, where it is very faint, to near the N.W. horizon. Trend in the zenith N. by W., but swinging more to the N.W. as it extends to the N.
- 01-07 A faint haze formation as the curtain of 0h. 35m., now seen 45° up in the W.
- 01-42 An extremely faint band from the zenith to the S.S.E. horizon. Also another fainter parallel one in the E. In the W. low down there are several patches of very faint nebula.
- 02-10 A faint, nebulous band, 15° up in the W. Another very faint one extending from near the S.S.E. horizon to the zenith, thence to near the N. horizon, so that it is concave on the E.
- 02-42 No aurora visible.
- 03-00 No aurora visible, though very faint indications of haze bars in the N. and N.E.
- 03-32 A faint, nebulous band 45° up in the N.E.; trend about N.W. by N. to S.E. by S.
- 04-25 A faint arch passing just E. of the zenith, visible only near the zenith, and to the south. Trend N.W. by N. to S.E. by S. A piece of another parallel band lower in the N.E. sky. Also a patch near the N.W. by N. horizon.
- 05-27 Three faint curtains, all parallel, trending W.N.W. to E.S.E. The chief one extends from south of the zenith to near the N.W. horizon, apparently a slight concavity to the W. Other two fragmentary curtains in the lower N.E. sky.
- 06-00 No aurora visible. The last of the old moon showing on the N. horizon.
- 06-30 Fragments of faint curtains in zenith and to the E. of the zenith, trending about W. by N.; some of them somewhat bent.
- 07-00 Streaks of auroral haze in the zenith, directed to the W. by N.
- 07-30 Several extremely faint haze streaks from the zenith towards the W. by N.
- 16-50 Faint twilight. No aurora visible.
- 17-18 No aurora visible.
- 17-47 Ditto.
- 18-00 Ditto.
- 18-08 An extremely faint band from E.N.E. to W.N.W. Maximum elevation 60°. Soon fading.
- 18-26 A few faint streamers about 45° up in the N. and N.N.E.
- 20-17 The east end of a haze arch rising from the E.N.E. horizon to 15° up in the N. by E.
- 20-45 Ditto.
- 21-23 Portion of an arch showing a few streamers, 15° up in the E.N.E., bright in the E.
- 21-35 A bright, nebulous arch from E. by N. to E.N.E. From 8° in the E. by N. to 12° in the E.N.E.

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- 28-21-44 The arch now extends to the E. by S.
 22-09 No aurora visible.
 22-45 An extremely faint, nebulous arch from N.E. horizon to 8° up in the N. by W.
 23-18 A moderately bright arch between W.N.W. and E.N.E. Maximum elevation 15°.
 24-00 A poorly defined curtain from 10° up in the N.W. to 10° up in the E.N.E.; the maximum elevation 15° in the N. by E.
- 29-00-45 Moderately bright curtain from 7° up in the N. by W. to 15° up in the N.E. Also a glow 5° up seen in the drift between E.N.E. and W.N.W.
 01-40 A nebulous band in N. between 5° and 60° up. Also one between N.W. and E.N.E. 5° up.
 01-48 Very faint streamers 40° up in the S.E. The band remains along the N. horizon, but brighter, and streamers appearing at the E. end.
 02-41 Faint, broken curtains, almost nebulous, from the N.N.W. to the zenith and to the E.N.E. Also a faint patch 15° up in E.S.E.
 03-00 A very faint, broken curtain from N.N.W. to E.N.E., 40° up. A second parallel curtain from 10° up in the W.A. patch, 10° up in the E. by S.
 03-34 A faint, broken curtain from N.W. to S.E. through the zenith. Also a nebulous band 10° up, between N.E. and E.S.E.
 04-00 Faint, streamers 45° up in the N.W.
 04-45 Faint, broken curtains through the zenith, from N.W. to S.E.
 06-00 Faint patches of streamers 40° up in the N.W. and 30° up in the S.E.
 06-45 Patches of streamers 50° up in the N.W. by N. Dawning in the E.
- 17-30 Sky practically clear. No aurora visible.
 18-00 A faint curtain from 2° in the E.N.E. to 30° above the N. horizon; brightest in the E.
 18-28 The faintest possible trace of a haze arch from the W.N.W. horizon to E.N.E. horizon. Maximum elevation 40° in the N.
 19-02 The same arch now only 20° up.
 19-27 The E. end of the same arch still discernible, though almost invisible.
 20-00 A moderately bright curtain in the form of half an arch, extending from the E.N.E. horizon to 45° up in the N. Trend about N.E. by E. to S.W. by W.
 20-21 A nebulous patch 6° up in the E.N.E. Also the haze arch as at 19 h. 27 m.
 20-29 A bright curtained arch from E.N.E. to 28° up in N. by E.
 20-50 The merest trace of the 20 h. 29 m. arch remains.
 21-15 No aurora visible.
 21-39 A very faint curtain from the E. horizon to 35° up in the N., then turning towards the zenith and reaching 80° up.
 22-04 A very faint curtain from the E. horizon to 12° up in the N.N.E.
 22-10 A faint, broken curtain from 10° up in the E.N.E. to 20° up in the N. Also a patch 25° up in the W. by N.
 22-40 No aurora visible.
 22-47 Ditto.
 23-10 Ditto.
 23-27 A faint patch of haze 10° up in the N.
 24-00 A faint nebulous band 10° up, between N. and N.E.
- 30-00-30 A faint, nebulous band 6° up, between N. and W.N.W.
 00-36 A moderately bright arch 3° up, between N.W. and N.N.E. Kindling travelling to the E.
 01-03 An irregular arch from W.N.W. to E. Maximum elevation 12°.
 01-10 Arch from W.N.W. to E. Maximum elevation 12°; brightest at E. end.

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- 30-01-37 A very faint, nebulous band near the horizon between N.N.W. and E.; brightest at the N.N.W. end.
- 02-00 Fragments of an arch 3° up in the N.N.W. and 10° up in the N. by E. respectively.
- 02-30 Irregular patches in the N.E., N., and N.N.W., portions of an arch with a maximum altitude of 10° .
- 03-00 Fragments of a faint curtain in the N. sky, trending more or less to the S.E. Maximum elevation 45° .
- 03-20 A faint curtain 30° up in the N.E.
- 03-45 Very faint, hazy patches from the N.W. horizon up to 45° of altitude.
- 04-20 A faint display of curtain about the zenith, and fragments in most parts of the sky except the S.W. The trends are about N.W. to S.E.
- 04-45 Several faint bands in the S.E., one passing through the zenith to the N.W. Also a very faint one 30° up in the N.E.
- 05-23 Faint curtains in the N.W. sky, trending towards and terminating in the zenith. Another faintly visible in the S.E.
- 05-50 Two well-defined curtains in the N.W., one of which continues to the zenith. A curtain suddenly developed from E. to N.N.W., attaining an altitude of 20° in the N.E.; waxing and waning rapidly.
- 06-00 A bright curtain trending from N.W. to E.S.E.; greatest altitude 15° . Also a faint curtain low in the S.E. Dawn twilight just appearing.
- 06-26 A curtain in the N.W. sky, becoming brighter as it trends towards the S.E. through the zenith. Also a faint band near the horizon between N. and N.N.W.
- 07-15 Dawn moderately advanced. No aurora now visible.
- 16-58 Twilight fading along the N. to W. horizons. No aurora visible.
- 17-35 Sky clear. No aurora visible, though there appears to be the faintest possible trace of haze band from E. horizon to 20° up in the N., visible only by sideway vision.
- 18-00 No aurora visible.
- 18-25 A very faint, nebulous band 10° up in the N. to the E. by N. horizon.
- 18-28 No aurora visible.
- 19-10 The E. end of a very faint, nebulous arch from E. horizon to 22° up in N.
- 20-03 A broad sheet of moderately, bright, nebulous aurora from the E. by S. horizon, fading out at 18° up in the N.N.E.
- 20-30 No aurora visible.
- 21-00 A very faint, nebulous patch in the E.N.E. up to 10° altitude.
- 21-20 A very faint, nebulous patch 10° up in the E.N.E.
- 21-32 The faintest possible trace of haze arch 12° up from N. to N.W.
- 22-00 No aurora visible.
- 22-48 A patch of nebulous aurora 22° up in N.W.
- 23-17 No aurora visible.
- 23-49 A faint auroral haze low down between E. and N.E.
- 31-00-07 No aurora visible.
- 00-37 A very faint, nebulous bar 3° up, between N. and N.W.
- 00-57 No aurora visible.
- 02-00 Ditto.
- 03-00 Sky appears slightly hazy. No aurora visible.
- 04-00 Ditto.
- 05-00 Ditto.
- 06-00 Ditto. Sky practically clear.
- 07-00 Ditto.

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- 31-17-51 A trace of a haze arch in the N., between E.N.E. and W.N.W.; maximum elevation 15° up in the N.
- 18-00 The haze arch remains.
- 18-27 A very faint, nebulous arch from E.N.E. horizon to 15° up in N.
- 19-20 A regular arch from E.N.E. horizon to W.S.W. horizon; maximum elevation 12° in N.; moderately bright at the E. end, fading out towards the W., becoming almost invisible W. of N.N.W.
- 19-37 A faint double nebulous arch between E.N.E. and N.W. horizons; highest 7° up in the N.
- 19-55 The arch as at 19h. 20 m. remains, but visible only as far west as N. by W.
- 20-34 A nebulous band from the E.N.E. horizon towards the W., fading out in the W.N.W.; altitude 7° ; a faint streamer rising in the N. by E.
- 21-00 An extremely faint, nebulous arch from about the E. horizon to 9° up in N.
- 21-30 A faint, nebulous band from near the E. horizon to the N.W., 10° up.
- 21-55 An arch 5° up between N.E. and N.
- 22-34 A very faint band 10° up, between N. by E. and N.E.
- 23-10 No aurora visible.
- 23-42 A very faint curtain over the zenith, from the southern horizon to near the northern horizon; trend from the zenith to a point a few degrees W. of N.
- 24-00 An extremely faint trace of the 23 h. 42 m. arch remains.

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- 1-00-30 A fragment of a broken curtain from near the N. horizon to a point 40° up towards the zenith. Also a short nebulous band 25° up in the N.E.
- 00-40 A curved band 20° up, between W. and N. by W.; one spot in the N.N.W. very bright. In two minutes it faded out until only the bright spot remained.
- 01-05 No aurora visible.
- 01-30 A very faint glow on the N.N.W. horizon.
- 02-00 A very faint glow between the E. and N.N.W. horizons, reaching a maximum elevation of 2° .
- 03-00 Bright curtain from the W.N.W. horizon, to 10° up in the E.; outline well defined undulating; very bright between W. and W.N.W., fading out towards the E.
- 03-17 The curtain now extends from the W.N.W. horizon to E.S.E. horizon; rising to 15° in the N.; intensity uniformly bright.
- 03-46 The curtain now extends from W.N.W. horizon to S.E. horizon, rising to 30° in the N.E.; streamers well defined, some 5° in length; brightest part between N. and S.E.
- 04-00 Display now fainter. Curtain stretches from N.W. horizon to S.E. horizon, rising to 40° in the N.E.; broken and very faint in the S.E.; brightest in the N.W. Also another faint curtain at an altitude of 20° in the N.E.
- 04-30 The line of the previous curtain now only faintly visible between the S.E. horizon and a point 30° up in the N.E.
- 05-00 Auroral display now complex and faint. A broken curtain with long streamers stretches from the S.E. horizon to the zenith, from where it continues fainter and more nebulous in an irregular band to the N.W. horizon. This curtain bifurcates near the zenith, the offshoot extending a little N. of the zenith. Also a faint band stretches from the N.W. horizon to 30° up in the E.
- 05-30 Three curtains start from the S.E. horizon. The first, after arriving at a point a little N. of the zenith, bifurcates and continues to the horizon in the N.W. by W. as two close bright curtains. The second fades out 45° up in the N.E. sky. The third fades out at a point 25° up in the E. Also there is a short faint band 15° up in the W.
- 06-00 Display faint but extensive. Many bands across the sky in the region of the zenith, trending N.W. by W. to S.E. by E. The display in the S.E. has developed markedly to the south; there are several bright patches in the S. by E. 20° up. Dawn just appearing.
- 06-30 Display stronger though dawn brighter. Portions of seven curtains starting from near the N.W. to W. by N. horizon and stretching in broken fragments across the zenith region to within 30° of the S.E. horizon.

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- 1-07-00 Dawn now obscures most of the aurora. Three bands radiate from the N.W. by W.; two lateral short ones, the medial extending past the zenith.
- 07-30 Dawn very bright. No aurora visible.
- 16-30 Sky almost completely clear. Twilight strong. No aurora visible.
- 17-25 Faint twilight low in the W.N.W. to W. horizon. No aurora visible.
- 17-43 No aurora visible.
- 18-00 No aurora visible.
- 18-20 A faint nebulous shaft rising from the E. horizon.
- 19-20 No aurora visible.
- 20-30 The faintest possible band of auroral haze 8° up, between N. and N.E.
- 21-00 A faint nebulous arch from 8° up in the N.E. to 10° up in the N.
- 21-38 As at 21 h.; now brightest in the N. by E.
- 22-06 A very faint nebulous band 8° up, from E.N.E. to N.; also an extremely faint haze trace continuing to the W.
- 22-30 A bright nebulous band 4° up, between N. by W. and N.N.E.
- 23-06 A faint nebulous band from 5° up in N.W. to 10° up in N. by E.
- 23-35 No aurora visible.
- 24-00 Ditto.

- 2-01-00 Lower N. sky clouded over, remainder of the sky becoming hazy. A faint glow 5° up, between E. and E.N.E.
- 02-00 Sky overcast, but cloud thin and hazy near the zenith. No aurora visible.
- 03-00 Ditto.
- 04-00 Ditto.
- 05-00 Ditto.
- 06-00 Sky overcast, except near the E. and S. horizons; in the zenith cloud thin and hazy. A faint auroral bar seen in the zenith, trending N.W. to S.E.
- 07-00 Sky overcast.

Sky overcast until the evening of the 5th.

- 5-18-00 Sky now for the most part clear; still overcast in the S. and W. A faint nebulous band from 10° up in the N. by W. to 5° up in N.E.
- 18-40 Clouds now in the N. below 15° of altitude. A faint glow along the top of the cloud.

Sky completely overcast until after 23 h.

- 23-21 Sky now clear near the E. horizon. A bright curtain from near the E. horizon to 5° up in the N.E., where it passes behind clouds, through which a glow visible as far as the N.
- 23-40 A patch 15° up in the E.
- 23-50 No aurora in the clear sky in the E. A bright band showing through a gap in the cloud near the horizon, between the N. and W.
- 24-00 A glow seen through cloud low down in the N.W.
- 6-00-15 A moderately bright arch from the W.N.W. horizon to 20° up in the N.E.; the S. continuation lost behind cloud.
- 00-54 Portions of the arch still remain. Cloud now much diminished, chiefly low in the N.
- 02-00. Aurora almost in the same place, but a little more extensive. Weak nebulous patches and a few streamers in a W.N.W. to E.S.E. line in the N. sky, and outlying part reaching 60° up. Also auroral haze over a cloud lower down between N.W. and S.E.

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6-02-52 Sky overcast, except near the zenith. In the zenith a faint nebulous band, trending N.W. by W. to S.E. by E.

Sky now completely overcast until the late afternoon.

17-40 Sky clear. A faint arch from 2° up in E.N.E. to 5° up in the N. by W.

17-50 No aurora visible.

18-00 Ditto.

18-25 A faint luminous patch on the E.N.E. horizon observed from the magnetograph house.

18-30 A nebulous band gradually extending from the above patch and stretching from the E.N.E. horizon to 10° up in the N.N.W.; bright in the E.N.E.

19-26 Faint arch from E. horizon to 8° up in the N. Moon shining.

19-36 A nebulous band from the E.N.E. horizon to 8° up in the N.; moderately bright.

20-00 A faint to moderately bright nebulous arch from the N.E. horizon across the N. sky at a maximum elevation of 12° , fading out in the W.N.W. The trend probably S.W. by W. to N.E. by E.

20-25 Arch from E.N.E. horizon to 8° up in N.W.; faint.

21-00 Faint nebulous arch from the N.E. horizon across the N. at a maximum elevation of 15° , fading out in the W.N.W.

21-36 A moderately bright uniform arch across the N. sky, between N.E. and W.; maximum elevation 12° .

22-00 Very faint arch in the N., maximum elevation 6° .

22-45 Faint arch 12° up in the N. to 6° up in the W.N.W.

24-00 Faint band 10° up in the N.

7-01-00 No aurora visible.

02-00 Ditto.

03-00 Ditto.

Clouds and dense drift obscure the sky until midnight.

24-00 Dense drift, so that stars are visible only near the zenith. During a slight lull a moderately bright patch of aurora was seen about 45° up in the N.

8-01-00 Faint arch seen through drift 30° up in N.

02-00 Dense drift. No aurora visible.

03-00 Ditto.

04-00 Sky less obscured by drift. A curtain from 70° up in the S.S.E. through the zenith, extending to 80° up in the N.N.W.; moderately bright.

05-00 Three faint and short broken curtains from 40° up in S.S.E., through the zenith, to 80° up in the N.N.W.

06-00 Four broken straight bands, faint, extending from the zenith to within 50° of the N.W. horizon; trending N.W. to S.E.

07-00 A fragment of a band at the zenith, trending N.W. to S.E.

18-00 The sky appears to be clear of cloud, but drift obscures the view below 45° . No aurora visible.

20-15 No aurora visible in the unobscured portions of the sky.

23-00 Sky cleared a little momentarily. Moon shining. An arch just visible low down in the N.E.

24-00 Drift lighter. A faint nebulous aurora 10° up between N. and N.E.

9-01-00 No aurora visible.

01-38 Ditto.

03-19 Faint auroral haze effects low in the N.E.

04-00 Clear sky. No drift. Faint nebulous bands at 5° and 20° up in the sky, between N. and E.; trend about N.W. to S.E.

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- 9-04-45 Portions of three faint arches respectively 75° , 35° , and 20° up, between N. and N.E.; trending roughly N.W. and S.E.
- 05-30 A moderately bright nebulous band across the zenith, trending W.N.W. to E.S.E., extending between the zenith and a point 30° up in the W.N.W. Also several fainter parallel bands towards the N.E.
- 06-00 Sky becoming somewhat hazed. Very faint nebulous bands; one from the zenith and somewhat S. of the zenith, towards the W.N.W., or slightly more W. Five others parallel in the N.E. sky.

Sky overcast until the early morning of the 11th.

- 11-01-00 Sky overcast, except in the zenith and to the W. No aurora visible.
- 01-30 Sky clear, except low on the horizon. No aurora visible.
- 02-15 Ditto.
- 02-55 Ditto.
- 03-33 A faint irregular curtain-like band low in the N.N.W., passing through the zenith to a point 10° beyond it towards the S.S.E.
- 04-00 No aurora visible.
- 04-30 Ditto.
- 05-00 Ditto.
- 05-30 Ditto.
- 05-00 Faint curtain 30° up in the N.W.

Sky obscured by cloud and drift until the evening of the 14th.

- 14-20-03 The greater part of the sky obscured by cloud. No aurora visible.
- 20-25 Sky clearing. Moonlight. No aurora visible.
- 21-00 Cloud now only in the N., below 8° . No aurora visible.
- 21-45 Ditto.
- 22-30 Ditto.
- 23-30 Ditto.
- 24-00 Cloud increasing. No aurora visible.
- 15-01-00 Cloud up to 12° in the N. Moonlight. No aurora visible.
- 02-00 Ditto.
- 03-00 Ditto.
- 04-00 Ditto.
- 05-00 Ditto.
- 05-35 Four long faint parallel bands from near the zenith and E. of the zenith to a point on the horizon a little W. of W.N.W.; trend approximately W.N.W. by half W. to E.S.E. by half E.
- 06-00 Cloud increasing. No aurora distinctly discernable.
- 06-40 Dawn strong enough to obscure all but strong effects.

Sky completely obscured until the evening of the 25th, except for occasional glimpses in the zenith, on which occasions no aurora was seen.

- 25-18-00 Sky clear, though view somewhat hazed lower down by drift. A faint greenish-yellow tint of the last traces of sunset on the horizon between W. and W.N.W. No aurora visible.
- 19-25 A complete very faint nebulous arch from E.N.E. to W.S.W. horizons; maximum elevation 35° . Another short piece rising from the W.S.W. horizon, extending 25° towards the zenith.
- 19-31 A faint patch on the W.S.W. horizon; another near the W.N.W. horizon.
- 19-35 Aurora now practically gone.
- 19-46 An extremely faint trace of complete arch still remains; maximum elevation 25° .

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- 25-20-10 A faint nebulous patch over a cloud 10° up in due W.; also a faint haze arch in lower N.W. The nebulous patch is very strikingly associated with a bar of cloud, appears to indicate that at least arches are strengthened when over cloud.
- 20-45 Hazy cloud patches forming in the N. sky. A very faint auroral haze arch, approximately from W.N.W. horizon to E.S.E. horizon; maximum elevation 15° .
- 21-00 Sky clearing again. Hazy in the N., below 25° . Faint nebulous bars low down between N. and N.N.E.
- 21-25 Two parallel nebulous arches from 8° up in the N.E. by N. to a corresponding point in the S. by S., but fading out 40° up in the S.; maximum altitudes respectively 60° and 40° from the S. horizon. Both very faint, except in the N.E. by N., where a moderately bright patch.
- 21-35 Arches now moderately bright, and have swung round, so that trend appears to be about N.N.E. to S.S.W., extending from 20° up in N.N.E. to 30° up in S.S.W.
- 21-45 Moderately bright streamer-like patches of the above arches remain; also a faint nebulous arch over the zenith. Trend of all N.N.E. to S.S.W.
- 21-51 Only very faint patches of the former arches remain.
- 21-59 An arch now appears parallel to the former; maximum elevation 60° in N.W.; stronger in the W. and fragmentary towards the N.E. end.
- 22-18 Faint indications of the 21 h. 59 m. arch remain.
- 22-40 The S.S.W. end of the arch remains very faintly visible; the position lower in the sky. Also a luminous haze low down in the W. over a cloud.
- 22-50 Several very faint haze patches in the lower W. sky between N.W. and S.W. A faint haze around cloud patches low in the W.
- 23-20 Aurora practically gone now.
- 23-35 No aurora visible.
- 23-55 Ditto.
- 24-00 Ditto.
- 26-00-45 A very faint trace of an arch at a maximum elevation of 20° in E.N.E. Sky hazy near horizon.
- 01-00 Drift partially obscures the sky below 25° . Aurora as at 0 h. 45 m.
- 01-30 The appearance of a very faint arch, 5° up, between N.E. and N.
- 02-00 No aurora visible.
- 03-00 Sky quite clear. A faint nebulous band 2° up, between E.N.E. and N. by W.; also a faint nebulous arch from the W.N.W. horizon to 3° up in the N.W., two minutes later becoming brighter and short streamers rising from the arch.
- 03-30 A very faint auroral haze 3° up between N.E. and N.
- 04-00 An auroral haze 2° up between N.E. and N.
- 04-30 Lower northern sky clouded. No aurora visible.
- 05-00 Ditto.
- 06-00 Sky thinly overcast. No aurora visible.
- 17-20 Twilight still strong, but stars can be seen in the E. Drift obscures the sky below 15° . No aurora visible.
- 17-50 Now fairly dark, but still too light for delicate auroral effects. No aurora visible.
- 18-00 Ditto.
- 19-25 No aurora, but a trace of luminosity above the W. horizon; connected with the last traces of twilight.
- 20-20 No aurora visible.
- 21-00 Ditto.
- 21-20 Ditto.
- 22-00 Stars now particularly clear, but below 10° drift obscures the view. A faint nebula near the N. horizon, between N. and N.E.

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- 26-22-38 No aurora visible. Drift somewhat increased.
- 23-07 Ditto.
- 23-29 Ditto.
- 23-47 Ditto.
- 24-00 A faint nebulous band 5° up between N. and N.W.
- 27-00-22 No aurora visible.
- 01-15 Ditto.
- 02-00 Ditto.
- 03-00 Sky clear; part of a faint nebulous arch 30° up between N. and N.E.; trend approximately N.W. to S.E.
- 04-20 Much drift; no aurora visible.
- 05-30 The faintest possible nebulous streak in the zenith, directed to the N.W.; traces of dawn in the E.N.E.
- 06-00 Twilight now would obscure all weak auroral effects; no aurora visible.
- 18-00 Sky clear; no aurora visible.
- 18-30 Ditto. Sky particularly free from auroral haze.
- 19-30 A faint haze arch from the W. horizon appears to junction at 35° up with a faint trace rising from about the N.N.E. horizon; so faint as to be seen only by sideway vision. That above the W. horizon tapers as it rises, and suggests a connection with the last traces of twilight.
- 19-55 A low faint nebulous arch rising from the E.N.E. horizon; fades to invisibility before reaching the N.
- 20-35 Drift obscures 5° above the horizon; no aurora visible.
- 20-58 No aurora visible.
- 21-28 Ditto.
- 21-50 Faint nebulous arch 8° up, between N. by E. and N. by W.
- 22-00 A very faint nebulous arch from 14° up in the N. to near the E. horizon.
- 22-07 Nebulous arch 4° up, between N. and E.N.E.
- 22-17 As at 22 h., but reaching only 10° up.
- 22-45 Clear; no aurora visible.
- 23-00 A brilliant curtain 6° up, between N. and N.E.; a tinge of red on the lower border.
- 23-05 A bright curtain 10° up, between N. by W. and N.N.E.
- 23-10 Now 15° up, but not so bright.
- 23-27 No aurora visible.
- 24-00 A bright band 10° up, between N.N.W. and N. by E.
- 28-00-10 A very faint arch 4° up, between N.W. and N.N.E.
- 00-40 Ditto, but only 2° up.
- 01-05 Ditto, 4° up; a bright patch in the N.N.W.
- 01-35 Faint nebulous band from W.N.W. horizon to 10° up in N.E.; also a few faint streamers 15° up in the N.W.
- 02-00 A patch 5° up in the N.W., and very faint patch 15° up in E.N.E.
- 02-35 A faint auroral haze 4° up, between N.W. and N.E.
- 02-50 A faint broken curtain rising from the N.W. horizon to a point 30° up; also a faint auroral haze 4° up, between N.W. and N.E.
- 03-22 Four curtains trending S.E. by E. to N.W. by W. The brightest one extends from near the zenith to near the horizon in N.W. by W.; another is situated more to the S. and W., and two others more to the N. and E. Broken fragments only in the S.E. sky. None of the curtains are more than moderately bright.
- 03-31 Faint traces only of the three more northerly now remain.

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- 28-03-56 Four curtains trending N.W. to S.E., chiefly in the N. half of the sky, fading out in the S. Two of these, namely, one between the zenith and 15° up in the N.W. and another parallel but lower in the W. are moderately bright; the other two more towards the N. and E. are fainter. The exhibition is a good normal one for this time of day.
- 04-08 Four curtains all between faint and moderately bright; trend towards the N.W., one in the zenith, one north of it, and two south; past the zenith towards the S.E. they fade out rapidly. Very steady in position, movements of any kind scarcely discernible.
- 04-22 Fainter scattered fragments are seen scattered over portions of the sky formerly occupied by curtains. Most prominent 40° up in S.E. A faint haze band seen earlier still exists 15° up in the N. and N.E.
- 04-36 A moderately bright, irregular curtain across the zenith, chiefly towards the N.W., less to S.E. A parallel fragment also moderately bright close by to the W.; also a faint one to the N.; also a continuous arch, maximum elevation in the N.E., where 15° up.
- 04-50½ Five broken curtains, now mostly to the N.E. of the zenith; all much curved. The average trend is more to the W. of N.W. than formerly. Disjointed streamer curtains and isolated streamers, some moderately bright, slowly waxing and waning, and moving very slowly.
- 05-10 Three main lines of streamers, all faint, one in the zenith and two N. and E. of it; visible chiefly in the N.W. sky; all much fainter than anything during the last hour. Faint traces of dawn in the E. to E. by S.
- 05-23½ A bright curtain from the zenith to 20° up in the N.W., waxing and waning; streamers appear to be travelling to the W. Two parallel fainter curtains to the W. and S.; only the faintest traces in the N. sky, likewise to the S.E.
- 05-38 An exceedingly faint band across the zenith from about 50° up in the S.E. to 80° up in N.W. Twilight strong now.
- 05-53 No aurora visible. Still sufficiently dark to note any but faint effects.
- 06-05 No aurora visible. All but moderately strong to strong auroral effects would be obscured now.

Sky obscured till evening of 29th.

- 29-20-00 Sky clear, light drift obscures sky below 8° up. No aurora visible.

20-30 Ditto.

21-00 Ditto.

21-15 Ditto.

21-58 Ditto.

22-43 Ditto.

23-28 Ditto.

23-48 Ditto.

24-00 Ditto.

30-01-00 Ditto.

02-14 Ditto.

03-00 Ditto.

05-08 Ditto.

06-00 Ditto.

19-30 Lower sky hazy with drift. No aurora visible.

20-35 Ditto.

21-10 Ditto.

22-07 Ditto.

23-10 Ditto.

24-00 Ditto.

31-01-00 Ditto.

02-00 Ditto.

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- 31-03-00 A faint indication of an arch from the zenith towards the N.W.
- 03-17½ Faint broken arch from 5° altitude N.W. by W. to 30° altitude, very faint.
- 03-32 A faint portion of curtain from 2° up in the W.N.W. to 10° up. Brighter at the lower end; also a very faint glow around the horizon 2° up, between W.N.W. and N.E.
- 03-47 The same general display. The lower end now a bright patch on the W. by N. horizon, from which faint curtains trend at 45° to the horizon for 10° in length. A very faint nebulous glow around the N. horizon.
- 04-10 Aurora now much stronger, of moderate brightness. An irregular curtain from the W.N.W. horizon through the zenith to the S.E. horizon; bright near the horizon at both ends; curves to the E. on the S.E. side of the zenith. A small branch from the zenith towards the S.W., 15° in length.
- 04-27 Curtain has faded in the N.W.; now stretches from 70° up in N.W. to S.E. horizon as a broken curtain; from a point 45° up on the S.E. side a branch descends to the E. by S. horizon. The display moderate; bright; a very faint glow along the N. horizon.
- 04-45½ A bright patch on the W. by N. horizon. A portion of a faint curtain 10° up, N.W. by W.; also faint portions of curtains from S.E. horizon to 40° up, and from E. by S. horizon to 30° up. Very faint nebulous patches 45° up in the S.W.
- 05-07 Dawn making its appearance, and auroral effects very faint; a patch near the W. by N. horizon, from which a faint band rises 20°; a very faint continuation seen in the zenith, trending to the S.E. At 45° up in the S.W. there is a wide faint streamer rising vertically.
- 05-25 Dawn now obliterates the Milky Way. Very faint indications of a band at 20° up in the W. by N., faded whilst observing.
- 05-32 A very faint portion of a curtain visible in the zenith, 20° in length, trending W.N.W. to E.S.E. Dawn.
- 18-00 Sky clear; twilight. No aurora visible.
- 19-12 A faint glow along the N. to N.E. horizon.
- 20-05 A very faint nebulous band 2° up, between N.W. and N.E.
- 20-11 A very faint nebulous band 2° up, between N.E. and N. by W., broken in the N.
- 20-55 A faint glow along the N. horizon.
- 21-35 A faint to moderate bright nebulous band 3° up in N.W. to N.E. by N.
- 22-33 A bright moving folded curtain from E. horizon to 2° up in N. by W.; most convolution in the N.; intensity strong.
- 22-45 A bright active curtain between N.N.W. and E., brightest between N.N.W. and N.E., maximum elevation 11°; some very long streamers quite 4° high.
- 23-10 Very faint nebulous band 18° up, between N. by W. and E.N.E.
- 24-00 A bright band 8° up, between N. by W. and N.E.

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- 1-01-00 Bright nebulous patch 20° up in the N.E., fading away in the E.N.E., the N. end fading away in the N. Isolated streamers of a broken curtain seen between 8° up in the N.W., and 80° in the W.
- 02-00 Faint glow 2° up, between N. by E. and N.E. Several patches between 10° up in the N. and 70° up in E., appearing to be portions of two broken bands; also isolated streamers as at 1 h.
- 03-00 Very faint arch 10° up in the N.W.
- 04-00 A faint streamer 10° up in the W., 3° high; also a faint arch from N.W. horizon to 6° up in the N. by E.
- 05-00 No aurora visible.
- 05-10 Very faint streamers 40° up in the N.W.
- 05-32 No aurora visible.

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- 1-18-30 No aurora visible. Sky obscured by drift, below 25°.
 19-37 Ditto.
 20-43 Ditto.
 21-00 Ditto.
 21-15 Ditto.
 21-30 Ditto.
 21-45 Ditto.
 22-00 Ditto.
 22-33 Ditto.
 23-00 Ditto.

Sky now obscured by cloud and drift until the morning of the 6th.

- 6-01-00 Clear in the zenith, but hazy around the horizon to 25° up. No aurora visible.
 02-00 Ditto.
 03-00 Ditto.
 03-45 Ditto.
 04-15 Ditto.
 05-00 Ditto.

Overcast until midnight.

- 24-00 Clearing, now obscured below 30°. A moderately bright curtain reaching 35° up, extending between N. and N.E.
 7-00-08 A nebulous band, 35° up, between N.W. and E.N.E.; trend appears to be about N.N.W. to S.S.E.
 00-30 A faint bent curtain extends between 30° up in E. to 15° up in N. by W.; maximum elevation, 45° in N.
 01-00 Very faint glow 12° up in N.E.
 01-30 A very faint auroral haze 12° up in N.E.
 02-00 Haze as at 1h. 30m: A faint band from the zenith to 60° up in the N.N.W., trend N.N.W. to S.S.E.
 03-00 Faint auroral haze 10° up in the N.E.
 04-00 A very faint band, 6° up, between N.E. and N. by W.
 05-00 The band of 4h. still visible.
 19-49 Sky clear south of the zenith, lower north sky covered with cloud. Moon nearly half full. No aurora visible.
 21-00 Sky obscured below 35° in the N. No aurora visible.
 21-28 Ditto.
 22-00 Ditto.
 22-30 Ditto.
 22-55 Ditto.
 23-35 Ditto.
 24-00 Ditto.
 8-01-00 Much of sky covered with thin cloud. No aurora visible.
 02-33 Ditto.
 03-00 Much of the lower north sky covered with thin cloud. No aurora visible.
 04-10 Faint traces of two N.W. to S.E. arches, 45° and 25° up in the N.E. sky respectively.

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- 8-04-25 A very faint nebulous arch across the zenith from N.W. to S.E., slightly concave to the west.
- 05-00 Twilight appearing. No aurora visible.
- 06-00 The red flush of sunrise in the E.
- 19-20 Sky obscured below 35°. A half-moon shining. No aurora visible.
- 20-13 Ditto.
- 21-00 Ditto.
- 21-45 Ditto.
- 23-15 Ditto.
- 23-32 Ditto.
- 23-45 Ditto.
- 9-00-04 Two moderately bright bands, 70° and 60° up in the N. respectively; trend E. and W. Slightly convex to N.
- 00-12 The auroral bands now fainter and broken.
- 00-30. A faint band just visible in the moonlight 40° up, between N. and N.E. Also a patch 50° up in the N.E.
- 01-25 No aurora visible.
- 02-03 Ditto.
- 02-17 Ditto.
- 03-00 Most of the western sky, also the lower sky in the east, obscured by cloud. No aurora visible.
- 04-00. Faint streamers in the zenith. Clouds clearing away considerably.
- 04-25 Two faint parallel curtains, 5° apart, from the N.W. through the zenith to the S.E.
- 04-43. A faint curtain from 10° up in the N.W. by W. to the zenith.
- 05-00 No aurora visible.
- 13-40 No aurora visible. Twilight would obscure weak effects.
- 19-59 A bright curtain in the N.W. by W. to E.N.E., reaching a maximum elevation of 13° in the N.N.E.; high streamers.
- 20-09½ Moderately bright nebulous band from the W.N.W. horizon to the E. horizon, reaching a maximum elevation of 12°. Also a patch of streamers 16° up in the E.N.E.
- 20-29 Two nebulous bands over a range as above, but fading out towards the western end; now very faint except for a moderately bright patch in the E.N.E.
- 20-43½ A moderately bright curtain between N. by W. and N.E., maximum elevation 22°; showing faint movement of the luminescence from W. to E. Appears to be curved slightly concave towards the N. Below at 12° is a band between N. by W. and E.N.E.; moderately bright between N.N.E. and N.E.
- 20-59½ A faint bar 8° up, between N.N.E. and N.E.
- 21-16 No aurora visible.
- 21-28½ Ditto.
- 21-46½ A bright curtain from the E. to W.N.W., maximum elevation, 60° between E.N.E. and N.; broken in the N.; lower between N.N.W. and W.N.W.; active streamer movement from W. to E., and a tinge of red below. Effects seen in moonlight from a half-moon shining in a clear sky. The intensities mentioned this evening are those as seen not allowing for moonlight.
- 21-48¾ Aurora now only very faint. A W.N.W. to N. portion and a trace to the E.N.E. Also lower in the E.N.E. to N.E. is a nebulous band, 10° up.
- 21-50 The form is now well defined. The curtain extends from near the W. by N. horizon around uniformly to a point 10° up in the N., it then curves back to the N.N.W., at the same time rising; in the N.N.W. it curves back again and rises rapidly, sweeping round as a uniform curve to the E. by S. horizon after reaching a maximum elevation of 60°. Streamers seen to be travelling from W. to E. around the curve.

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- 9-21-51 $\frac{5}{8}$ The curtain brightened up between N. and N.W. for a few seconds.
- 21-52 $\frac{1}{2}$ All now very faint; practically faded out to the E. of N.
- 21-57 $\frac{1}{2}$ Is now brighter above, but fading in a few seconds.
- 21-58 $\frac{1}{2}$ Again bright, instantly fading.
- 21-58 $\frac{5}{8}$ Again strong, especially in the E.S.E.
- The shape of the curtain has been continuously altering, the eastern end swinging round more and more to the south and rising towards the zenith. About this time curved fragments were observed eastward of and parallel to the main convolution. During the last few minutes the luminosity has been steadily transferring itself to the eastern end, the western end fading.
- 22-02 $\frac{1}{2}$ Faded in the zenith, brightest in the S.E., where two bands disappear over the horizon; nebulous in the north, especially seen between N.W. and N.E., where it reaches a maximum elevation of 45°.
- From this time on it rapidly increases in brightness, quickly reaching the maximum stage. The main portion from this time on is the N.W. to S.E. trending portion, extending from north of the zenith to the S.E. horizon, it reaches the zenith itself within a few minutes.
- 22-05 $\frac{3}{8}$ A momentary brightening of the main curtain. This is one of a number of rapidly succeeding intensity pulsations, leading up to the absolute maximum—each intensity pulsation being a minor maximum.
- 22-06 $\frac{1}{8}$ Another bright point. The intensity pulsations now come from the S.E.
- 22-06 $\frac{1}{2}$ Ditto.
- 22-07 $\frac{1}{2}$ Ditto.
- 22-08 $\frac{7}{8}$ Three intensity points at about the absolute maximum of this evening's exhibition. These three times and the four preceding were all taken at the one observation without a gap.
- 22-09 $\frac{3}{8}$ These three last maxima were accompanied by the usual colours of brilliant aurora, but the tints were not strong, perhaps on account of the moonlight. Rapid rippling of streamers was observable all the time, appearing to travel dominantly to the east, but with a minor back surge to the west; however, when in the zenith most of the apparent westward travel was seen to be accounted for by convolutions. When in the zenith the curtain was seen to be very much zigzagged, perhaps explaining the cross cleavage, and giving it a considerable breadth. At the maximum period the brilliant portion was from a point N. of the zenith across the zenith to the S.E. horizon. The display in the lower N., N.W., and W.N.W. sky was broken irregular and much less brilliant.
- From this time on the waning appears to have set in, and the curtain slowly swung back, retracing its steps and sinking. In its waxing phases the turning movement of the main portion of the curtain as seen from the hut was clockwise, not counter clockwise, as is usual.
- 22-12 Almost nothing to be seen now. Breaks between each observation now.
- 22-12 $\frac{1}{2}$ Commencing to appear again.
- 22-13 $\frac{1}{2}$ Another illumination.
- 22-14 $\frac{1}{2}$ Again faded and little to be seen.
- 22-15 $\frac{1}{2}$ Only traces now, and all lower to the E., the S.E. limb swinging round to towards the E.
- 22-22 $\frac{1}{4}$ Traces of a band from the W.N.W. horizon round to the E.S.E. horizon, reaching a maximum elevation of 15°. Also a moderately bright patch on the E.S.E. horizon.
- 22-23 A slight brightening as far as E.N.E., then fading again.
- 22-28 Only traces now remaining. An arch 5° up, between N. and N.W., and 12° up, between E. by S. and E. by N., both faint.
- 22-38 A faint patch 3° up in the E. and a faint bar 8° up between N.E. and N.E. by N.
- 22-46 $\frac{1}{4}$ A faint to moderately bright nebulous mass 10° up N.E. to E. by S.
- 22-54 $\frac{1}{2}$ Very faint traces of the original curtain low down, and further to the E. as : Traces 4° up between N. and N. by W.; another 5° up in N.N.E.; several patches about E.N.E. horizon, and traces of streamers as high as 25° in the N.E.
- 23-12 $\frac{1}{2}$ Very faint patches 10° up in the N.E. and on the E. by N. horizon.

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9-23-16 A faint band 6° up in the E.N.E.23-17 $\frac{1}{2}$ The band just referred to faded away and a faint one from the E. by S. horizon to 5° up in the E. by N. appeared.

23-29 No aurora visible.

23-44 $\frac{1}{2}$ Ditto. Faint effects, of course, would be obscured by the moonlight.

24-00 Ditto.

10-00-27 A faint bar 6° up, between N. and N.N.E.00-29 Bar fainter, but 8° up.

00-37 No aurora visible.

00-50 Ditto.

01-03 Ditto.

01-36 A faint patch 3° up in the N.01-53 Faint band N.E. to N.N.W., 7° up.

02-34 No aurora visible.

03-06 Ditto.

03-40 Ditto.

04-15 Ditto.

04-15 Ditto.

21-00 Cloud obscures sky for 30° above the northern horizon. Bright moon. No aurora visible.

21-23 Ditto.

22-03 Ditto.

22-36 Ditto. Drift increasing assists to obscure the view.

23-08 Sky hazed by a thin cloud. No aurora visible.

23-26 Ditto.

Drift and cloud obscure the view until the evening of the 11th.

11-19-40 Sky below 15° hazy and obscured by drift. A faint nebulous band 15° up, N. by E. to N.W. Moonlight.20-00 A patch of streamers rising above the drift cloud 15° up in N.

20-11 No aurora visible.

20-30 Ditto.

20-43 Ditto.

20-57 Ditto.

21-28 $\frac{1}{2}$ Ditto.21-41 $\frac{1}{2}$ A faint nebulous band 20° up, between N. and N.E.

21-56 No aurora visible.

22-05 Ditto.

22-18 Ditto.

22-35 Ditto.

22-48 Ditto.

22-56 Ditto.

23-18 Ditto.

23-37 Ditto.

24-00 Ditto.

12-00-29 A nebulous band 14° up, N. to N.E.00-35 Band stronger, waxing and waning. The outline identical with that of the early stages of the 9th inst., extending between W.N.W. and E.N.E. with a kink just west of north. Maximum elevation 16° .

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- 12-00-55 A moderately bright kinked curtain extending from low in the N. by W. to N.E. horizon. Maximum elevation 25°; waxing and waning.
- 01-00 An even outlined curtain 30° up, N. by W. to N.E.; trend probably W.N.W. to E.S.E.
- 01-15 A very faint arch from 4° up N.N.W. to 5° up N.E.
- 01-25 A moderate bright arch from N. to E.N.E., 5° up; strongest in the N.E.
- 02-00 No aurora visible.
- 02-25 Ditto.
- 02-45 Ditto.
- 03-03 A very faint auroral band from N. to E.N.E. reaching 15° up.
- 03-16 A faint arch from the horizon in the N.W. to 30° up in the N. Also three faint parallel bands from S.E. horizon to 40° up towards the zenith.
- 03-30 No aurora visible.
- 03-45 Ditto.
- 04-00 Ditto.
- 04-30 Ditto. Dawn commencing.

Sky obscured, clearing somewhat on the evening of the 15th.

- 15-21-30 Clear in the zenith. No aurora visible.
- 22-00 Ditto.
- 23-00 The lower sky much clouded over. Patches of aurora seen through cloud low in the N. and N.W.
- 23-15 Traces of an auroral band about 10° up, seen through foggy cloud between N. and N.W.
- 23-45 Cloud rapidly increasing. No aurora visible.

Sky obscured, clearing on the morning of the 19th.

- 19-19-50 Sky unusually clear and very little cloud. No aurora visible.
- 20-22 A very faint nebulous arch 30° up, from S.S.W. through S. to E., brightest near E. horizon; several minutes before this showed as a haze band becoming brighter. Also two nebulous patches, one just S. of the zenith, and another 45° up in the S.E.
- 20-31 An ill-defined arch 40° up, faint in the middle, extending between E. and S.W., waxing and waning in the E. Also a very faint arch 7° up from N. by W. to E.
- 20-40 A very faint curtain 70° up in S.; the W.S.W. extremity is up 20°, waxing and waning; the eastern end now terminates 8° up in the E.N.E. Also an extremely faint band low in the north extending from N. by W. to E.N.E.
- 20-52 A very faint haze arch extending from W. by S. to E.N.E., passing a few degrees north of the zenith, brightest at the extremities. Also a very faint arch low in the N. between N. by W. and E.N.E.
- 21-04 A couple of exceedingly faint detached streamer curtains passing a little north of the zenith from the S.S.W. horizon to about the N.E. horizon. Only occasional patches visible.
- 21-21 The aurora, from a state of almost invisibility, is now brightening somewhat. Traces of the two detached streamer curtains visible, one passing 50° up, the other 30° up, from about S.W. to N. by E. horizons; slightly concave on W.
- 21-28 Two faint detached streamer curtains still visible, one 45°, the other 25° up between the S.W. and N. by E. horizons; concave on W.
- 21-39½ A very faint hazy broken streamer arch 12° up, trending about S.W. by S. to N.E. by N. Also a faint glow over a cloud in the N. to N.E. as previously.
- 21-40 All faded but the centre portion.
- 21-56½ A very faint trace of an arch 10° up in the W. to N. horizon. The luminosity over the cloud decreasing.
- 22-09 A faint luminous haze in the lower W. to N. sky; also faint luminosity over cloud low down between N. and E.N.E.
- 22-21½ A very faint detached streamer curtain from 10° up in the W. to the N. by W. horizon. Brightest in the N., fading out as it proceeds south.

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September.

- 19-22-27 A faint curtain from the horizon in the N.N.W. to 5° up in the W.
 22-29½ A detached streamer curtain increasing in intensity visible between W. by S. and N.W.
 Maximum elevation of the lower extremity 5°.
 22-43½ A very faint haze band 6° up, W. by N. to N.W.
 23-00 A very faint patch 5° up in the N.W.
 23-12 No sign of aurora.
 24-00 Sky becoming hazy. No aurora visible.

Sky overcast until the evening of the 22nd.

- 22-20-45 Sky clear except near the horizon. A faint auroral glow in the E. seen through misty cloud between the horizon and 8° up.
 21-05 Auroral glow above cloud 6° up in the N.E.
 21-22½ Faint streamers and nebula between N. and E. Maximum elevation 8°.
 21-34½ Sky now completely clear. An extremely faint nebulous band 8° up, between N.N.E. and E.N.E.
 21-46½ No aurora visible.
 22-03 Ditto.
 22-37 Ditto.
 22-40 An extremely faint aurora increasing somewhat.
 22-57 A faint nebulous band, N. to N.E. by E.; maximum elevation 9; brightest in N.E.
 23-06 An extremely faint nebulous band 8° up, N. to E.N.E.
 23-20 The aurora brightening. A faint to moderate bright curtain between N.N.W. and E.N.E. Maximum elevation 10°, long streamers.
 23-26 The same extending between N.W. and N.E., active and moderately bright.
 23-35 Now extending between N.W. and E.N.E.; long steady streamers; curtain moderately bright in parts, but patchy.
 23-45 Curtain fainter and more nebulous: extends between N.W. and E.N.E. Maximum elevation, 5°.
 24-00 Several faint detached streamer patches 6° up, between N.W. and E.N.E.
- 23-00-23 Ditto, but fainter.
 00-40 Ditto.
 00-55 Faint curtains 6° up, N. to E.N.E.
 01-10 Faint curtain low down, extending between N. and S.E.
 01-30 Ditto between N. and E.
 01-50 Very faint nebulous band near horizon, between N. and E.
 02-30 Faintest possible glow low in the N. Already twilight appearing on E. horizon.
- 19-55 Glow on cloud 10° up, N. to N.N.W.
 20-06 Very faint glow 8° up, N. to N.N.W.
 20-22 No aurora visible.
 20-43 Sky obscured by cloud low in the N. and up to 35° in E. and S.E. Extremely faint glow 5° up in N.
 20-52 Ditto.
 21-00 Cloud between horizon and 5° up in north, between W. and E.N.E.; above this, sky hazy to 15°. A very faint glow 6° up, between N. and N.N.E.
 21-25 No aurora visible.
 21-35 Ditto.
 21-47 Ditto.
 22-00 Ditto.
 22-10 Two bright curtains 4° and 6° up, between N.N.W. and N.N.E.; streamers 2° high.

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- 23-22-12 Main curtain extends from 2° up in N.W. to 12° up in N.E.
- 22-22 A wavy curtain from 5° up in W.N.W., through N. (where it is 10° up) to 10° above the E.N.E. horizon. Very high streamers. Also a short curtain 7° up in N.E. and bright glow 8° up in N.W.
- 22-27 A fine bright curtain between W. by N. and E. by S. Maximum elevation 30°; a moderate amount of movement. Streamers unusually high, about 9°.
- 22-32 Curtain still strong, but hardly so active as several minutes ago. Maximum elevation, 38°.
- 22-36 Curtain more nebulous and fainter; very little now E. of N. In addition an auroral haze 7° up in S.W.
- 22-51 The main curtain now shows up well again between a point 20° up in the E. and a point 5° up in the W.N.W. Two lower nebulous patches in lower north between N.N.E. and N.E. Also an auroral haze band 8° up, between S. and S.W.
- 22-56 A minor rekindling, but the aurora generally less brilliant than earlier.
- 22-57 Curtain rekindles in the N.
- 23-10 Aurora appears now as a long faint to moderately bright nebulous band. Maximum elevation 18°.
- 23-30 Curtain of an elongated S shape from E.N.E. to N.W.; maximum altitude 6°; streamers bright in patches from time to time.
- 23-31 Aurora very dull and nebulous. A patch between N.W. and N., and another in E.N.E. Maximum elevation 6°.
- 23-47½ Curtains between N.W. and E.N.E. concave on N.; very faint, with moderately bright patches. Maximum elevation 20°.
- 24-00-02 Moderately bright curtain with long streamers between N. by W. and N.N.E., extending beyond to the E.S.E. as an intermittent nebulous band of very faint intensity. Maximum elevation 20°. Shape like that of the early stages of the 9th inst. A minute later it faded to dulness.
- 00-19 Faint curtain from 3° up in the N.W. to 10° up in the N. Also a very faint nebulous haze on the horizon, between E.N.E. and E.
- 00-30 A very faint curtain as at 2 m. after midnight, but moved bodily somewhat to the W. and lower.
- 00-50 Bright curtain from 2° up in the W.N.W. to 10° up in N.; streamers 2° in length. A second somewhat fainter curtain extends from 3° up in N.W. just below the previous to 8° up in N., then on to the E. by S. horizon; brightest at the eastern end.
- 01-31 A faint discontinuous curtain from 2° up in W.N.W., where several convolutions, crossing the northern sky at a maximum elevation of 25° in the N.E., then falling to the S.E. horizon; streamers at the N.W. end, nebulous to the S.E.
- 01-46 The curtain still remains in the same position, though the S.E. end has faded out; bright at the W.N.W. extremity. The whole now rapidly waned becoming very faint in two minutes.
- 02-00 The curtain remains very bright at the W.N.W. end, faint at the highest point, which is in the N.E. At 15° up in the N.E. another very faint short curtain.
- 02-15 A complete but faint curtain now stretches from the N.W. horizon, rising to 25° in the N.E., then on to the S.S.E. horizon. The remains of the first curtain now faint, visible from the W.N.W. horizon to 20° up in the N.
- 02-35 Aurora now faint, of the intensity of the Milky Way. An arch from the N. by W. horizon to 35° up in the N.E. to the S.S.E. horizon. A second faint arch from the N.W. horizon to the zenith; also a streamer-like portion of a third about 10° in height in the W. by N. Dawn appearing.
- 03-00 Sky hazy all over, a few stars visible. A faint nebulous glow near horizon in W. by N. and in N.W.
- 03-15 Cloud along the western and north-eastern horizons, clouded elsewhere. A bright patch of aurora seen through cloud at 5° up W.N.W.
- 20-10 Sky clear of cloud, but obscured by drift below 25°. No aurora visible.
- 21-15 Ditto.
- 21-38 Ditto.
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1913.

September.

21-21-48 Sky now obscured to 35° up. A faint glow over the drift in the N.

22-10 No aurora visible.

22-27 Ditto.

23-05 An auroral glow over drift bank between N. by W. and N.N.E.

23-30 An auroral glow on drift 25° up, N. by W. to N.E.

24-00 A very faint glow 5° up in the N. by W. Drift interference subsided.

25-01-00 Drift again obscures lower sky. No aurora visible.

02-00 Ditto.

03-00 Ditto.

20-30 Sky clouded below 45° up. No aurora visible.

20-40 Ditto.

20-50 Ditto.

21-00 Ditto.

Sky now obscured by cloud until the late evening of the 28th.

28-23-00 Sky largely obscured by cloud. No aurora visible.

23-30 Sky clearing. No aurora visible.

24-00 Lower sky only obscured. No aurora visible.

29-01-10 Sky slightly hazy. A faint glow 10° up in the N.E.

01-30 Glow stronger.

02-00 No aurora visible.

03-00 No aurora visible.

21-00 Sky largely overcast. No aurora visible.

22-00 Lower sky obscured by cloud. No aurora visible.

22-15 A faint glow over cloud 10° up in the N.E.

23-06 A trace of a glow on a cloud 6° up in the N. Sky cleared.

23-25 A faint patch 3° up in the N.

23-37 No aurora visible.

23-50 No aurora visible.

24-00 Ditto.

30-01-00 Glow 10° up in the N.W., also at same altitude in the N.E.

01-30 No aurora visible.

02-00 Ditto.

02-40 A faint auroral band from 5° up in the N.W., ascending towards the zenith to an altitude of 30°. The Milky Way now almost invisible in the twilight.

03-00 A very faint band from 30° up in N.N.W. to a point 5° on the S.S.E. side of the zenith. Twilight obscures the Milky Way.

03-15 No aurora visible. Twilight considerable.

Sky obscured until the evening of 2nd October.

October.

2-20-51 Two faint nebulous arches; one 85° up in the N., the other fainter and 25° up in the N.; visible in the western half of the sky; trend W. by S. to E. by N. Cloud obscures sky up to 20° from the N. horizon.

21-45 No aurora visible.

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October.

- 2-21-50 A strong glow over clouds 5° up in E.
 22-30 No aurora visible. Considerable drift obscures view.
 23-00 Ditto.
 24-00 Ditto.

Drift obscures view in the early morning hours of the 3rd.

- 3-20-45 Sky clear. Moderate drift. No aurora visible.
 21-00 Ditto.
 22-00 Ditto.
 22-30 Ditto.
 23-00 Ditto. Light drift only.
 23-30 Ditto.
 24-00 Ditto.

- 4-00-40 Ditto.
 01-00 Ditto.
 02-00 Ditto.
 03-00 Ditto.

- 21-00 Sky clear. Considerable drift, obscuring lower sky. No aurora visible.
 22-00 Ditto.
 23-00 Ditto.
 24-00 Ditto.

Sky obscured until the evening of the 8th.

- 8-21-00 Sky clear. Considerable drift. No aurora visible. Moonlight.
 22-00 Ditto.
 22-37 Ditto.
 23-15 Ditto.
 23-35 Ditto.
 24-00 Ditto.

- 9-01-00 Ditto.
 02-00 Ditto.
 02-30 Ditto. Dawn in the S.E. sky.

- 21-40 Sky almost clear. Moderate drift. A short auroral bar 10° up in the N.; must be fairly bright as the moonlight is strong.
 21-45 No aurora visible.
 22-05 A moderately bright band from 12° up in the N. to 4° up in the N.W.
 22-25 An auroral glow through the drift 3° up, between N. and N.W.
 23-25 No aurora visible.
 24-00 Ditto.

- 10-00-20 No aurora visible.
 01-00 Ditto.
 01-30 Ditto.
 02-00 Ditto.
 03-00 Ditto. Considerable twilight.

- 21-00 Sky clear. Bright moonlight. No drift. No aurora visible.

1913.

October.

- 10-21-38 A uniform moderately bright nebulous arch between N.W. and N.E. horizons, 5° up in the N.
- 21-50 A faint band low in the N. and a moderately bright band from E. by N. horizon up to 10° in the N.E.
- 21-53 The band becomes very bright, and also extends a little northwards.
- 21-54½ A bright patch formed 2° higher than the above band in the N.E. by E.
- 21-58 The bright patch referred to has extended into a very bright band, E. by N. horizon to 12° up in N. The first band now fainter. A minute or so later another patch 2° higher still appeared in the N.E. by E.
- 22-03½ A temporary waning of the band. The main band reaches a maximum elevation of 12° in N.; the extent is from N.N.W. to E.N.E. Traces of a higher arch appear in the N.E. and E.N.E.
- 22-13 A bright band, apparently now trending N.W. to S.E., from 5° up in the N.N.E. to 4° up in the E.N.E., rising to 12°. Very bright in N.N.E. Parallel cross cleavage well shown, probably the effect of convolutions partly obliterated by the moonlight. A minute later the folds had flattened out and the whole much fainter.
- 22-22 Band much fainter. Extends from 10° up in the N. by W. down to the E. horizon; somewhat broken.
- 22-23 Brightened in the N., and a faint streamer rising from it in the E. by N.
- 22-32 All very faint indeed, and more broken. 20 seconds later it commenced to brighten in the N.E. and fade elsewhere. By 22h. 33m. 00sec. it extended from 12° up in the N. by E. to 8° up in the E.N.E.
- 22-41 Only a very faint remnant from 6° up in N.E. to E. by N., where view cut off by rocky landscape.
- 22-42 Only the upper portion in the E.N.E. remains.
- 22-42½ No aurora visible during the next minute.
- 22-52½ Ditto, during the next half-minute.
- 23-00 No aurora visible.
- 23-15 Ditto.
- 23-30 Ditto.
- 24-00 Ditto.
- 11-02-00 Ditto.
- 21-30 Sky clear. Very little drift. Strong moonlight. No aurora visible.
- 21-47 Faint auroral bar 2° up, between N. and N.E.
- 21-57 No aurora visible.
- 22-05 A regular arch, moderately bright in parts, between N. and N.E., reaching a maximum elevation of 5° in N.N.E.
- 22-12 Aurora practically faded.
- 22-23 No aurora visible.
- 22-35 Ditto.
- 22-56 Ditto.
- 23-10 Ditto.
- 23-40 Ditto.
- 23-50 Ditto.
- 24-00 Ditto.
- 12-00-20 Ditto.
- 01-00 Ditto.
- 02-00 A bright narrow band of aurora from the N.N.W. horizon across the zenith to about 25° beyond. Moonlight and dawn interfering.
- 02-15 A very faint trace of the band in the N.W. sky.

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October.

12-02-25 No aurora visible. Now strong twilight.

21-00 Sky clear. Moonlight. Moderate drift. No aurora visible.

22-00 Traces of several curtains visible in the lower N. sky, the topmost from 20° up in the N. to the E. horizon. Also a bright bar 5° up in the N. The display waxing and waning, and moderately strong.

22-10 A curtain across all the N. sky, 3° up in the N.N.W. to N., then rising rapidly and sweeping to the E., reaching a maximum elevation of 25° in the N.E. The general shape reminiscent of that of the strong September 9th display.

22-20 The curtain now more regular; maximum elevation, 2°.

22-34 Curtain faint to moderately bright from 25° up in N. to near the W.N.W. horizon.

22-57 Faint traces of an arch, between N.N.W. and E.N.E. Maximum elevation 20° in N.

23-27 No aurora visible.

24-00 Ditto.

13-01-00 Ditto.

02-00 Ditto.

03-00 Ditto. Dawn.

22-00 Cloud obscuring much of the sky. Moonlight. No aurora visible.

23-00 Ditto. Clouds clearing.

24-00 Sky clear. No aurora visible.

14-00-20 Ditto.

00-45 Ditto.

01-13 Ditto.

01-50 Ditto.

02-23 Ditto. Traces of dawn.

03-00 Dawn obliterates the stars. No aurora visible.

Sky now overcast, clearing on the evening of the 16th inst.

16-22-00 Sky clear. Much drift obscures view of lower sky. No aurora visible.

22-40 Ditto.

23-00 Ditto.

24-00 Ditto.

17-02-00 Ditto.

Sky now completely overcast, clearing on the evening of 18th.

18-21-30 Sky clear. No drift. No aurora visible though twilight sufficiently subdued to render visible several stars.

21-50 No aurora visible.

22-00 Ditto.

22-15 Ditto. Twilight now faint.

22-30 No aurora visible.

22-45 Ditto.

23-05 Ditto.

23-20 Ditto.

23-30 Ditto.

23-45 Ditto.

24-00 A faint suggestion of auroral haze on the horizon in the N. Faint twilight on the southern horizon

1913.

October.

- 19-00-15 A very faint tenuous broken curtain 5° up in the N. . . Also suggestions of streamers higher up.
- 00-32 No aurora visible.
- 00-37 Ditto.
- 01-00 Ditto.
- 02-00 Ditto.
- 21-30 Sky almost clear of cloud. No aurora visible.
- 21-55 Ditto.
- 22-00 Ditto.
- 22-10 Ditto.
- 22-26 A bright band 3° up, from N.E. to N.N.E.
- 22-33 A faint arch with a few streamers 6° up, between N.E. and N. by W.
- 22-35 A curtain 9° up in the N. to the E. horizon; broken but bright at the eastern end; rapid motion of the streamers to the W.
- 22-38 Bright continuous curtain from 11° up in the N. to the E. horizon; faintly reddish below.
- 22-40 Curtain much faded.
- 22-44 $\frac{3}{4}$ Again much fainter; now extends from 10° up in N. to 4° up in E.N.E.
- 22-46 $\frac{1}{4}$ Only a very faint trace of the curtain now.
- 22-46 $\frac{3}{4}$ A few moderately bright streamers fading in 15° seconds. Apparently still moderately bright on the horizon at the eastern end, but view cut off by rocks.
- 22-50 Only a very faint trace except within 2° of the horizon, between E.N.E. and E. The last five entries result of continuous observations.
- 22-56 The eastern end has faded, but revived a little elsewhere, now waning.
- 23-02 A momentary revival. Now a faint broken active streamer-curtain, between N. and E.N.E., reaching maximum elevation 8° .
- 23-04 Now fainter; 6° up, waxing and waning.
- 23-05 $\frac{3}{4}$ Faded still more.
- 23-07 Only a faint haze remains in place of former curtain; but a faint nebulous bar appears 1° up between N. and N. by E.
- 23-08 $\frac{3}{4}$ The nebulous bar now increasing somewhat.
- 23-12 The bar now fades, but the position of the upper arch, which has for some time been outlined only by faint haze, increases in part to a strong haze.
- 23-16 A faint haze patch 5° up in the N., and traces of haze further to the E.
- 23-19 $\frac{1}{2}$ A faint haze band 3° up in N.N.E. to E. horizon.
- 23-27 A revival to moderately bright in parts, especially in the N.N.E. Maximum elevation 4° ; nebulous patches and occasional streamers.
- 23-29 $\frac{3}{4}$ A momentary revival; streamers moving to the east.
- 23-31 Revival at a single spot 4° up in the N. by E.
- 23-32 $\frac{1}{2}$ Another revival. Visible aurora now resolved into a curtain 5° up, N. by W. to N.N.E.
- 23-33 $\frac{1}{4}$ A minor revival.
- 23-35 $\frac{1}{2}$ A slight revival. Now extends between N.N.W. and N.N.E.
- 23-43 $\frac{3}{4}$ A faint nebulous patch 3° up in N. by E. Auroral haze elsewhere low between N. and E.N.E. Continuous observations since 23 h. 02 m.
- 24-00 No aurora visible.
- 20-00-06 Ditto.
- 00-15 Ditto.
- 00-22 Faint glow 2° up N. to N. by W.
- 00-38 A faint nebulous band 8° up, between N.W. and E.N.E.
- 01-00 Patches of auroral nebula low between N. and N.E.

1913.

October.

20-02-00 Lower sky clouded. No aurora visible.

22-00 Thin cloud over almost the whole sky. No aurora visible.

23-00 Much cloud; but clearing. Drift increasing. No aurora visible.

23-10 A bright curtain 4° up, between N.W. and N.N.E., partly obscured by cloud and drift.

23-16 A dull nebulous band 3° up, between N. by W. and N. by E.

23-18 Very dull.

23-19½ Practically faded out, but haze band appearing between N.N.E. and N.E., 6° up.

23-22 Very faint nebulous band 6° up, N. to E.N.E.

23-23½ Very faint band 6° up, N. to N.E.

23-24½ A little brighter.

23-25½ Very faint again. Watched for some minutes after this it continued very faint. The last seven entries were the result of continuous observations.

23-37 Very faint nebulous band 3° up, N.N.W. to N.N.E.

23-45 Faint nebulous arch from 2° up in N. to 6° up in N.N.E.

23-50 No aurora visible.

24-00 Ditto.

21-00-20 Ditto.

00-45 A faint broken curtain with long streamers from N. horizon to zenith and across to 45° up in the S.E.

00-50 The same, but from N. to zenith only. Twilight quite strong.

01-05 A patch 20° up in N.

01-30 No aurora visible. Much twilight.

21-00 Sky clear. No aurora visible.

22-00 Ditto.

22-30 Ditto.

22-40 Ditto.

22-51 Moderately bright curtain 3° up, N. to N.W.

23-00 No aurora visible.

23-08 Ditto.

23-25 Ditto.

23-40 Ditto.

24-00 Ditto.

22-01-30 No aurora visible.

02-30 Ditto.

Sky now overcast till the evening of the 23rd.

23-22-00 Lower northern sky obscured by cloud. No aurora visible.

22-45 Cloud largely cleared away. No aurora visible.

23-30 Ditto.

24-00 Cloud low in the N. No aurora visible. Faint twilight.

24-01-00 Drift much obscures view. No aurora visible.

Sky now remains obscured by cloud and drift for several days, when it eventually cleared (on 29th inst.). The daylight even at midnight was too strong for aurora to be seen.

QUEEN MARY LAND.

2.—RECORD OF AURORÆ FOR THE YEAR 1912, "THE GROTTOS,"
SHACKLETON ICE-SHELF.

Chief Recorder: M. H. MOYES.

1912.

- 9 April. Auroral arch from S.W. to N., visible 7.15 p.m. Curtains change to form of luminous band and ball of light travelling E. and W.
- 10 „ Auroral arch from N.E. to S.W., 7.30 p.m. Angle above horizon, 60°. Horizon curtains also. Disappeared at 9 p.m.; again appeared at 10 p.m. as brilliant line on horizon.
- 11 „ Streamer curtain directly through zenith.
- 16 „ Aurora brilliant. 7.30 p.m. A luminous band from E. to W. at elevation of 30°. Curtain in N.E. disappearing and giving place to ball of light. Two more curtains above, between N. and W.
10.30 p.m. Luminescent mass N.E. to W.
2.30 a.m. Brilliant band N.E. to S.W.
- 17 „ Aurora visible.
- 18 „ Luminous band.
- 19 „ Luminous band.
- 22 „ Luminous band N.E. to S.W. at intervals.
- 23 „ Aurora at 12 (midnight), as a bright folded curtain about 20° above horizon from N.E. to W., then sweeping round low down and faint to N.
3 a.m. Bright broken arches with streamers E.N.E. to W.
6 a.m. No aurora visible.
- 24 „ 9 p.m. Streamers E. to S.W.
- 25 „ 3.35 a.m. Band E. to W. over zenith. Indistinct at E., but forming a curtain more distinct at W. end, with a lower recurved portion. The luminescence moving E. to W. to E. Finally lower band disappeared, and line on W. horizon as far as N.E. formed into beautiful curtain while arch at zenith became brighter. Then luminous nebula appeared in position of former band. In the N.W. and in E. several very bright streamers.
- 29 „ No aurora.
- 30 „ At 5.30 p.m. Parallel arches from N.E. to S.W. over zenith were just visible, and disappeared with increasing moonlight.
- 1 May. No aurora recorded.
- 4 „ A faint aurora from 7.25 p.m. to 9 p.m.
- 5 „ At 9.30 p.m. one band (faint) through zenith.
- 6 „ At 6 p.m. A faint band between N.E. to S.W. low down.
At 9.30 p.m. An auroral band rising from the E. horizon to 20° in altitude, where it is particularly bright, then straight through S. to W., where a curtain formed, and back to horizon at W.S.W. Other parallel bands above and a few streamers.
12.30 a.m. A luminous band E. to W. over zenith.
- 7 „ 3 a.m. and 6 a.m. No aurora visible.
- 8 „ 5.30 p.m. Faint band at 30° from N.N.E. to W., with bright patch on W. end.
9.30 p.m. Faint band N.E. to W., two faint streamers N.
Faint band N.N.E. to W., elevation 30° with bright patch at W.
9.50. Faint band N.E. to W., two streamers N. by E.
- 15 „ 9 p.m. No aurora visible.
12 p.m. Arch from N.E. to N.W., rising quickly and extending horizontally at 5° of elevation.

- 1912.
- 16 May: 6 p.m. Faint auroral band.
 11.30 p.m. Aurora stretching W.N.W. to E.N.E. From E.N.E. to N. In the form of a right spiral up 10° elevation, and continues horizontally as fainter line. One streamer at E. end.
 12.30 a.m. Aurora extending N.E. to N.W., with curtains N.E. to N., and luminescence travelling as if curtains shaking.
- 18 „ 8.30 p.m. Arch extending N.E. by N. to S.W. up to 60° elevation. Giving way at the N. end to separate streamers.
- 19 „ 6.30 p.m. Faint horizontal band at 15° elevation from N.W. to S.W.
- 20 „ 6 p.m. A few streamers in S.W.
 12 (midnight). Elliptical band N.E. to N.W. Larger upper portion elevated up to 60°, bright; lower portion down to 30° of elevation, faint.
- 27 „ No aurora visible.
- 30 „ 12 (midnight to 3 a.m.). Faint arch elevated to 10° between N. to N.W.
- 1 June. One band N.E. to N.W., with faint colouring of green below and yellow over.
- 4 „ Faint band N. to W. continued all night.
 8 p.m. Nebulous band, zenith N.E. to S.W. Body travel to the south.
 10.30 p.m. Between N.N.E. and N.W. a band coloured green, yellow and red on top;
- 5 „ One luminous streamer S.W., and nebulous band S. by E. at 45° elevation.
- 8 „ Faint aurora visible since 4 p.m., between N. and N.W. at 30° elevation.
 8 p.m. Nebulous band N. to W. and streamers E.
 12 (midnight). Nebulous band N. to W. at 45° elevation.
- 9 „ 12 (midnight). Nebulous flat arch at 10° elevation, S.S.E. through S. to N. From E. by N. to S.E., three more bands with curtains above, and big nebulous patch above these.
- 10 „ 12.30 a.m. One long arch through zenith, travelling S. and striæ in it rapidly moving towards Mag. S.
 From 6 p.m. to midnight. Nebulous band N. to W. at 20° elevation.
- 11 „ 6 p.m. Nebulous band N. to S.W.
 9 p.m. to 3 a.m. No aurora visible.
- 13 „ 7.15 p.m. Two arches between N.E. to S.W., one through zenith; one rising to 45° from horizon.
 At 9.30 p.m. A broad luminous band E.N.E. to W.S.W., through zenith.
 12.15 a.m. Band N.N.E. to W. on horizon at N. by E., bare patch in it showing very black.
- 14 „ 12.17 a.m. Two bands widening, and with filmy streamers rising to 45° over whole length of band.
 12.20 a.m. Aurora spread to zenith in a curtain with streamers. Magnet deflected.
 12.27 a.m. Still rising towards zenith and streamers widening.
 12.30 a.m. Rising rapidly to 85° altitude, and with brilliant nucleus spread round to N.E. This remained steady for some time. Magnet deflected strongly.
 12.41 a.m. Aurora retreated to 40° up, one strongly defined band without streamers remaining.
 12.45 a.m. to 12.55 a.m. Aurora fading away. The arch retreated to 30° elevation, and at 40° another faint band appeared.
 12.57 a.m. Whole becomes very faint.
 1 a.m. to 1.5 a.m. Aurora steady and faint.
 1.10 a.m. Faint streamers appearing along whole length of band.
 1.17 a.m. Aurora brightening, but band now fragmentary.
 5 p.m. Three streamers in the E. and two in the S.W.
 7.30 p.m. Band through zenith from E. to W.
 9.30 p.m. Small nebulous patch N.

1912.

- 17 June. 5.30 p.m. Arch from E.N.E. to S.W. through zenith, breaking into parallel bands. The part at S. end drifted away to S.
- 6.30 p.m. Few streamers in the N.E. and parallel bands through zenith from the N.E. Nebulous patches in the W. to S.W. up to the zenith.
- 7.30 p.m. Long streamers like searchlights from horizon in the E.N.E. to a point 45° up in the N.
- 8.30 p.m. Nebulous band through zenith from S.W. to N.
- 9.30 p.m. Faint band from N.E. to N.W. on horizon.
- 11 p.m. Nebulous band on N. horizon. This brightened fast, but remained stationary till 12.30 a.m.
- 11.30 p.m. The glow increased and band changed to an arch, rising 5° to 10° in the N. Coloured red on horizon and green above.
- 11.45 p.m. The arch becomes larger, rising and moving E. with streamers darting out towards the zenith. A faint band also visible in the sky below it.
- 11.50 p.m. Suddenly waves of light commenced to rush from E. to W. along the arch, showing various colours. Then the light seemed to be concentrated in a luminous wavy band on N.E. horizon.
- 18 " 12 (midnight). The luminous area of sky N. to W. became broader and less bright, with the appearance of curtains and streamers all round.
- 12.25 a.m. The curtains and streamers faded out, leaving no sign of aurora, till at 12.25 a.m., the W. sky brightened rapidly till it was studded with streamers and curtains. The luminescence extended N.; but fainter in that direction.
- 12.35 a.m. The band began to vibrate again, and the streamers appeared also to be rushing from W. to E. The glow spread slowly past W. to W. by S., magnificent curtains forming at W.
- 12-45 a.m. The curtains formed at W. rushed rapidly towards E., reaching the zenith. This movement continued for some time, when more curtains arose in the S.W.
- 12.55 a.m. The band and curtains from the S.W. through zenith in rapid motion as far as N.E. This continued till 1 a.m., when the aurora commenced to die out.
- 20 " 9 p.m. Single streamers in N.E. and S.W.
- 21 " Low arch in N.E. to W.N.W. at 5 p.m.
- 23 " At 8 p.m., a few streamers in S.W. travelling rapidly to S.
- 24 " A low band from N. to N.W., remaining stationary. This was visible at 6, 9, and 12 p.m., and at 2 and 4 a.m.
- 29 " 4 a.m. The aurora coming northerly from S.W. First it appeared at the S.W., a narrow tail widening to N., where it was very diffuse and pink in colour, and in very rapid oscillatory motion. The lower edge appeared pink and violet; the upper part, pale-green to pale-orange. It split after a few minutes into two concentric elliptical forms in W. All small stars behind the diffuse portion were blotted out by the strange light of the aurora. It seemed very close. Also a faint band seen in distance in W. all night.
- 2 July. At 6 p.m., three streamers seen in the S.W.
- 3 " A faint band in the N. at 4 o'clock.
- 8 " 8.30 p.m. An arch from N.E. to N.N.W., rising 15° of elevation.
- 9 p.m. The arch has travelled higher and further to W., as if going in S. direction. Another beam from N.E. appears as tangent to the arc.
- 10.30 p.m. The arch extends N.E. to W., and is broken. Luminous waves passing quickly to and fro.
- 9 " 2 a.m. A band extending N.E. to W. at 5° of elevation, then curtain extended back above to N. Suddenly broke and sent up streamers between W. to N. Then W. end moved round towards S. and rapid flashes of light ran back and forwards. Finally the whole arch had moved up and past the zenith. When just past the zenith vibrations of extraordinary rapidity rushed from the E. end to W. end. Although vibratory movement went W., vibrations themselves seemed to be going E. The W. end broken into a double curtain, and, shaking violently, was moving southwards and showing brilliant purple flashes. Finally, whole faded away.

- 1912.
- 9 July. 2.15 a.m. A band appeared at zenith. It vibrated for 5 minutes and then died away.
- 2.25 a.m. Suddenly again from E. a luminous band ran out rapidly towards the zenith, as if a brush of white paint had been drawn across the sky. Colour effects appeared in the form of whirling eddies. The movement quickly reached W., where a double curtain had again formed. The brilliance from E. over zenith lessened, but the arch became wider and vibrations continued. The luminescence seeming to accumulate at the W. end, where various colours were visible. Finally, all that remained was a luminous curtain at W. end and a diffuse band 15° in elevation around from W. to N.E.
- 2.35 a.m. The sky suddenly illuminated again by flashes across zenith from E. (Magnetic S.), starting about 45° up. At same time parallel pencils from W. end vibrated towards the S., and spread, leaving finally a diffuse mass from W. to N.W., and from E. end was left an arc like a half of a feather, the rib extending up to 15° of elevation in the N.
- 2.45 a.m. A faint band appeared across zenith, from E. to W. Suddenly flashes lit up sky, and the luminescence was noted travelling from E. to W. on the north side of the band, and from W. to E. at the S. side. Then, while the vibrations continued, the whole band commenced to wriggle, and at times broke, resulting in the appearance as if balls of fire were being hurled. This display finally faded from the E. to the W. again, leaving a triple curtain at the W. end, and a band with streamers from zenith towards the W.
- 5.20 p.m. Numerous bands rising from the E. One band 45° up, crossing N. of zenith.
- 5.35 p.m. A triple arch E. to W. One through zenith, and the other at 10° on either side.
- 5.45 p.m. The northern arch has moved slowly N., till now at 45° up. The southern arch is broken at zenith and fades away towards W. A nebulous patch where the three arches meet in the W.
- 5.50 p.m. Two arches, one from E., the other from E. by N., forming nebulous band near zenith and covering together W. The southern arch moved bodily southwards.
- 6 p.m. The northern arch faded away leaving a wide nebulous arch from E. to W. between 45° to 55° up.
- 6.5 p.m. The arch divided and another also appeared 10° to the south of the zenith.
- 6.15 p.m. A nebulous Noah's ark from E. to W.; 20° wide at zenith.
- 6.20, 6.30, 7.15 p.m. No aurora visible.
- 9 p.m. Aurora from E. to S.W.
- 10.50 p.m. A bright arch from E. to S.W. through N., rising to 30° in elevation; also a faint arch parallel, but 5° below it extending N. to N.W.
- 22 ,, 9.12 p.m. Band from N.E. to S.W., rising to 15° .
- 23 ,, 3 a.m. Band low down from N. by E. to W.
- 6.30 a.m. A luminous zig-zag-shaped band low in the west.
- 31 ,, 5 p.m. Numerous arches from E. to W. by S. over the zenith.
- 5.30 p.m. Arch from E., breaking into streamers at zenith and continuing as a streamer arch to the W.
- 6.30 p.m. A few streamers E. to N.E. and W. Also a diaphanous band through the zenith from E. to W. The moonlight became too bright later to observe auroral phenomena.
- 5 August. 7. 45 p.m. A beam from a bright nucleus in the W. at 15° up extending to the N. Another smaller one from the E. towards zenith.
- 9 p.m. A band from the E. curving towards the N. and then back up to zenith.
- 10.10 p.m. A horseshoe-shaped arc in the N. Another band appeared and moved from E. to N. lower down.
- 10.15 p.m. Two dull patches in the E.; also a curtain in the N.N.E. at 10° up to 15° up in the N.E.
- 10.20 to 10.25 p.m. Numerous wisps of light between E. and N.E. up to 45° above the horizon.
- 6 ,, 6.8 p.m. Band between N.N.E. to N.W., broken at W.
- 9 p.m. Brilliant arch from N.E. to W. by N., rising to 5° up only.

1912.

- 7 August. 12.35 a.m. The arch which had remained in position low down all the evening, rose quickly and extending to E. and W., gave out numerous streamers. These developed into curtains and the whole then spread in all directions, shaking violently the while. The curtains at E. and W. were well defined but higher in the heavens, the appearance was as of parallel streamers moving rapidly to E. by N., the motion in the bands themselves being W. At the eastern extremity a double curtain, very bright, showing red and green tints remained stationary, and at the western end a bright nucleus persisted. The dense mass continued vibrating, and at length reached the zenith, where it formed a crown of waving streamers. The whole N. half of the sky was covered with diffused light and brilliancy so great as to be noticeably reflected from the glacier ice. The nucleus in the west became of a yellowish colour and the parallel beams still travelling eastwards partook of this colour, the green colouration being visible only in the E. The principal line of motion of the mass passed the zenith and finally reached to 45° up in the southern sky, where it remained for some time.
- 12.50 a.m. The remnant of Aurora on N. side of zenith became very dull, while the principal band moved down to between 35° and 40° on S. side. of the heavens. This ended in three parallel curtains in W. by S., rising from the horizon, turning N. and round again southward at 30° elevation. At the eastern end an irregular, very bright portion terminated in a brilliant nucleus in the N.N.E. The motion was now confined to the portion of the band S.E. to S.W. where rapid motion in an easterly direction could be observed.
- 1 a.m. The band broke in the S.S.E. into about a dozen parallel beams very short, and although these appeared to move E. the formation went W. Only one curtain remained in the W., and now there were three visible in the E. The whole band rose again, as if swinging on pivots at each end, and fusing at zenith, spread out, appearing like four parallel arches connected by dull nebulous luminescence. The movement to the zenith, and past it slightly, was fast, and the luminescence still continued moving to the E.
- 1.7 a.m. The auroral luminescence spread as a nebula from 15° S. of zenith to 45° N. of zenith, but contracted at either end into curtain forms.
- 1.15 a.m. The auroral light continued spreading to the N., and the curtains at the end unfolded as if pulled out by the movement. Fresh luminous masses appeared rising from the W., but of no special brilliancy. Finally motion ceased, and only a dull mass of light remained.
- 11.15 p.m. Two low bright narrow arches in N.N.E.; also an irregular band in the N.
- 12 (midnight). A faint glow along the N. horizon.
- 8 " 12.40 a.m. An irregular glow, as from a distant fire, from E. to N.E., and still fainter in N.
- 1.15 a.m. A bright wavy band rising and broadening from N.E., rising to height of 50° and then folding back. Also above this is a broader and fainter band to N.W., diffused and showing repeated folding. The eastern end showing long streamers. The illumination is so bright as to cause all the glacier around to be visible.
- 3 a.m. A long, faint, and broken band from the S.E. to N.E., about 30° high, terminating in a broad fan of brighter light. Also a low, fainter band from E. to N.E.; almost in ring form in N.N.W., where it is fairly bright.
- 6 a.m. Long, curving bands rising from W.N.W. and reaching to zenith.
- 14 Aug. 7.30 p.m. A few dull streamers visible in the E. and S.W. An elliptical band seen through fog from N. to W., between the horizon to 45° up.
- 18 " 9.30 p.m. An arch from the horizon in the N.E. to N.W. at 45° up.
- 22 " 9 p.m. An irregular band across from E. to W., a little S. of zenith.
- 23 " Band from E. to W., 15° up in the N. Wavy towards E. Stationary all evening.
- 28 " A small curtain in the N.W.
- 8 Sept. A thin band 15° up in the N.E. to S.W.
- 14 " 9 p.m. A few streamers in the W. to N.W. sector.
- 16 " 7.30 p.m. A band from E. by N. through zenith; also two lines of vertical streamers in the N. rising from 30° up (disjointed curtains).
- 8 p.m. As at 7.30 p.m., but faded; also a band from E. towards N. from horizon 45° up.
- 9 p.m. A few isolated streamers between N.E. and N.

MACQUARIE ISLAND.

3.—RECORD OF AURORÆ FOR THE YEARS 1912-13.

Recorder: G. F. AINSWORTH.

- 1912.
- 13 May. 9 p.m. Noah's ark cloud or aurora for 35 minutes.
- 4 July. Auroral display.
- 13 " Auroral display, 11.20 p.m.
- 16 " Auroral light in the south.
- 17 " Auroral light from 10 p.m.
- 6 Aug. Auroral light.
- 17 " Prolonged display of aurora in the evening.
- 21 " Auroral light, 8 p.m. to 9.30 p.m.
- 9 Sept. Faint auroral light.
- 11 " A well-defined auroral arch in south.
- 12 " Auroral light in south.
- 18 " Auroral light in south.
- 21 " Faint auroral light in south.
- 22 " Ditto.
- 1 Oct. Auroral arch across the zenith; lasted for several hours.
- 2 " Faint auroral light in the south.
- 7 " Faint auroral light.
- 9 " Faint auroral light in the south.
- 12 " Ditto.
- 13 " Auroral light shifting about between S. and S.W.
- 29 " Auroral light in the south.
- 30 " Ditto.
- 1 Nov. Auroral streamers visible occasionally.
- 4 " Auroral light with streamers.
- 6 " Faint auroral light.
- 1913.
- 9 April. Auroral light appeared in S. at 8 p.m. Arch very poorly defined; with stars visible through luminous parts. Faint glow stretching from E. to W. in the shape of a flattened arch. Occasional shafts of light shot upwards for a little distance at 9.10 and 9.15 p.m., when the light began to fade, and at 9.30 p.m. the glow was only just discernible. Dense cloud bank under the arch was the only cloud visible.
- Luminous glow from E.S.E. to W., after 9.50 p.m., with a small oblong patch of nebular light about the centre of the upper edge of the arch. This formation persisted without alteration till 11 p.m., when the southern sky became densely clouded, totally obscuring the light for some time.
- At 11.30 p.m. the sky cleared somewhat and coloured bands of pale green and dull yellow could be observed pulsating apparently from the N.E. to S.W., though showing directly overhead. This occurred five times in about as many minutes. These greenish-yellow bands may more aptly be termed "ribbons," and they, both in progress and appearance, resembled a faint, broad lightning flash. A very indistinct tint of violet was noticeable at times.
- No further pronounced activity was seen, though the arch-shaped, luminous glow lasted till 5 a.m.
- During the periods when the arch attained heightened brilliancy, the segment underneath appeared to increase in darkness.
- A flash of lightning in S.E. at 11 p.m.

1913.

- 28 April. Faint auroral glow in the S. at 9 p.m., but it lasted only a few minutes, when the sky became heavily overcast and rain fell. Sky cleared again in S. at 11.30 p.m., but no aurora visible before watch ceased at 1.30 a.m.
- 29 „ Faintly luminous glow appeared in southern sky at 7 p.m., and lasted without change till 8 p.m., when it was hidden by cloud. It did not show up when sky cleared, but at 10 p.m. a luminous patch was visible in the W.S.W. for 15 minutes.
- Nothing further up till 11.30 p.m., and as the sky became heavily clouded watch was discontinued.

- 1 May. Faint auroral light in S. at 8 p.m. for a few minutes. It appeared again at 8.50 for 15 minutes, when clouds covered the southern sky, obscuring the luminous area. At 9.30 p.m. a bright patch was seen for a few minutes in the W.S.W., but was obscured by clouds. It next flashed up in the S.E. from 9.50 till 10 p.m., and shortly afterwards a luminous glow, arch-shaped, could be observed gradually spreading over the southern sky from S.W. to S.E., though very much flattened. This form persisted till 10.35 p.m. Stars could be plainly seen through the glow. Sky became overcast and misty rain fell till 10.47 p.m., when clouds broke up somewhat, showing evidence of light in the S. At 11 p.m. sky again became overcast, and several light, misty showers fell up till 11.20 p.m., after which a glow was noticeable at infrequent intervals, and for very short periods till 12.20 a.m., when watch ceased.
- 4 „ Misty in early evening, but a very faint glow was noticeable in the S. at 1 a.m., though it had faded away at 1.45, and made no re-appearance.
- 5 „ Auroral light in S., centrally situated in S.S.W. No display of pronounced activity. At 10.45 p.m. it assumed the form of a banded arch rather low and somewhat flattened, stretching from 10° S. of W. to almost due E. Lasted a few minutes, and then faded away to a whitish glow. Assumed same form again at 11.40 p.m., and passed away in a similar manner without manifesting increased activity.
- 30 „ Auroral light in S. early in evening. Shape was irregular till 10.30 p.m., but stretched from W.S.W. to E.S.E. at 10.40 p.m., and assumed the form of a flattened arch. Rather a bright display immediately took place, during which greenish-yellow and whitish shafts of light shot up some distance from the arch and showed a slight convergence, purely a perspective effect. This period of activity lasted for 10 minutes, and then gradually faded away till at 11 p.m. only a nebular glow was visible. No change during next couple of hours, except for a further decrease in brightness, rendering the glow almost invisible.

At 9 p.m. some very bright, irregular patches showed up for a transient period.

- 5 June. Auroral light, assuming the usual flattened arch form, appeared at 10.30 p.m., stretching from S.W. to S.E., very low down, elevation about 6°. Few cumulus clouds floated across the luminous band. The glow was very whitish, almost milky colour. It lasted only 15 minutes, and then faded away in the usual gradual manner.
- A repetition of this display occurred at 11.40 p.m., lasting this time for only 5 minutes. Very little cloud. A most favourable night.
- A very pale, whitish light could be observed at intervals after midnight. At 12.30 a.m. sky became very cloudy.
- 6 „ Faint auroral light (probably reflection) in S. from 7.30 p.m. Glow became much brighter at 9 p.m. for a few minutes, but gradually assumed former whitish colour and appearance. Calm night, with very little cloud. No increased activity manifested during the night, and the light just faded away, disappearing entirely at 1.15 a.m.
- 18 „ Thinly overcast sky, showing patch rather brighter than rest of the sky in S.S.W., visible from 9.30 till 10.30 p.m., with no change. May be auroral light at back of the clouds, or it may be due to reflected light from snow-capped Mount Elder; again, it may possibly be very thin, whitish cloud.
- 30 „ Faint auroral light appeared in S. at 7.5 p.m., but shortly afterwards clouds obscured the view. It had disappeared without increase in brilliancy at 7.40 p.m., but re-appeared later, being visible through rifts in the clouds at frequent intervals. Most unfavourable night—too much cloud. The period of greatest brilliancy was from 11 till 11.15 p.m., with the centre of activity in S.S.W. No streamers showed, nor could any other than greenish-white light be detected. Remained almost obscured till some time after midnight. No reappearance of light during the rest of the night. The glow was of the usual flattened arch form, with an elevation of only 5°.

- 1913.
- 15 July. An auroral arch appeared in the S. at 7.20 p.m.; the luminous band being little wider than an ordinary rainbow, and with an elevation of 7° . Faded out at 7.55 p.m., after widening vertically at the eastern end; but reappeared in a few minutes, though only just discernible. Disappeared completely at 8.30 p.m. Reappeared, but fainter, at 8.55 p.m., lasting only fifteen minutes; then again at intervals till 11.30, when it showed brightly; and at 11.45 an irregular arch of luminous yellow colour spread from S.E. to S.W., and a reddish tinge was discernible in the centre of activity. This scene of activity changed instantly from due S. to S.W., and beams of greenish-yellow shot upward, but showed no inclination to convergence. This display ceased after two or three minutes, when a single beam of whitish light shot up from S.S.E., almost at the eastern end of the arch, after which it gradually faded out, a faintly luminous area only being visible at midnight. What proved to be the expiring effort occurred at 12.15 a.m., when the glow pulsed up a little brighter, and two yellowish beams of light shot up for a couple of minutes. The whole phenomena then died completely out. No recurrence up till 2.30 a.m.
- 20 „ No sign up till 9.40 p.m., when a narrow, flattened arch of 20° elevation appeared (centre S.S.W.) stretching from S.S.E. to W. It increased in brilliancy, and at 9.45 p.m. was a bright light yellow (lemon) colour, with lower segment very dark. Seemed to disintegrate, though arch remained and bright patches showed in the hitherto dark segment. At 10 p.m. six separate shafts of light shot up in S.W. for a minute or two, then faded out, though the bright patches became a little brighter, a condition which lasted till 10.15 p.m., when the phenomenon began to fade. At 10.30 p.m. no sign of activity was visible. At 10.45 p.m. a faint arch appeared, but of much less elevation (11°) than preceding one, and after failing to improve in brilliancy, died out completely at 11.5 p.m. The latter display suggested a retreat of the field. At 11.30 p.m. a very bright patch of light flashed up in W.S.W., throwing up shafts which swayed gently, as if blown by gentle wind. Lasted two minutes. At the same time a single detached shaft showed in W., and swayed in same manner. Then a bright patch in S.S.W. threw up one shaft, which gradually fell into the shape of portion of an arch. This was the only suggestion of connection between the above mentioned areas, the whole of which occurred in a period of seven minutes. There was no sign of an arch during these manifestations, the activity occurring in three, seemingly detached areas or patches. Nothing further till midnight, when several whitish shafts of light showed very briefly in S.W., and simultaneously an irregular yellowish patch in S.S.W. Fainter shafts showed momentarily between S.W. and S.S.W. till 12.25 a.m. No activity from then till 1.55 a.m., except several faint shafts which showed in S.W., and a bright patch in S.S.W.
- A most peculiar manifestation took place in connection with this display. About 11.45 p.m. an arch of nebular appearance, with an elevation of 30° , and broader than a rainbow, formed from W. to E. It never altered, and persisted till 4.30 a.m. Stars could be seen through the matter. Its growth was gradual, apparently commencing at about the highest part of the arch, and slowly, very slowly, and almost unnoticeably, gaining completion. Several times it seemed to become faint momentarily, but this may have been a trick of the eyesight, as gazing upward and southward with a very cold southerly wind blowing is not conducive to steady sight. At 1.20 a.m., several faint shafts of whitish light surged upwards, almost reaching this arch, but no alteration took place in it. This was the only evidence of connection between the arch and the activity which was taking place in its segment, where the curtain effect was more noticeable than on any previous occasion.
- Faintly luminous patches appeared a several times between 1.30 a.m. and 2.15 a.m., but were of very small area, and just discernible.
- 25 „ Auroral light visible in S., behind enormous cloud masses, but showing only on edges, and then during early evening only. Clouds covered the whole sky from 8 p.m. till 8.45 p.m., when light was again visible on cloud edges for a few minutes. Clouds then totally obscured the S. sky for the rest of the night.
- 3 Aug. Auroral arch from S.W. to S.E. with an elevation of 8° showed at 8.15 p.m. Greatest activity at S.E. end; shafts of light showing up to 15° and swaying slightly. Whitish light with faint tinge of green noticeable during flashes. Very dark segment under narrow arch. Persisted with varying degrees of brilliancy till 8.50 p.m., when it faded almost out, though a faint trace remained till 10.30 p.m., when it momentarily flashed up in the S.S.W. in two small patches. These lasted but a few seconds, and up till 11.15 no sign of activity was noticeable. Stars could be seen in the area, though what appeared to be a small cloud-bank remained. The height of the last patches was 6° , seeming to suggest a retreat of the field. At 11.40 p.m. a shower fell from a sky which had clouded very rapidly. No further sign of auroral light occurred up till 2 a.m.

1913.

5 Aug.

A flattened arch appeared at 7.45 p.m.; stretching at an elevation of 7° from S.W. to S.E. Began to fade out at 8.10 p.m. and disappeared at 8.25 p.m. Reappeared at 9 p.m. brighter, and two arches 7° and 9° above the horizon respectively became visible. This form persisted for 10 minutes, then began to fade and retreat, till a single arch showed elevation of 5°. Disappeared at 9.20 p.m. Flashed up again at 9.35 p.m.; with faintest suggestion of shafts of light at S.E. end and in the centre. Elevation of arch 6°. This persisted for several hours with elevation varying from 5° to 6°, but no further shafts of light till 10.30 p.m. It became very faint at times, and was never really very bright. Whitish light with faintest suggestion of green. Shafts of light numerous for a few minutes at 10.30 p.m., but faint.

Faded right away at 10.50 p.m.; but signs of activity noticeable occasionally in S.W. between 11 and 11.30 p.m. Shortly before midnight faint patches appeared in the S. just 3° above horizon, then another patch 8°, but no arch formed.

Activity in S.W. at 12.15 a.m., but very low down. The effect here suggests a wonderfully good display viewed from Adelie Land. (Wireless communication re-established with Adelie Land to-night.)

8 ,,

Very faint auroral reflection in S. at 11.30 p.m. Three sheet-lightning discharges in rapid succession at 10.20 p.m.

22 ,,

Auroral light of indefinite form appeared in S. and S.W. at 8 p.m. and showed behind heavy clouds at rare intervals. Glow only "moderately bright." Visible at midnight, but still very heavily clouded. Disappeared at 1.30 a.m.

23 ,,

Auroral arch appeared in S. at 7 p.m. Very faint at first, with stars visible through darkened segment. Shafts of light in S.E. and S.S.W. at 8.5 p.m. Glow increased in brightness later but very heavy clouds continuously passed across area, almost obscuring it. The light disappeared at 1.5 a.m.

31 ,,

Very faint auroral glow in S. at 10.20 p.m., but was visible only now and again on account of densely clouded atmosphere. It was noticeable till 11.15 p.m., but nothing could be seen after that hour.

2 Sept.

Auroral activity in S.E. from 9.15 till 9.35 p.m. Arch formation stretching from E. to W. at an elevation of 8°. Segment densely black; but stars could be seen through dark area before maximum brightness was attained. Streamers were very faint and attained no great vertical extent. Heavy clouds almost obscured southern sky from 9.50 till 10.45 p.m., after which a very broad but faint flattened arch became visible. A luminous patch in due S. At 11 p.m. the light faded further and assumed only a nebular brightness. At 11.10 p.m. a momentary revival of brightness occurred in S.E., dying away again in a couple of minutes. Cloudy again in active area; but very faint streamers noticeable at E. end at 11.20 p.m. Glow again died to nebular brightness, though the arch was preserved and persisted till almost obscured by cloud at midnight. Pale whitish glow continued till a few minutes to 1 a.m., when it gradually faded away, being only just discernible at 1.30 a.m.

4 ,,

Auroral light visible behind clouds at 10.15 p.m., and again at 11 p.m.; but densely clouded condition of atmosphere rendered it impossible to see nature of display.

5 ,,

Auroral arch at 9.15 p.m.; elevation 6°; bright patch at S.E. end, but very faint towards S.W. At 10.20 p.m. shafts of light were numerous in S. and S.S.W., while the arch in S.W. brightened considerably.

At 10.30 p.m. the field retreated, showing very much flattened arch; elevation only 4°, but peculiar hazy or nebular effect reached to 10°. Appearance about as bright as that in region of Milky Way on a clear night.

At 10.45 p.m. seemed to be going further away. Very faint shafts of light discernible in S.W., going up fairly high. Very little energy so far. Few minutes later scene of activity shifted to S.E. No activity after 11 p.m., when the glow, which had gradually weakened, died out.

8 ,,

Faint auroral light discernible behind cloud masses in S. and W. from 11 p.m. till midnight.

9 ,,

At 9.45 p.m. disconnected patches of light appeared in the S. and S.E. at 10 p.m.; narrow bands of nebular brightness could be seen converging to an indefinite area in the zenith. The scene of greatest energy was in the S.E., though on rare occasions several shafts of light pulsed across the sky from the W., always failing to reach as far as those from any southerly direction. This display, with varying degrees of brightness, while never really being very bright, continued till 10.25 p.m., when a sudden access of energy became apparent in the S.E., manifesting itself in an increased brilliance of the beams of light, which shimmered greatly, and, generally

1913.
Sept.

speaking, showed rapid movement. At 10.35 p.m. a brilliant shaft began to curve and at the same time to increase in brilliancy to a very bright lemon colour. It lasted about a minute, and with its diminution in brightness a general fading away of the whole display commenced. At 10.45 nothing but a faint whitish glow in the southern sky could be seen. This disappeared before midnight.

This was, as far as I could judge from observation, the closest display we have had, though not the brightest.

- 21 ,, Auroral light appeared in southern sky at 10 p.m. General glow, arch shaped, stretching from S.E. to W., with an elevation of 8°. Heavily clouded sky obscured view till midnight, when it showed again. Changed shape at 1 a.m., assuming shape of a rainbow, but, of course, showing no colour other than the light yellow.

It shortly afterwards began to fade, and at 1.30 a.m. was only just discernible. No further activity.

- 22 ,, Light showed at a few minutes to 10 p.m. and gradually extended for the most part by means of broad streaks till the whole of the southern sky from W.N.W. to E. showed areas of light, which, though faint, were constantly shimmering. At one time during a pulsation to greater brilliancy the curtain effect was distinctly noticeable, though only for a few seconds. No sign of a corona, though the light stretched right across the sky slightly beyond zenith. No indication whatever of any formation overhead was to be seen. Clear patches of sky dusky in colour, with stars visible, showed between the areas of light. At 10.10 p.m. all the light, with the exception of that stretching right across the sky from W.N.W. to E., faded away, but the light remaining assumed the appearance of cirrus cloud bars, and stretched almost from horizon to horizon, a "Noah's Ark" perspective effect being produced. This form persisted till 11 p.m., when it began to fade at the W. end, and by 11.15 p.m. had disappeared, except for small areas in E.

At 11.30 p.m. an incomplete arch, centre S.S.W., with an elevation of 6°, showed for a few minutes. Sky clouded rapidly, and at 11.45 p.m. a shower fell. At midnight patches of light appeared in the S.E., but clouds obscured almost the whole southern sky. Light, very faint, was visible through openings between clouds up till just after 1 a.m. No further activity noticeable.

- 24 ,, Auroral light visible behind clouds at 7.15 p.m., but sky too cloudy thereafter, though now and again, till midnight, faint signs on cloud edges could be seen.

- 1 Oct. Auroral light in S. at 8.50 p.m. Arch form, with an elevation of 8°. No streamers during the whole time. Clouds obscured at times the area, which extended from S.E. to S.W. Arch disappeared at 11 p.m., but pulsed up again at 11.20 for a few minutes, only to fade away gradually, till at midnight no sign of light was visible.

- 8 ,, Faint auroral light in southern sky at 7.30 p.m., but sky almost clouded over. Several very faint streamers shot up, reaching almost to zenith at 7.45 p.m.; then a passing hail squall occurred. At 7.55 p.m. multiple arches of 12°, 15°, and 25° were visible, and the last named brightening up very much, sent up streamers along its entire arch. The light was coloured yellow, merging with the darker portion below, assuming a dark heliotrope colour, certainly not very pronounced but noticeable. Almost immediately streamers of light worked right across the sky from W. to S.E. and remained there several minutes. No coronal effect. Luminous patches also flashed up within the active area. Most activity was evident in S.E. At 8.15 p.m. only arches of 5°, 12°, 15°, and 25° were visible, and stars could be seen through the luminous areas. The whole display gradually faded away, and at 8.30 p.m. only a small area in S.E. indicated activity. At 8.45 p.m. no light was visible, but at 9 p.m. a luminous arch-shaped patch, with an elevation of only 5°, could be seen sending up a faint streamer. This arch-shaped patch remained in view till 11 p.m., but the sky was very cloudy, most of the time obscuring the light. At 12.45 p.m. the sky became overcast, no light being discernible.

- 18 ,, Faintly luminous area in S. from 10 p.m., occasionally hidden by cloud. No exceptional activity noticeable till 1.30 a.m., when several streamers, so faint as to be scarcely discernible, pulsed up for several minutes. The phenomenon gradually died away, and at 2.15 a.m. no sign of light could be seen.

- 25 ,, Faint glow in S. from 10 p.m. till 12.20 a.m., when it disappeared from view. Stars could be seen through the bright area, which was now and again hidden by cloud masses.

MACQUARIE ISLAND.

4.—RECORD OF AURORÆ FOR THE PERIOD DEC., 1913, TO NOV., 1914.

Recorder: F. J. HENDERSON.

1913.		
6 Dec.	... 10 p.m.	An auroral glow increasing in strength, brightest in S.
9 "	... 10 p.m.	Auroral glow.
10 "	... 10 p.m.	A glow, brightest in the zenith.
11 "	... 11 p.m.	A very strong glow, brightest in the S.
12 "	... 11.30 p.m.	A very strong glow, increasing in strength and brightest in S.
13 "	... 10 p.m.	A slight glow, brightest in E.S.E.
14 "	... 10.30 p.m.	A slight glow, brightest in S.
16 "	... 11.20 p.m.	A very bright glow, brightest in S.
17 "	... 9.30 p.m.	A very bright glow, brightest in S.
22 "	... 10.30 p.m.	A slight glow.
26 "	... 10 p.m.	A bright glow.
28 "	... 9.30 p.m.	A very bright and high glow.
30 "	... 10 p.m.	A very bright and high glow, decreasing.
1914.		
1 Jan.	... 11.15 p.m.	A glow, brightest in S.
2 "	... 10 p.m.	Ditto.
3 "	... 10.40 p.m.	A slight glow, brightest in S.
5 "	... 10.30 p.m.	A very bright glow.
15 "	... 10 p.m.	A slight glow.
17 "	... 9.40 p.m.	A slight glow.
20 "	... 9.30 p.m.	A slight glow.
21 "	... 9.30 p.m.	A slight glow, low down, brightest in S.
23 "	... 9.30 p.m.	A strong glow, brightest in zenith.
26 "	... 9.15 p.m.	A glow in the S., largely obscured by clouds.
31 "	... 9.30 p.m.	A strong glow.
5 Feb.	... 11.30 p.m.	A very bright light and yellowish streamers.
20 "	... 10 p.m.	Bright green streamers; intensity increasing.
22 "	... 9.45 p.m.	A slight glow, brightest in the S.
26 "	... 8.30 p.m.	Very bright green streamers.
2 Mar.	... 9.30 p.m.	Bright glow in S. and E., and streamers in W.
4 "	... 8.20 p.m.	Very bright glow, strongest in S.; intensity waning.
19 "	... 9 p.m.	Very bright streamers extending from E. to W., and a glow in the S.
31 "	... 9 p.m.	An auroral glow.
1 April	... 11 p.m.	Very bright green streamers and glow, brightest in zenith.
6 "	... 9.30 p.m.	Very bright green and white streamers, brightest in zenith.
18 "	... 9.15 p.m.	A greenish glow, brightest in the S.
19 "	... 9.30 p.m.	A slight glow, brightest in S.E.
24 "	... 9 p.m.	A bright glow.
28 "	... 9.30 p.m.	A glow, brightest in zenith.
2 May	... 9 p.m.	A slight glow, brightest in the S.
17 "	... 9.15 p.m.	A bright arch from E.S.E. to S.S.W., and streamers from the S.
19 "	... 9.45 p.m.	A bright glow, brightest in S.S.E.

- 1914.
- 1 June ... 9.15 p.m. A bright green glow, waxing brightest in the S.E.
- 15 ,, ... 11 p.m. A slight glow, brightest in the S.
- 19 ,, ... 9.10 p.m. A slight glow, brightest in S.S.E.
- 27 ,, ... 9.15 p.m. A very fine display widely spread over the heavens in the form of streamers
nebula, and glow.
- 20 July ... 10.30 p.m. A very bright glow.
- 22 ,, ... 9.15 p.m. A very bright glow, brightest in S.S. to E.
- 24 ,, ... 9 p.m. A slight glow, brightest in the S.
- 25 ,, ... 9.15 p.m. A very bright general glow, strongest in the S.
- 27 ,, ... 9.25 p.m. Glow increases to very bright, strongest in S.
- 30 ,, ... Midnight. A brilliant nebulous aurora, violet, purple and green, strongest in zenith.
- 31 ,, ... 9 p.m. Very bright streamers and glow.
- 16 Aug. ... 10 p.m. Very vivid green streamers, strongest in S.S.E.
- 23 ,, ... 9.15 p.m. A slight glow, strongest in S.S.E.
- 26 ,, ... 9 p.m. A bright glow.
- 28 ,, ... 10.15 p.m. Intermittent streamers, strongest in zenith.
- 9 Sept. ... 9.15 p.m. Very bright glow and slight streamers, brightest in S.S.E.
- 10 ,, ... 9.30 p.m. A bright glow (waxing), also streamers, brightest between S.E. and S.W.
- 12 ,, ... 9.15 p.m. A glow in S.E., followed later by glow in E., and streamers in W.
- 9 Oct. ... 9 p.m. A very bright glow, waxing brightest in S.
- 10 ,, ... 9 p.m. Very bright streamers and nebula, followed later by arches, brightest in S. and
zenith.
- 11 ,, ... 9 p.m. A glow in S., extending later between S.E. and W., and faint bands in the zenith.
- 13 ,, ... 9.30 p.m. Faint streamers, strongest in S.E.
- 22 ,, ... 11.30 p.m. Glow starting from a dark arch between S.E. and S.W., and extending N.
- 5 Nov. ... 12.30 p.m. Bright green nebulous aurora in zenith, also streamers extending N. and S.
- 8 ,, ... 9.30 p.m. A slight glow in one spot only in S.
- 9 ,, ... 11 p.m. Ditto.
- 14 ,, ... 10 p.m. A glow, followed later by white bands across the zenith from E. to W.
- 15 ,, ... 9.30 p.m. A general glow behind clouds.
- 18 ,, ... 11.45 p.m. Ditto, strongest in S.
- 26 ,, ... 10.30 p.m. Ditto.

MACQUARIE ISLAND.

5.—RECORD OF AURORÆ FOR THE PERIOD DEC., 1914, TO NOV., 1915.

Recorder: A. C. TULLOCK.

- 1914.
- 7 Dec. At 10 p.m. A glow behind clouds in the S.
- 8 ,, Vivid auroral display in the S. At 10.30 p.m. a red glow in S.E.
- 9 ,, 10.30 p.m. Glow, blueish to orange, between E. and S.
- 10 ,, 10.30 p.m. Glow behind clouds, between E. and S.
- 11 ,, 10.30 p.m. Glow on S.E. horizon.
- 12 ,, 10.30 p.m. Fairly strong coloured glow to S.

1913.

- 13 Dec. 10.30 p.m. Bright yellow and orange on S. and S.E. horizon.
 14 ,, Midnight. Small patches of glow visible through clouds.
 15 ,, Aurora visible in S. to S.E. horizon, giving a reflection like a city fire. At 10.30 p.m. a yellow glow on S.E. horizon.
 18 ,, 10.30 p.m. A general glow, lighting up the landscape.
 20 ,, 10.30 p.m. A glow giving considerable light.

1915.

- 8 Feb. Auroral streamers extended across the sky from S.E. to S.W. like a great search light, with smaller, streamers coming up from the S., forming a kind of corona effect. At 9.20 p.m. bright bands from E. to W. in zenith.
 9 ,, ... Aurora streamers showed up from the S.
 12 ,, ... Auroral streamers showed pale green illumination across the southern horizon.
 20 ,, ... Aurora appeared at 9.10 p.m. Flashed from zenith to S.E. with mauve, pale-green, and pink colours, like a blanket, across southern sky. Later it changed to a glow.
 22 ,, ... Auroral reflection along the S.E. to S.W. horizon.
 11 Mar. Very bright aurora from 9 to 9.30 p.m. Appeared with streamers from E. to W. at zenith and also formed an arch like a rainbow from S.E. to S.W. Coloured purple, yellow, and pale green.
 23 ,, ... From 8 p.m. very brilliant streamers and nebulous form (later fading to a glow) shot up from the southern horizon, and, extending round the horizon to due E. and W., formed a dome-like centre at zenith. White, green and violet colours.
 24 ,, ... Auroral reflection in S. At 10.30 p.m. streamers visible through mist to E.S.E.
 8 April 10.5 p.m. Glow in zenith and to the S. and W., showing through clouds.
 15 ,, ... Dim aurora on S. to S.W. horizon. At 8.45 p.m. glow in S.
 20 ,, ... Faint reflection in S. At 8.45 p.m. light glow in S.E.
 23 ,, ... Splendid auroral display from 10 to 11 p.m. across southern sky, sending up streamers from S. horizon to a centre a little N. of zenith. Light quite eclipsed that reflected by the moon. At 9.25 p.m. a vivid glow and streamers in S. and E., and bright band from zenith to W.
 26 ,, ... Auroral streamers from eastern horizon to zenith at 11.30 p.m. At 11 p.m., streamers from E. to W. through zenith.
 4 May ... 9.25 p.m. A small patch of glow to the S.
 5 ,, ... Vivid aurora from 9 to 9.30 p.m. Light in the form of a bright rainbow across the southern sky about 20° from horizon. Afterwards developed streamers shooting up into the sky. Pale blue to purple. At 9.5 p.m., only slight glow to S.
 9 ,, ... Rainbow-shaped aurora across S. sky about 20° above the horizon.
 10 ,, ... At 10 p.m. Glow in S. and occasional streamers.
 11 ,, ... Auroral reflection in the S.
 12 ,, ... At 7 p.m. A general glow from the zenith to the S. Obscured later.
 17 ,, ... 10.40 p.m. Very bright aurora, but obscured by clouds.
 18 ,, ... Brilliant auroral bands from S.W. to S.E. about 20° above S. horizon, afterwards sending up streamers to a little S. of zenith. Streamers appeared to work from E. to W. along the band. Light stronger than ordinary moonlight. (Time, 7.15 p.m. to midnight).
 22 ,, ... Auroral reflection in S.E.
 23 ,, ... Brilliant aurora from 10 p.m. until midnight, when observation ceased. A rainbow-shaped band from E. to W., about 20° above S. horizon, with streamers shooting up at intervals. Colours noted were from purple at base to yellow and green above. Moon had little effect on its brilliance. A lovely clear night.
 8 June... Dim auroral glow in the S.E. at 9 p.m., partly obscured by clouds; sky cleared at midnight, showing brilliant bands across the S., with vivid green streamers shooting up to zenith.
 12 ,, ... Exceptionally brilliant display, first noticeable at 6 p.m., and gradually improved in brilliance, with maximum at 11-15 p.m. Three series of arches were visible across the sky from E. to W., the centre being most brilliant. The centre was at about the zenith, but moved 10° N. and S. Streamers moved from E. to W. along the bands; one streamer appeared to leave the bands and finish up like a whirlwind at zenith. Lights mostly coloured purple to red.

- 1915.
- 13 June ... Brilliant aurora showed up at 7 p.m. from E.S.E., and running across to the W. Very bright at 6.30 p.m., but afterwards obscured by clouds. Long curved bands in the zenith at 7 p.m.
- 14 " ... Brilliant aurora behind the clouds appears to be from E. to W, about the zenith, and later in the night in S.W.
- 16 " ... Slight auroral glow in the S. Very low down at 8.40 p.m.
- 17 " ... Brilliant red aurora; looked something like a Japanese fan opening and closing. Its centre or base was a little N. of zenith, and spread out about E.S.E. to W.N.W. (about magnetic E. and W.) Colours varied from bright green and purple to a deep red round the edges. Continued all evening; at 10 p.m. it worked N.N.W., appearing to reach the northern horizon; it was then as streamers and nebulous sheet, and in ring form in the W. and N. Between 5.30 p.m. and 5.40 p.m. it appeared as a very vivid nebulous sheet in zenith, then as a large red band in the N.E., with the appearance of being low and close; then the red faded and glow remained.
- 18 " ... Brilliant aurora visible between breaks in the clouds. At 9.20 p.m. it was overhead.
- 20 " ... Corona and arch across the south sky-line from 9.30 p.m. to 10.30 p.m.
- 28 " ... Auroral glow in S.S.W. at 11 p.m.
- 29 " ... Brilliant aurora 10 to 10.45 p.m.; first appeared at zenith and worked in scroll-like bands to E. and W., making feather-like curls of pale green to purple light. Whole display gradually worked southwards and disappeared behind the clouds (S.W.) about 20° above the horizon.
- 2 July... Auroral glow showed up behind the fog bank in the S.
- 6 " ... Brilliant aurora commenced at 6 p.m. with faint arch across the sky at zenith and a glow in the S. At 10.5 p.m. it showed purple and green nebulous mass in zenith and a glow in the S. At 10.15 p.m. it became very bright, and hung like a fringed curtain across the sky about 10° N. of zenith. Brilliant streamers working from W. to E. Brightest part was in E.E.S.
- 10 " ... At 11.30 p.m. Arch across the S. and shafts and streamers up in the zenith.
- 12 " ... Auroral glow in S. At 7 p.m. a pale double arch across the S.
- 28 " ... Auroral glow in the S. At 10.15 p.m., appeared greenish behind clouds in S.
- 29 " ... Aurora visible at zenith at 9 p.m., but soon obscured by clouds.
- 30 " ... Faint auroral glow in the S.
- 1 Aug... Aurora visible behind clouds.
- 2 " ... Aurora from S.E. to S.W., but mostly obscured by clouds. At 7.10 p.m., apparently very bright behind clouds.
- 6 " ... 11.25 p.m. Slight glow in S., obscured by clouds.
- 12 " ... 11.15 p.m. Slight glow in S.
- 30 " ... Brilliant aurora in the S.; it worked up to about 35° from the S. horizon, then gradually receded again, extending across the sky from E. to W. Streamers shooting up reached as far as zenith.
- 4 Sept... 10.40 p.m. Glow all over the southern sky obscured by cloud.
- 5 " ... Brilliant nebulous sheet aurora noted from 8.30 p.m. until watch ceased at midnight. Commenced across the sky from E. to W., about 20° from S. horizon, and worked up to about 10° N. of zenith.
- 7 " ... Aurora visible in S. appears to be a bright display, but obscured by clouds.
- 8 " ... Auroral glow in S. to S.E. all evening; sent up streamers at 10 p.m.
- 11 " ... Brilliant auroral arch from S. to S.W. at 10.40 p.m., only a very slight glow across the southern sky.
- 12 " ... Auroral glow showed in the S. Only very slight at 8.45 p.m.
- 27 " ... Faint streamers visible from 8 to 11 p.m. Commenced about magnetic E. and worked to S. At 9.40 p.m. a faint band from E. to W.
- 29 " ... Brilliant aurora showed in two irregular arches radiating from S.E., and worked to W.S.W. Light streamers connected the two arches. The whole worked up zenith. At 11.10 p.m. only a bright glow in S., with occasional streamers between S. and N.
- 1 Oct. ... Aurora showed up between the clouds chiefly in the E.S.E., and worked to W. Appeared to be brilliant, but view spoilt by rain and clouds. At 8.45 p.m. glow seen in zenith and to N. through breaks in clouds.

1915.

- 2 Oct. ... Dim. aurora noticeable under clouds in S.S.W.
- 5 „ ... Aurora visible through clouds in S., about 20° above the horizon.
- 10 „ ... Aurora visible in S. to S.E. at 11 p.m., but mostly obscured by clouds.
- 11 „ ... Bright aurora seen behind clouds at 10.20 p.m.
- 17 „ ... Aurora commenced at 9.5 p.m. in the S.W., and worked an arch across to S.E., about 20° above the horizon in the centre. Visible until after 11 p.m., but not brilliant. An earlier exhibition at 8.30 p.m., when corona and streamers in S.W. to S.E.; some faded.
- 20 „ ... Brilliant aurora noticed at 10 p.m., about 10° S. of zenith: A very broad arch from E. to W. It gradually worked northward and faded out about 10° N. of zenith. Colours yellow, pale green, and a little pink to purple.
- 24 „ Faint auroral arch visible at 10 p.m. from S.E. to S.W., about 35° from southern horizon. At 9.45 p.m. a very faint band from E. to zenith.
- 27 „ Faint but quite distinct auroral arch across the sky from E. to W at 11 p.m.; centre about 30° from S. horizon. At 11.40 p.m. a glow seen high up in the S.
- 1 Nov. Few auroral streamers from S.S.W., but sky soon becomes overcast. Night very light, probably the result of the aurora.
- 2 „ Between 8.25 and 9.30 p.m., slight glow in S.W. Changes to glow all over S., and moves N.
- 3 „ Few faint auroral streamers from S. to S.S.W. horizon at 9 p.m., extending up to about 25° into the sky.
- 6 „ Remarkable aurora visible at 11 p.m. and continued after watch ceased. It was further N. than any yet noticed. Seemed to start in the N.W. and work to N.E., and worked to a centre about 10° N. of zenith. It illuminated all the northern half of the sky. It was in the form of very bright, luminous patches all over the sky, extending far to the N.
- 7 „ Aurora visible in S.S.W. Streamers seemed to descend from about zenith to about 23½° from S. horizon, then die out. Bright glows from E. to W. At p.m. bright patches spread over sky from S. to N.
- 8 „ Between 9 and 9.30 p.m. only a slight glow in the S.; later on extensive aurora all over southern half of sky an extending to 10° N. of zenith. Streamers running up to a dome-like centre at zenith. Display not very brilliant, but whole landscape lit up much lighter than moonlight.
- 10 „ Bright auroral display from E.S.E. to S.W., and extending up to zenith, partly obscured by clouds. At 9.40 p.m., bright light green patches; brightest in E. by S.
- 11 „ Auroral glow in S., mostly obscured by clouds.
- 16 „ Auroral glow all over the S. and up to zenith, but only noticed through the clouds. The sky being overcast obscures the effect.
- 17 „ Magnificent auroral display all over southern sky. Commenced at 9.15 p.m. as a small arch across from S.E. to S.W., then worked up to zenith as a pale-green curtain. It then formed a perfect dome, sending out streamers in all directions from N.W. *via* S. to N.E. Brightest at 10.5 p.m. From 10.15 p.m. it took the form of flashes of light, almost like sheet lightning as seen in thunderstorms.
- 18 „ Brilliant aurora to-night, from 9.30 p.m. Very similar to last night's display. At 9.30 p.m. in the form of very pale bands from E. to W., and to N. of zenith.
- 19 „ Brilliant aurora commenced at 10 p.m., but lasted only five minutes. Reappeared at 10.20 p.m., and then kept on all evening. Very similar to the previous night, but more like a curtain across the sky from E.S.E. to W., and extending to zenith. At 9.30 p.m., slight patches visible to S. of zenith for a few minutes.
- 21 „ Brilliant aurora from 10.5 p.m. commenced simultaneously from E. to W. about zenith. Showed a brilliant arch for about ten minutes, then faded down to glows and kept on intermittently through the night. At 9.30 p.m., faint streamers across to W. for five minutes.
- 22 „ Evidently a brilliant aurora, but mostly obscured by clouds.
- 23 „ Aurora in S.E. to S.W.; brilliant patches noticeable at times, but mostly obscured by clouds.
- 24 „ Aurora in S. mostly obscured by clouds; streamers shooting up at 11 p.m.
- 25 „ Aurora streamers from S. to S.W. at 9 p.m.; afterwards a huge glow from the S. The effect mostly obscured by clouds.
- 26 „ Bright auroral arch low down (about 23½°) from S.S.E. to S.W., with occasional streamers rising upwards. Clouds obscuring view. At 11.10 p.m. the glow seen to be well to the N.

IV.—GENERAL DISCUSSION.

I.—TYPES OF AURORA REPRESENTED.

The nomenclature of auroral types which constitutes Section II of this contribution embraces all the varied forms of luminous phenomena of this nature manifested both at Cape Denison, in Adelie Land (latitude 67°), and at Cape Royds, in the southern Ross Sea region (latitude $77^{\circ} 30'$) witnessed respectively during this present expedition and the British Antarctic Expedition of 1907-09.

The phenomena presented at the Queen Mary Land base (latitude $66^{\circ} 20'$) were evidently very similar in type, though one entry is novel. This feature is recorded under date of 9th July, 1912, at 2.45 a.m., when there was an "appearance of balls of fire being hurled." Such a feature has come under my notice once only, and that was during a very remarkable auroral visitation witnessed over the whole of southern Australia one evening in September, 1909. On that occasion blobs of bright nebulous luminescence burst into being at many points in the heavens between 10.30 p.m. and 11 p.m., the motion in many cases conveying the impression of the nebula being hurled into position. Possibly this type is not uncommon in regions more distant from the South Magnetic Pole than Adelie Land and the Ross Sea. The Queen Mary Land Station was, it is to be remembered, about 1,000 miles farther from the Magnetic Pole than was the Cape Denison Station; and proximity or remoteness from the Pole may have a considerable influence on the nature of the luminous phenomena presented.

A study of the Macquarie Island record leaves no doubt that, though many of the types observed were similar to those appearing in the Antarctic zone to the south, yet other features were novel. Widespread nebulous glow auroræ, seen in the south, were rather common. Also strongly-coloured phenomena often persisted over a long time, whereas, in the Antarctic localities mentioned, when an exhibition showed colours other than the normal greenish-yellow, the abnormal colouration would last but for a few minutes or perhaps, at the most, half an hour. The case described in the record for the evening of the 17th June, 1915, appears, so far as one can understand the description, to be unparalleled by anything seen in the Antarctic zone to the south. On that occasion the log records: "Brilliant red aurora; looked something like a Japanese fan opening and closing. Its centre of base was a little N. of the Zenith, and it spread out to the E.S.E. and W.N.W. Colours varied from bright green and purple to a deep red around the edges. Continued all the evening."

The Macquarie Island Station was located almost due north of the Magnetic Pole, and distant therefrom by about 1,100 statute miles. It may well be that the notable falling off in verticality of magnetic dip in this more remote station accounts for some of the novel features noted in the log of this Subantarctic station.

II.—RELATIVE FREQUENCY AT ALL STATIONS.

Having experience of both stations, I can state quite definitely that both the frequency and intensity of auroral phenomena are greater at Cape Denison than at Cape Royds. For more specific information in this regard comparison should be made of the Cape Denison log for years 1912 and 1913 with the Cape Royds auroræ for the year 1908, the latter already published.* This finding is made the more definite when due weight is given to the fact that the year 1908 was a year of very high sunspot frequency, whereas 1912 and 1913 were years of waning sunspot frequency, which condition, under normal circumstances, is associated with waning auroral frequency.

Wright and Priestly have found† that the same holds true in relation to their Cape Adare Station and their Cape Evans Station; the Cape Adare location being in a zone of much more frequent and intense auroræ than Ross Island, whereon are both Cape Evans and Cape Royds. All three localities—Cape Denison, Cape Adare, and Ross Island—are situated almost equally distant from the South Magnetic Pole, but, respectively, in approximate latitudes 67° , $71^{\circ} 20'$ and $77^{\circ} 30'$. Both the more northerly stations are in a region of high auroral frequency.

Wright states‡ that auroræ were seen at their Cape Adare station on 64 per cent. of the possible occasions. An analysis of the Cape Denison record, made with a view to establishing the frequency of auroral appearances, results as tabulated herewith—Table I. The figures refer to the percentage of hours in which some form of auroral manifestation appeared, meteorological conditions permitting observation. The basis for these figures is the tables II-A to II-P, appearing later, which embody an analysis of the record. On account of the unsuitable conditions for observation in strong twilight, the figures relating to the first hour in the afternoon and the last in the morning during which any auroral manifestation appeared at any time during the particular month were neglected in making up the monthly average frequencies.

TABLE I.

	Year 1912.	Year 1913.	Average 1912-13.
March	54	61	57.5
April	54	35	44.5
May	36	57	46.5
June	54	50	52
July	63	66	64.5
August	54	59	56.5
September	46	64	55
October	54	24	39
Mean	51.9	52	52 (approx.)

This means that on 52 per cent. of all hours of moderate twilight and darkness, and including all moonlight hours, when the sky was clear for observation, auroral lights would be seen at least some time within the hour.

* "Auroral Observations at the Cape Royds Station, Antarctica," Trans. Roy. Soc. S. Aust., Vol. XL, 1916, pp. 151-212.

† "Observations on the Aurora." British (Terra Nova) Antarctic Expedition, 1910-13; by C. S. Wright, M.C., B.A. (Research, Cantab.), M.A. (Toronto), F.R.A.S., F.Inst. P.

‡ *Loc. cit.*, page 21.

This mean average figure of 52 per cent. is not strictly comparable with that mentioned as deduced for Cape Adare, though it would appear that in all probability there is greater frequency at Cape Adare than at Cape Denison. If not more abundant, then surely the auroræ witnessed at Cape Adare must have been more intense on the average, for coloured manifestations were, apparently, more numerous.

The region of greatest frequency lay well to the north of Adelie Land, as indicated by the prevalence of auroræ seen from Cape Denison low down in the heavens between N.W. and E.N.E., and the fact that, as seen from Macquarie Island, the vast majority were well down in the southern sky. Colour phenomena were certainly more marked as observed from Macquarie Island than from Adelie Land.

There can be no doubt that auroral phenomena are less conspicuous at Queen Mary Land than at either of the other three Antarctic localities referred to, but the logging at the former station was so fragmentary that no strict comparison can be made. Likewise the observations made at Macquarie Island, being even more sporadic, furnish no data useful for a quantitative estimate of the phenomena.

III.—INTENSITY.

On a few special occasions, such as 23 h. on the 8th, and 23 h. on 10th June, 21 h. on 6th July, and 21 h. 20 m. on the 18th September, 1912, the intensity of the exhibitions as seen from Cape Denison was very remarkable and probably nothing grander is ever seen at any other locality in the world, but such occasions were quite exceptional. On the other hand, bright auroræ in the form of curtains and arches were abundant, and, in many cases, of sufficient intensity to develop a red colouration along their lower margin. Fainter effects, however, prevailed during most of time, and all gradations of luminescence were presented down to delicate haze effects, which could not be definitely recognised as auroral had they not been traced, step by step, as faded forms of brighter manifestations, or been found to subsequently wax into definite aurora.

A noteworthy fact seems to be that whereas in the Antarctic zone very delicate and faint effects are constantly appearing, they are not notable to any extent in the Subantarctic regions as judged by our own experience.

On a number of occasions at Cape Denison the light of the aurora was sufficient to illumine the landscape noticeably. Once during full moonlight a strong auroral curtain, traversing the sky from east to west, was well defined everywhere except immediately in the vicinity of the moon itself, where it faded into invisibility, though the moon was seen clearly through it, unaffected by the intervening auroral luminescence.

At the maximum phase of the great aurora of 6th July, 1912, all stars (not the planets) were obliterated and very distinct shadows cast. Also the landscape was so lighted that objects could be seen one mile away.

On account of the fact that only the weak auroræ remain sensibly steady, it is scarcely possible to secure useful photographic records, which are sharp in detail. Plate VI is the result of about 10 seconds' exposure in the case of two ordinary bright, curtained bands in which there was exhibited a moderate amount of motion. The result is too hazy to be of value in defining the detail and features of the phenomenon. As a consequence, resort has been had to sketches, of which a series are presented in Plates I to V. None of these is intended to represent faithfully any particular occasion, but they are all founded on specific cases, and are to be taken as generalised forms of such cases.

IV.—OBSERVATIONS RELATING TO VERY FAINT PHENOMENA.

To the careful and critical observer the appearance, as seen from Cape Denison, of the weakest form of auroral manifestation recognised in our nomenclature was specially noteworthy. The forms assumed were, for the most part, haze patches and haze arches, but, at times, there was the appearance of auroral haze distributed over large areas of the sky in an exceedingly tenuous form. On such occasions, when loggings of this nature were made, the question as to whether it might be a luminous fog (condensed water vapour) was critically considered before entry in the record. Furthermore, if I, myself, was not entirely responsible for the entry, I at least checked the same by personal observation.

In order to glean some idea of the phenomenon of haze arches, reference should be made to the entries of the evening hours of the 5th and 6th June, 1913. Auroral manifestations were noted to wane until so faint as to be unrecognisable to the average observer, then to maintain themselves in such faint forms for many minutes and often several hours, finally to wax again, not as a new appearance, but merely as a renewal of the old feature. This fading and revivification may take place repeatedly, so that there is no atom of doubt that the very faintly luminous haze observed on such occasions is, in fact, an auroral effect.

Be it understood that I am dealing with truly faint effects, such as can be distinguished only on very dark occasions, the extra darkness of the sky permitting the necessary contrast. On the Antarctic Continent, such dark, clear nights are often unusually dark and clear, for the atmosphere is very free from moisture; more so than even the desert; also being situated far from other lands where rising dust stocks the air with dust moates, the clarity of the view of the heavens is superlative at times of clear undisturbed weather. These very faint phenomena are quite beyond the power of discernment unless the eye has fully accommodated itself to the dark, for which a period of ten minutes, at least, is required after leaving the lighted interior of the Hut. A recorder going outside the Hut for the usual periodic observations and making a

hasty survey of the sky for auroral manifestations would normally take no cognisance of these most delicate effects. Furthermore, it can be added, from personal experience, that only a proportion of individuals have that sensitive vision adequate to appreciate very delicate luminous phenomena. Before undertaking such observations, a recorder should satisfy himself that he has the necessary sensitiveness of vision under conditions of darkness.

For further examples of log entries of haze arcs refer to July, 1913, on the 8th at 20 h. 33 m. and 21 h. 30 m., also on the 26th at 23 h. 7 m. Other examples are recorded, but most of the observers who contributed to the record would, in all probability, pass faint phenomena of the kind. Furthermore, it was only on very clear occasions that such observations were at all possible.

It was early noted, 8th July, 1912, at 18 h. 27 m., that there was a great similarity in appearance between definite auroral nebulous haze, such as was frequently seen as a faded phase of an obvious aurora, and certain faint luminous appearances seen in the heavens, and not obviously connected with aurora. Such luminous hazes might occupy only portions of the heavens, and the tendency to be seen to the north was greater than to the south, as indicated in the record of 1st July, 1913, at 1 h. 5 m.

The entry at 5 h. on 8th July, 1913, is of interest in connection with auroral haze effects. On that occasion several very faint haze arches were visible high in the heavens, whilst all along the horizon in the N.E. quarter there was noted a belt of auroral haze; the journal adds, "apparently due to packing of very low haze arches. Compare this effect with the luminous horizon noted at other times." This was a case where faint auroral bars could be detected fairly widely separated in the higher heavens, but approximating to each other in the lower sky, owing to the perspective view. Finally, along the horizon a noticeable luminescence was observed, apparently due to the fact that the line of sight at that low angle would pass through several of the haze bands one behind the other, with the result that a more conspicuous luminescence was presented, notwithstanding the distance away. The final suggestion being that, when on other dark occasions, the sky near the horizon appeared more luminous than the upper heavens, the explanation may be that tenuous auroral haze is present, becoming more obvious as the line of sight approaches the horizontal, for there it traverses a greater thickness of the upper atmosphere.

On the 25th August, 1913, mention is made of "a faint greenish-yellow tint of the last traces of sunset on the horizon between W. and W.N.W." Such greenish-yellow colour, very similar to the auroral tint, was a common feature of the last stage of twilight after sunset. In this connection reference should also be made to the entry for 7th July, 1913, at 23 h. 29 m. when a curtain which had appeared in the N.W. to E.N.E. at an elevation below 35 deg. above the horizon faded to a faint, nebulous band; it "in intensity and colour resembles the greenish-yellow last traces of twilight."

In considering any possible relationship with twilight effects, it is to be remarked that two peak points in auroral frequency at Cape Denison were, respectively, just after sunset and just before dawn, in each case as twilight faded sufficiently auroral bands became recognisable, a feature which is dealt with in a subsequent section. A reference in the log bearing on this aspect is that of the 27th August, 1913, at 19 h. 30 m., where, in recording exceedingly tenuous haze arches, it is mentioned that "that above the W. horizon tapers as it rises; and suggests a connection with the last traces of twilight."

In conclusion, therefore, it may be said that faint nebulous haze of a definitely auroral nature was indistinguishable from certain very faint luminous hazes sometimes appearing in the heavens, which were not obviously explainable in any other way than by assuming that they were, in fact, diffuse auroral manifestations. Furthermore, there is a vague suggestion that something of an auroral nature is associated with twilight.

V.—COLOUR.

The general colour effects, to which the observer becomes accustomed from observations on dark nights, appear of a different tone when seen in bright moonlight or in twilight. Illustrations of such effects are noted under entries for 27th April, 1912, at 20 h. 30 m. and 26th May, 1912, at 20 h. 10 m., and 17th October, 1912, at 22 h. 30 m. Under such circumstances, the tendency is for the normal greenish-yellow tint to appear more green by contrast with the warmer tone of moonlight. By contrast with twilight the normal colour exhibited by auroræ appears cold and palid.

Viewed in the absence of twilight or moonlight, the auroral luminescence in normal cases is always of a greenish-yellow tone of sensibly uniform tint, a colour which in the past has been referred to the prominent line of the Krypton spectrum. With increasing intensity, auroral phenomena exhibit a range of colour extending from a vivid green to crimson. In all such cases of bright colouration, the demonstrations show every indication of being more intense than usual.

Special colour effects of this nature were recorded at all three stations. At Macquarie Island the auroral manifestations appear to have been more often variously tinted than was the case at the two Antarctic stations, also the coloured glows continued for longer periods. The colour phenomena, as seen at Queen Mary Land, were quite similar to the manifestations at Adelie Land. As seen at these latter localities, auroral haze, as well as ordinary nebulous patches and streamers, and even disjointed curtains, never showed more than the normal greenish-yellow colour. But more intense phenomena, such as strong curtains and arches, as well as sheets of intensely luminous

nebula, occasionally noted, were frequently variously coloured. Some of the most powerful displays exhibited a lilac tone. At other times there appeared a range of colour from crimson to bright green.

Referring to the Adelie Land record, cases where special colour was noted occurred on dates as follows:—

1912.		h. m.	1913.		h. m.
May	5...	21 30	May	1...	21 15
"	12...	17 00	"	5...	20 15
"	15...	20 45	June	10...	22 54
June	3...	21 40	"	19...	23 16 <i>et. seq.</i>
"	8...	22 55 <i>et seq.</i>	July	7...	23 08 <i>et. seq.</i>
"	9...	22 48	"	10...	22 53
"	10...	23 05 <i>et seq.</i>	August	27...	23 00
"	30...	20 52	September	9...	21 46
July	1...	23 17	October	19...	22 38
"	5...	19 50 <i>et seq.</i>			
"	6...	6 05			
"	6...	18 40 <i>et seq.</i>			
"	7...	4 36 <i>et seq.</i>			
August	6...	17 00			
"	10...	20 20			
September	12...	20 26			
"	18...	21 20 <i>et seq.</i>			
October	15...	22 02 <i>et seq.</i>			
"	17...	21 45			

The occasions on which the most remarkable colour effects were observed happened during the evenings of 8th and 10th June, the 5th and 6th July, and the 18th September, in 1912. On the first of these occasions, at 23 h., the already strong curtain effects gave place to (at a point just east of the zenith) a rapidly-broadening sheet of luminescence. This extended laterally and particularly to the E.S.E. in a pulsating fashion.

The seething nebulous luminescence presented the appearance of a sea of breaking waves, the whole area appearing like the surface of a choppy sea, and, on its eastern margin, the waves broke successively further and further in that direction. The waves, and particularly their "crests," were of a rose-pink to red colour, whilst in the intervening areas flashes of brilliant green appeared. The whole was a remarkable exhibition of intense auroral activity and of colour. In this case the red colouration appeared, notably on the waves as they swung towards the direction of advance of the phenomena, in this case to the E.S.E.

Out of all these records comes the general observation that, as seen from Cape Denison, red tones, when they appear, are distinctive of the lower margin of auroral curtains as contrasted with a greenish tint in the upward extension. Further reference to colour distribution in arches is made later in the text.

VI.—ALTITUDE.

No measurements were made of the altitude at which the phenomena appeared. The impossible weather conditions of Adelie Land made it impracticable to carry out simultaneous observations for height determinations from two separated stations, in wireless communication, as was planned. However, there is no reason to suppose that in regard to vertical distribution the phenomena in the south differ from those of the Arctic regions which have been very fully studied by several observers.

The latest finding* in the case of Arctic manifestations is that the lower limit is little below an altitude of 100 kilometres, whilst occasional ones are at an elevation of 300 km. The bulk of all auroræ have been shown to be situated, so far as their lower margin is concerned, at about the 100 km. to 105 km. level, or about the altitude where, it seems probable, that the nitrogen-oxygen atmosphere of the lower zone gives place to an upper stratum composed predominantly of helium and hydrogen.†

Such entries in the log-book as "the aurora appears to be lower in the sky than usual," which appear at intervals, refer only to the impression made upon the observer, and cannot be regarded as a definite record of proximity or otherwise, for in the same way, depending upon the atmospheric conditions, the stars appear distant or otherwise.

No auroral phenomenon came under my notice during the two years of observation in Adelie Land, which, for its explanation, demanded a lower altitude than shown by Dr. Störmer to be the case in the Scandinavian region.

Curtains and arches extending to the horizon appear, of course, to meet the land or sea surface, and may be so miraged at the apparent contact as to result in a blurring, suggesting that the auroral light has descended slightly below the horizon on the line of sight between the observer and the horizon. Cases of this kind, apparently affected by mirage, are recorded in the log of the Cape Royds Station.‡ In this fashion arches crossing the heavens and disappearing behind the sky-line of the high shoulders of Mt. Erebus, sometimes appeared to be slightly kinked near the apparent point of contact. Mirage effects are often very remarkable in the Antarctic regions, particularly along the coastal zone, consequently allowance should be made for possible distortion of phenomena when seen at very low altitudes.

In the Cape Royds log a number of entries appear of low altitude luminous manifestations, which were not regarded as necessarily auroral. In most of those cases the possibility of the appearance being due to the reflection of a distant aurora,

* "Summary of Results of the Aurora Borealis Expedition of 1913 to Bosskop, Norway," by Carl Störmer, *Terr. Mag. and Atmospheric Electricity*, Dec., 1916, p. 157.

† "Les phénomènes d'aurore boréale et les problèmes qui s'y rattachent," par Carl Störmer, *Ve Congrès des Mathématiciens Scandinaves* (à Helsingfors), 1922, p. 74.

‡ *Loc. cit.*

or of the moon hidden from the observer—perhaps behind the Ross Island highlands—was borne in mind at the time of logging. Consequently there is reason to believe that not all were to be explained in this way. In all such cases the effects were faint and nebulous. Examples were luminous borders on condensation clouds over Mt. Erebus and luminous appearances in cloud strata and fog banks.

Weak luminous phenomena may result from phosphorescence, triboluminescence, frictional electricity, and brush discharge. It may be that something of the kind operates under special circumstances to produce some of the phenomena recorded. The rapid subjection to very low temperatures of ice crystals formed rapidly from an atmosphere rich in water vapour suggests conditions conducive to triboluminescence. Luminous phenomena arising from the friction, in high velocity winds, of snow particles at low temperatures were noted at Cape Denison. In the winter hurricanes the cloud of drifting snow on the land slopes to the south of Winter Quarters at Cape Denison presented at times the appearance of being weakly self-luminous. At all times, in such hurricanes, the steady glow of St. Elmo's fire (silent discharge) illuminated all pointed objects.

VII. HOURLY DISTRIBUTION OF AURORAL PHENOMENON.

An analysis of the Cape Denison record appears in tabular form herewith, tables 11A to 11P. The figures under the columns headed "Auroral phenomena recorded" refer to the number of occasions, within the particular month, when auroral phenomena were noted for particular hours. The hour is taken to cover the half-hour preceding and succeeding that quoted. Any single report of aurora within the hour secures an entry for the hour, and no additional recognition is given where more than one report of aurora appears within the period. In cases where the only manifestation has occurred just about halfway between two hours an entry of half an occurrence only is given for each hour before and after. In a few cases a quarter entry appears where an hour has been singularly free from aurora and merely very faint appearances showed up about half way between hours.

The tabular statement is in no way quantitative as regards intensity, but a rough quantitative idea of the spread of a particular occurrence over the heavens is secured by spreading the record over as many sectors as it affected. Where no aurora was visible though the meteorological conditions were favourable for observation an entry also appears under the appropriate column. In arriving at the entries under "Total hours sky not obscured," failure to observe though the sky may have been favourable for observation is included with the normal overcast or dense drifting occasions when the sky was truly obscured. It was very seldom, however, that hours were missed.

AUSTRALASIAN ANTARCTIC EXPEDITION.

TABLE II A—MARCH, 1912.

Hour of Local Time.	Auroral Phenomena Recorded.									Total Number of Hourly Occurrences in all Sectors.	Sky unobscured. No Aurora visible.	Total Hours Sky not obscured.	Total Occurrences in all Sectors. Daily Mean of observable occasions.	Aurora Visible as percentage of observable occasions.
	N. to N.E.	N.E. to E.	E. to S.E.	S.E. to S.	S. to S.W.	S.W. to W.	W. to N.W.	N.W. to N.	Zenith (within 20°).					
20	4	1	...	...	...	...	1	4	...	10	4	9	1.1	55
21	7.5	2	...	...	...	...	3.5	4	...	17	5	13	1.3	61
22	5.5	3	...	...	...	...	3	4	...	15.5	6	14.5	1.1	59
23	4	2	...	...	...	...	2	5	...	13	6	11.5	1.1	48
Midnight ...	7	2.5	...	1	1	...	2.5	5.5	...	19.5	2	11	1.8	82
1	2.5	1	...	...	...	...	1	1	...	5.5	9	12	0.8	25
2	2	1	...	...	0.5	...	...	2.5	...	6	3.5	7	0.9	50
3	2.5	...	...	1.5	1.5	...	...	2.5	2	10	3	6	1.7	50
4	2.5	...	...	...	...	...	...	1	...	3.5	5	7	0.5	29
Total.....	37.5	12.5	0	2.5	3	0	13	29.5	2	100	43.5	91	Av. 1.1	Av. 51

TABLE II B—APRIL, 1912.

18	1	...	...	...	...	...	...	...	...	1	6	7	0.1	14
19	1	1	...	...	...	...	1.5	1	...	4.5	5	7	0.6	29
20	4	1.5	0.5	0.5	0.5	...	1.5	2	...	10.5	5	9	1.2	44
21	4.5	3	0.5	...	...	...	1.5	0.5	...	10	1.5	8	1.3	81
22	6.5	2	...	...	...	...	1	1	...	10.5	2	7	1.5	71
23	1	...	...	...	...	...	...	...	...	1	4.5	7.5	0.1	40
Midnight ...	4.5	2.5	1	...	...	...	...	2	...	10	4	9	1.1	55
1	2.5	...	...	...	...	...	0.5	2.5	...	5.5	3	7	0.6	55
2	3.5	1	1	1	1	...	...	2.5	1	11	1.5	7	1.6	79
3	2	...	...	1	1	1	1	2	1	9	3.5	6.5	1.4	46
4	1	...	...	1	1	2	2	2	...	9	5	7	1.3	29
5	1	...	1	1	...	1	1	1	2	8	3.5	7.5	1.1	53
6 .....	...	...	...	1	...	1	0.5	1	1	4.5	5.5	8.5	0.5	35
Total.....	32.5	11	4	5.5	3.5	5	10.5	17.5	5	94.5	50.0	98.0	Av. 1.0	Av. 49

TABLE II C—MAY, 1912.

17	2.5	2	...	...	...	...	...	1.5	1	7	7	11	0.6	36
18	2	2.5	0.5	...	...	...	0.5	1	2	9.5	9	13	0.7	31
19	1.5	1	...	...	...	...	...	1	1	4.5	10	11.5	0.4	13
20	2	1.5	...	...	...	...	...	1	1	5.5	8.5	11.5	0.5	26
21	3	2	...	...	...	...	...	2.5	...	7.5	9	13	0.6	31
22	6	4.5	...	...	...	...	...	1	5	16.5	8	13	1.3	38
23	3	1.5	3	...	...	...	0.5	2.5	...	7.5	8.5	11.5	0.7	26
Midnight ...	4.5	3	0.5	2	0.5	...	...	2	1	16	9	15	1.1	40
1	1.5	2	1	...	...	...	...	2.5	...	7	6.5	12.5	0.6	56
2	3	...	0.5	...	...	1	...	2	...	6.5	5.5	11.5	0.6	52
3	1.5	0.5	1	2	...	...	...	2	2	9	6	9.5	0.9	37
4	1.5	1.5	1.5	0.5	0.5	0.5	1	1	3	11	6.5	9	1.2	28
5	2	2	2	1.5	0.5	1.5	2	2	3	16.5	5.5	9.5	1.7	42
6	4	4	3.5	...	0.5	0.5	3	3.5	5	24	6	13	1.8	54
7	1	...	3	2	...	...	2	2	3	13	7.5	12.5	1.0	40
8 .....	...	...	...	...	...	...	...	1	...	1	10	11	0.1	9
Total.....	39	28	16	8	2	4	12.5	33.5	19	162	112.5	177.0	Av. 0.9	Av. 34

TABLE II D—JUNE, 1912.

Hour of Local Time.	Auroral Phenomena Recorded.									Total Number of Hourly Occurrences in all Sectors.	Sky unobscured. No Aurora visible.	Total Hours Sky not obscured.	Total Occurrences in all Sectors. Daily Mean of observable occasions.	Aurora Visible as percentage of observable occasions.
	N to N.E.	N.E. to E.	E. to S.E.	S.E. to S.	S. to S.W.	S.W. to W.	W. to N.W.	N.W. to N.	Zenith (within 20°).					
16	1	1	1	...	...	...	2	1.5	...	6.5	14.5	17.5	0.4	17
17	6.5	3.5	1	...	...	0.5	2.5	4	1	19	10	19	1.0	53
18	7.5	3.5	0.5	0.5	...	0.5	2.5	6	1	22	10	19	1.2	53
19	5.5	2	1	...	...	...	...	3	...	11.5	12.5	18	0.6	31
20	6.5	2.5	...	...	...	...	...	2.5	...	11.5	8.5	16.5	0.7	48
21	8	7.5	...	...	...	...	...	5	...	20.5	5	17	1.2	70
22	10.5	5.5	1	...	...	...	1	7.5	...	25.5	5	16	1.6	70
23	10	5.5	1	...	...	...	4	7.5	3	31	4.2	16	1.9	72
Midnight ...	7	6	...	...	...	...	2.5	8	...	23.5	10.2	18.5	1.3	44
1	6.5	2.5	0.5	...	...	...	2.5	6	1	19	8	15.5	1.2	48
2	2.5	1.5	0.5	1	...	...	2	3	1	11.5	9.2	15	0.8	38
3	2.5	1.5	2	1.5	...	1	4	4.5	2	19	9.2	15.5	1.2	40
4	3	2	1.5	2	...	...	3.5	2.5	4	18.5	8	16	1.2	50
5	3.5	1.5	4	2.5	0.5	...	4.5	5	5	26.5	8.5	18.5	1.4	54
6	8	5.5	7.5	1	0.5	1.5	8.5	6.5	10	49	5.5	18.5	2.6	70
7	2	2	5	1	1	1.5	9	2.5	9	33	6.5	17.5	1.9	63
8 .....	...	1	1	...	...	1	5.5	1	2	11.5	11	19	0.6	42
Total.....	90.5	54.5	27.5	9.5	2	6	54	76	39	359	146.5	293	Av. 1.2	Av. 51

TABLE II E—JULY, 1912.

16	1.5	1.5	1.5	...	...	0.5	1.5	0.5	2	9	18.5	21	0.4	12
17	9	3.5	3.5	1.5	2	2.5	6.5	7.5	4	40	6	21	1.9	71
18	10	6	4.5	3.5	3	1.5	6	12	3	49.5	6	21	2.4	71
19	6	3	1	1	1	1	1	4	0.5	18.5	10.5	18.5	1.0	43
20	6.5	2	...	...	...	1	3	7.5	2.5	22.5	10	19	1.2	47
21	7	2	1	0.5	...	...	2	4.5	2	19	10.5	18	1.0	42
22	10	4	1	1	0.5	...	2	6.5	...	25	6.5	17.5	1.5	63
23	11	3	...	...	1	1	2	10	2	30	3	18.5	1.6	84
Midnight ...	9.5	2.5	...	...	1	1	3	9	1	27	5.5	19.5	1.4	80
1	8.5	3.5	2	0.5	...	...	0.5	5	...	20	6	17	1.2	65
2	6	2	1	...	...	0.5	1.5	6.5	...	17.5	6.5	15.5	1.1	58
3	6	1.5	2.5	1	...	0.5	4	3.5	1	20	7.5	15.5	1.3	52
4	6	2.5	3	3	1.5	1	4.5	5	6	32.5	6.5	15.5	2.1	58
5	3	2.5	6.5	4	1	1.5	7	4	8	37.5	6	18	2.1	67
6	3.5	4	9	5.5	2.5	3	11	6.5	11	56	4	17	3.3	76
7	5	5	8	4.5	1.5	1.5	8.5	8	11	53	4.5	18.5	2.9	76
8	1.5	1.5	5	1	1	2.5	8	2.5	3.5	26.5	10.5	19.5	1.4	46
Total.....	110	50	49.5	27	16	19	72	102.5	57.5	503.5	128.0	310.5	Av. 1.6	Av. 59

AUSTRALASIAN ANTARCTIC EXPEDITION.

TABLE II F—AUGUST, 1912.

Hour of Local Time.	Auroral Phenomena Recorded.									Total Number of Hourly Occurrences in all Sectors.	Sky unobscured. No Aurora visible.	Total Hours. Sky not obscured.	Total Occurrences in all Sectors. Daily Mean of observable occasions.	Aurora Visible as percentage of observable occasions.
	N. to N.E.	N.E. to E.	E. to S.E.	S.E. to S.	S. to S.W.	S.W. to W.	W. to N.W.	N.W. to N.	Zenith (within 20°).					
17	1	...	...	...	...	...	...	...	...	1	11	12	0.1	8
18	4.5	3.5	0.5	...	...	...	1	2	...	11.5	6.7	14	0.8	52
19	3	2	...	...	...	...	...	1	...	6	8.5	12	0.5	29
20	6	1.5	...	...	...	...	...	2.5	...	10	9.5	16.5	0.6	42
21	6	1.5	...	...	...	...	0.5	3.5	...	11.5	7.7	14.2	0.8	44
22	9	4	...	...	...	...	0.5	4.5	0.5	18.5	5.5	15.5	1.2	65
23	6	2.5	...	...	0.5	0.5	...	5	0.5	15	3.5	12.5	1.2	72
Midnight ...	7.5	1	...	...	...	...	...	8	...	16.5	4	14	1.2	71
1	6	2	...	...	...	...	0.5	5.5	...	14	4	12	1.2	66
2	4.5	1.5	0.5	0.5	...	...	...	5	...	12	7.5	13	0.9	46
3	2.5	2	1	...	...	...	...	3	...	8.5	8	12.5	0.7	36
4	5	2	4	2	...	...	5	4	3	25	6.5	13	1.9	50
5	2.5	0.5	4	3	0.5	1	4	6.5	4	26	5.5	12.5	2.1	56
6	4	3	4	3	...	1.5	6.5	6	4.5	32.5	6	17	1.9	65
7 .....	...	...	0.5	0.5	...	...	0.5	0.5	1	3	14	17	0.2	18
Total.....	67.5	27	14.5	9	1	3	18.5	57	13.5	211.0	107.9	207.7	Av. 1.0	Av. 48

TABLE II G—SEPTEMBER, 1912.

19	2	0.5	...	...	...	...	...	...	...	2.5	13	15	0.2	13
20	8	2.5	...	...	0.5	0.5	...	1.5	1	14	14	22	0.7	36
21	9	5.5	...	...	...	...	3	6	0.5	24	11.5	22.5	1.1	48
22	13	3	1	...	...	1	2	8.5	1	29.5	8.5	22.5	1.3	62
23	9	3.5	...	...	...	...	0.5	4.5	1	18.5	13	23	0.8	43
Midnight ...	8.5	3	...	0.5	0.5	...	0.5	4.5	...	17.5	11.5	21.5	0.7	47
1	5	0.5	...	...	...	...	1	4	...	10.5	10	20.5	0.5	51
2	5	0.5	1	1	...	...	2	6.5	2	18	10.5	21.5	0.8	51
3	6	...	1	1	...	1	2.5	9.5	4	25	10	21	1.2	52
4	1	...	1	...	...	...	3	0.5	2	7.5	16	20	0.4	25
5	1	1	1	1	...	...	...	1	1	6	18	20	0.3	10
Total.....	67.5	20	5	3.5	1	2.5	14.5	46.5	12.5	173.5	135	229.5	Av. 0.8	Av. 40

TABLE II H—OCTOBER, (first seventeen days), 1912.

21	1	...	...	...	...	...	...	...	...	1	5.5	6.5	0.2	15
22	3	2	...	...	...	...	...	3	...	8	1.5	4.5	1.8	66
23	3	1	...	...	...	...	...	2.5	...	6.5	3	6.5	1.0	54
Midnight ...	1.5	...	...	...	...	...	...	1.5	...	3	4.5	6.5	0.5	41
1	1	...	...	...	...	...	...	1	...	2	3.5	7.5	0.3	53
Total.....	9.5	3	0	0	0	0	0	8	0	20.5	18.0	31.5	Av. 0.8	Av. 46

TABLE II I—MARCH, 1913.

Hour of Local Time.	Auroral Phenomena Recorded.									Total Number of Hourly Occurrences in all Sectors.	Sky unobscured. No Aurora visible.	Total Hours. Sky not obscured.	Total Occurrences in all Sectors. Daily Mean of observable occasions.	Aurora Visible as percentage of observable occasions.
	N. to N.E.	N.E. to E.	E. to S.E.	S.E. to S.	S. to S.W.	S.W. to W.	W. to N.W.	N.W. to N.	Zenith (within 20°).					
22	1	1	...	...	...	...	...	...	...	2	2	3	0.7	33
23	2	1	...	...	...	...	1	1	...	5	1	4	1.2	75
Midnight ...	1	1	...	...	...	...	1	1	...	4	1	4	1.0	76
1	1	...	...	...	1	...	...	1	...	3	4	6	0.5	33
2 .....	...	...	1	...	...	...	1	1	2	5	3	6	0.8	50
Total.....	5	3	1	0	1	0	3	4	2	19	11	23	Av. 0.8	Av. 53

TABLE II J—APRIL, 1913.

18	1	...	...	...	...	...	...	1	...	2	5	7	0.3	29
19	1	2	...	...	...	...	...	...	1	4	1.5	8	0.5	20
20	2	2	...	...	...	...	...	...	...	4	7	10	0.4	30
21	5	5	...	...	...	1	1	3	...	15	7.5	15	1.0	50
22	4	1	1	1	...	...	...	4	1	12	7	12.5	1.0	44
23	3	1	...	...	...	...	...	1	...	5	6.5	11	0.5	40
Midnight ...	...	...	...	...	...	...	...	3	...	3	10	13	0.2	23
1	1	1	...	...	...	...	1	5	...	8	7	11	0.7	36
2	2	2	1	1	...	...	2	2	2	12	6.5	11.5	0.6	43
3 .....	...	...	1	...	...	...	4	...	1	6	7	11	0.5	36
4 .....	...	...	1	...	...	...	1	...	1	3	6	9	0.3	33
5 .....	...	...	2	...	...	...	2	1	1	6	6.5	9	0.7	28
Total.....	19	14	6	2	0	1	11	20	7	80	77.5	128	Av. 0.6	Av. 34

TABLE II K—1913.

17	2	0.5	...	...	...	...	...	1.5	...	4	6	11	0.4	45
18	4	1	...	...	...	...	...	2	...	7	6	11	0.6	45
19	2	...	...	...	...	...	...	...	1	3	7	9	0.3	22
20	3	1	...	...	...	...	...	1	2	7	5	9	0.8	44
21	4	3	...	...	...	...	...	1	1	9	4	10	0.9	60
22	6	2	...	...	...	...	1	3	1	13	2	11	1.2	82
23	7	2	...	...	...	...	...	4	0.5	13.5	2	10	1.3	80
Midnight ...	4	1	...	...	...	...	...	3	1	9	3	11	0.8	73
1	2	...	...	...	...	...	1	2	...	5	4	8	0.6	50
2	1	...	...	...	...	...	...	2	...	3	4	7	0.4	43
3	1	...	...	...	...	...	1	2	1	5	4	7	0.7	43
4	1	1	2	...	...	...	...	1	2	7	3	7	1.0	57
5 .....	...	1	0.5	0.5	...	...	0.5	1.5	3	7	3	8	0.9	62
6 .....	...	1	0.5	0.5	...	...	2	2	1	7	3	8	0.9	62
7 .....	...	0.5	...	...	...	...	1	0.5	1	3	4	7	0.4	43
Total.....	37	14	3	1	0	0	6.5	26.5	14.5	102.5	60	134	Av. 0.8	Av. 55

AUSTRALASIAN ANTARCTIC EXPEDITION.

TABLE II L—JUNE, 1913.

Hour of Local Time.	Auroral Phenomena Recorded.									Total Number of Hourly Occurrences in all Sectors.	Sky unobscured No Aurora visible	Total Hours. Sky not obscured.	Total Occurrences in all Sectors. Daily Mean of observable occasions.	Aurora Visible as percentage of observable occasions.
	N. to N.E.	N.E. to E.	E. to S.E.	S.E. to S.	S. to S.W.	S.W. to W.	W. to N.W.	N.W. to N.	Zenith (within 20°).					
16	1	1	...	...	...	...	...	1	...	3	8	10	0.3	20
17	4	1.5	...	...	...	0.5	...	2	2	10	11	15	0.7	27
18	7	3	...	...	0.5	1.5	...	2	1.5	18	8	16	1.1	50
19	6	3.5	0.5	...	1	...	0.5	3	...	14.5	9	15	1.0	40
20	8	1.5	...	...	...	...	...	2	...	11.5	7	15	0.8	53
21	9	3	...	...	...	...	0.5	2	...	14.5	7	16	0.9	56
22	8	2	...	...	...	...	1	3.5	...	14.5	7	16	0.9	56
23	9	2.5	...	...	...	...	1	6	1	19.5	7	16	1.2	56
Midnight ...	7	3.5	2	1	...	...	1.5	7	...	22	9	18	1.2	50
1	6	1	...	1	3	2.5	2	4	1	20.5	9	17	1.2	47
2	2.5	1	...	...	...	...	...	2.5	...	6	12	15	0.4	20
3	1	2.5	1.5	...	...	...	0.5	1.5	2	9	11	15	0.6	27
4	4.5	3	3.5	...	...	...	3	2	3	19	5	12	1.6	58
5	3	4.5	4	1	...	...	3.5	2	6	24	4	16	1.5	75
6	2.5	4	4	1.5	...	...	6	2.5	6	26.5	4	16	1.7	75
7	1	1.5	4.5	...	...	...	5.5	3	7	22.5	3.5	13.5	1.7	70
Total.....	79.5	39	20	4.5	4.5	4.5	27	45.5	30.5	255	121.5	241.5	Av. 1.0	Av. 49

TABLE II M—JULY, 1913.

17	2	2	...	...	...	1	2	...	0.5	7.5	8	13	0.6	38
18	7	3	...	...	...	1	...	4	1	16	5	13	1.2	61
19	6	3.5	...	...	...	1.5	2.5	3	...	16.5	5	12.5	1.3	60
20	10.5	5	...	...	0.5	2	3.5	5	2	28.5	4	14	2.0	71
21	10	4.5	...	...	...	...	2.5	6	...	23	4.7	14.7	1.6	68
22	9.5	4	...	...	...	...	1.5	3.5	1	19.5	3.5	14.5	1.3	76
23	6.5	3	...	...	1	...	1.5	5.5	1	18.5	2.2	14.7	1.3	85
Midnight ...	7.5	2.5	...	...	0.5	...	2	6	2	20.5	3.7	14.7	1.4	74
1	9.5	3.5	...	...	...	1.5	4	8	1	27.5	3.2	14.7	1.9	78
2	6.5	1	0.5	0.5	...	...	1.5	4	1	15	4.5	13.5	1.1	66
3	5	1.5	0.5	...	...	0.5	2.5	4	1	15	7.7	15.7	1.0	51
4	5	5	1.5	2	...	...	3.5	3.5	4.5	25	8.5	14.5	1.7	41
5	3	3	4.5	2.5	...	...	4.5	5.5	9	32	6.5	14.5	2.2	55
6	5.5	4	4.5	1	...	...	3.5	5.5	7	31	4.5	14	2.2	68
7	2	1	0.5	...	...	0.5	6	2.5	3	15.5	5	14	1.1	64
8	1	1	...	...	...	0.5	1.5	1	2.5	7.5	8.5	12	0.6	30
Total.....	96.5	47.5	12	6	2	8.5	42.5	67	36.5	318.5	84.3	224.0	Av. 1.5	Av. 62

TABLE II N—AUGUST, 1913.

18	2	1.2	0.3	...	...	...	...	2	...	5.5	2	7.5	0.7	73
19	3	2	...	...	...	1	1.5	1.5	...	9	3	7	1.3	57
20	4.2	1	...	...	...	0.5	2	2.5	...	10.2	3.5	8	1.3	53
21	5	0.5	...	...	1	1	3	3	...	13.5	4.5	8.5	1.6	47
22	5.5	4	1	1	...	...	1	1.5	1	15	3	8.5	1.8	65
23	5.5	3.5	...	...	1	1	1	3	...	15	3	9.5	1.6	68
Midnight ...	3.5	...	...	...	...	...	...	3.5	...	7	4	10.5	0.6	62
1	2	2	...	...	...	...	1	3	...	8	7	11	0.7	36
2	2	2	...	...	...	...	0.5	3	...	7.5	7.7	10.5	0.7	26
3	5	1.5	1	...	...	...	3.5	3.5	2	16.5	3.5	10.7	1.5	67
4	4	3	3	2	0.5	0.5	1	4	3	21	2.7	9.2	2.3	70
5	3	3	1	3	0.5	0.5	1.5	4.5	6	23	3	9	2.6	67
6	3	3	2	2.5	...	0.5	3	4.5	4.5	23	2	10	2.3	80
7 .....	...	...	0.5	0.5	...	...	1.5	0.5	2	5	1.5	4.5	1.1	66
Total.....	47.7	26.7	8.8	9	3	5	20.5	40	18.5	179.2	50.4	124.5	Av. 1.4	Av. 60

TABLE II O—SEPTEMBER, 1913.

Hour of Local Time.	Auroral Phenomena Recorded.									Total Number of Hourly Occurrences in all Sectors.	Sky unobscured. No Aurora visible.	Total Hours. Sky not obscured.	Total Occurrences in all Sectors. Daily Mean of observable occasions.	Aurora Visible as percentage of observable occasions.
	N. to N.E.	N.E. to E.	E. to S.E.	S.E. to S.	S. to S.W.	S.W. to W.	W. to N.W.	N.W. to N.	Zenith (within 20°).					
20	2	1	...	1	1	1	1	3	1	11	3	7.5	1.5	60
21	3	1	...	...	...	1	2	2	2	11	3	9	1.2	67
22	5	1	1	...	...	...	2	3	1	13	2.5	9	1.4	72
23	5.5	2.5	...	...	1	...	1	4	...	14	2.5	10	1.4	75
Midnight ...	3.5	2	1	...	...	...	...	3.5	1	11	3	10	1.1	70
1	6	2	1	...	...	...	2.5	2	1	14.5	3	10.5	1.4	71
2	5	1.5	0.5	...	...	...	1	4	1	13	5.5	10.5	1.2	48
3	2	1	1	...	...	...	2	2.5	2	10.5	4.4	9	1.2	55
4	2.5	...	...	...	...	...	0.5	1.5	2	6.5	2.5	6.5	1.0	61
5	1	...	...	...	...	...	1.5	1	1	4.5	3	6	0.7	50
Total.....	35.5	12	4.5	1	2	2	13.5	26.5	12	109	32	88	Av. 1.2	Av. 63

TABLE II P—OCTOBER, 1913.

21	2	1	...	...	...	...	1	1	1	6	13	15	0.4	13
22	5	3	0.5	...	...	...	...	3	...	11.5	9	15	0.8	40
23	3	2	...	...	...	...	...	3.5	...	8.5	9.5	15	0.6	39
Midnight ...	2.5	0.5	...	...	...	...	...	...	...	3	12.5	15.5	0.2	26
1	1.5	...	0.5	0.5	...	...	...	1.5	1	5	11	13	0.4	15
2 .....	...	...	...	...	...	...	...	1	1	2	12	13	0.2	8
Total.....	14	6.5	1	0.5	0	0	1	10	3	36	67	86.5	Av. 0.4	Av. 23

(a) Total Hourly Occurrences in all Sectors.

Considering only the months of June and July, when observations over the greatest range of hours are available, the figures in the foregoing tables mean out as follows :—

TABLE III.

Hour	16	17	18	19	20	21	22	23	Mdt.	1	2	3	4	5	6	7	8
Total occur- rences in all sectors.	4.6	19.1	26.4	15.2	12.5	19.2	21.1	24.7	23.2	21.7	12.5	15.7	23.7	30	40.6	31	15.2

The figures at either limit, namely at 16 h. and 8 h. are, of course, much affected by strong twilight, all weaker aurora being blotted out. Making allowance for twilight at either limit of observation, it is obvious from these figures that at Cape Denison, in the winter months, there are three maximum periods of auroral abundance during the

dark hours. These are about 6 p.m., 6 a.m., and 11 p.m. The graph (fig. 1,) which expresses these mean figures, very clearly indicates the periods of maximum and minimum distribution.

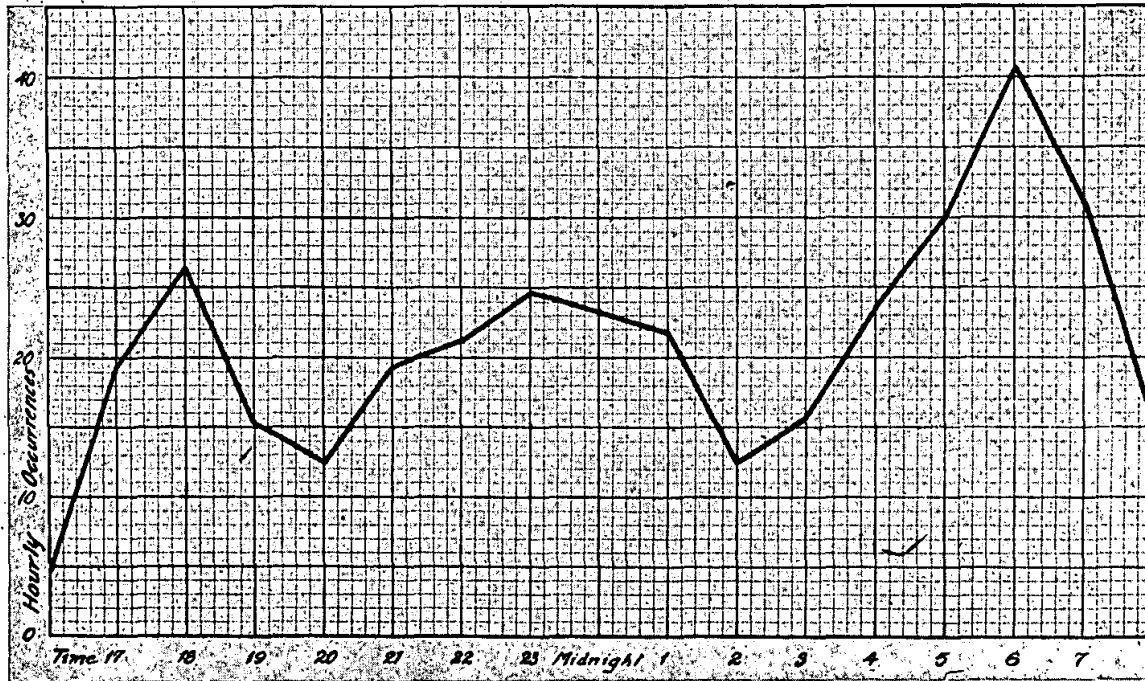


Fig 1.—Total Number of Hourly Occurrences in all Sectors—Mean for months of June and July of 1912 and 1913. Cape Denison.

As regards the relative intensity of the auroræ seen, an estimate based solely upon the apparent brightness or otherwise of the luminous phenomena as logged in the record cannot be accepted as correct, for the following factors must be taken into account. Firstly there is some want of uniformity among observers in defining the degree of intensity exhibited. Secondly, as the atmosphere was not uniformly clear even in "clear" weather, auroral lights of the same actual intensity would appear at times brighter than at others. Thirdly, the presence or absence of moonlight was a very important determining factor as to whether an auroral manifestation would appear to the observer as dull or bright; indeed, only the strongest auroræ would be visible at all. Finally, the intensity as noted by visual observation of all auroræ seen during twilight hours cannot be strictly compared with that of phenomena appearing during dark hours.

This being so, no analysis of the record has been made with the object of establishing, on a quantitative scale, the relative proportions of bright and weak auroræ. But it can be stated that our experience at Cape Denison very conclusively indicated that the daily period of apparently most intense auroræ was between 9 p.m. and 11.30 p.m. The maximum phase of the six greatest manifestations witnessed at Cape Denison fell between 11.8 p.m. and 11.41 p.m., averaging the mean time of 11.17 p.m. Four other very remarkable and brilliant auroræ of the curtain type culminated respectively at 9.25 p.m., 10.0 p.m., 10.54 p.m., and 11.17 p.m. The auroræ

so regularly appearing in the twilight hours of early morning, and, to a less extent, of the evening, though never extremely brilliant to look at, must often have been intense in order to be at all apparent in twilight. But there rarely was ever at such times any other colour observable beyond the greenish-yellow tint; consequently it would appear that, after all, the later evening hours were *par excellence* the period of the day when auroræ of the greatest intensity were to be expected.

The Queen Mary Land record is too fragmentary to allow of the possibility of yielding really satisfactory figures for comparison with the foregoing. But in any case they will have some value. An analysis on the same lines as that undertaken for Adelle Land yielded the following figures, all months being, in this case, taken into consideration.

TABLE IV.

Hour	17	18	19	20	21	22	23	Mdt.	1	2	3	4	5
Total occurrences in all sectors	3	12.5	9	15	16	7	5	20.5	1	1	13	0	3

Here the most obvious feature is the occurrence of peaks at special observation hours, namely, at 6 p.m., 9 p.m., midnight, and 3 a.m. It was the custom to make meteorological observations at these hours, and, naturally, more loggings of auroræ appear against them than for intermediate periods. The significance of the figures is best realised in the graph Fig. 2.

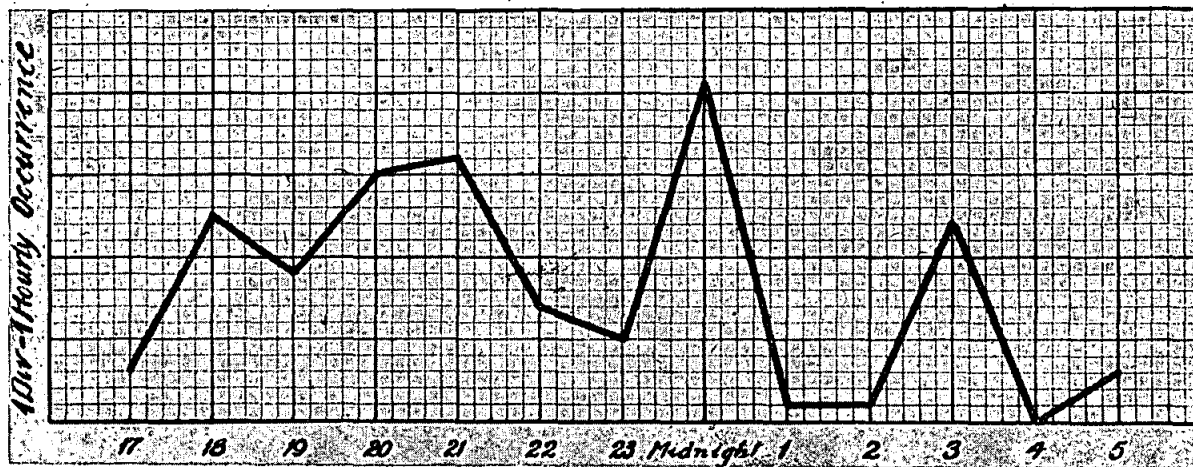


Fig. 2.—The Total Number of Hourly Occurrences in all Sectors—Queen Mary Land Station—Year 1912.

Making allowance for the artificially enhanced position of the hours 6 p.m., 9 p.m., midnight, and 3 a.m. the following deductions may reasonably still be made. That maximum period of auroral distribution was about midnight, but that a rapid falling off took place shortly afterwards followed later in the early morning hours by a rise. In the evening, as twilight departed, a considerable amount of aurora was commonly seen, which increased as the evening proceeded with a possible temporary falling off

at 7 p.m., though this fall may be all due to the fact that dinner was on about that time and inspection of the heavens would then be less frequent than usual. That a falling off did occur after 9 p.m. seems certain, for if auroral manifestations were waxing, observers would certainly have continued to observe and log the features presented, only relinquishing watch when a definite subsidence was established. There seems no doubt therefore that a definite diminution in auroral manifestations did occur, say, between 9.30 p.m. and 11.30 p.m.

As regards intensity at the Queen Mary Land station the period of intense, active, and coloured auroræ is later in the evening than that noted at Cape Denison. Practically all the more brilliant demonstrations are recorded between 11.30 p.m. and 3.30 a.m., the most favoured time being between midnight and 1 a.m.

Of the four years record at Macquarie Island only that for 1913 is suitable for analysis with a view to ascertaining the hourly distribution of auroræ, and even that is deficient for, owing to shortage of observers, all regular observation ceased after 10 p.m. unless there happened to be a demonstration actually in progress, when Mr. Ainsworth would continue on duty until it subsided. It may therefore be that a revival of the phenomena featured in the later early morning hours when, ordinarily, all watch was relinquished. But, on the other hand, taking all things into consideration it is not likely that such was the case to any notable extent, for on the various occasions when men were about at 4 a.m., 5 a.m., and 6 a.m. little was ever seen of auroral lights. An analysis of the 1913 data gives the following figures:—

TABLE V.

Hour.....	19	20	21	22	23	Mdt.	1	2	3	4	5	6
Total occurrences in all sectors.....	5.5	16	24	37	35.5	31	21	5	4	4	2	1

These figures are graphically represented in Fig. 3, where a steady rise to 10 and 11 p.m. is shown with a gradual falling off thereafter. This is distinctly different to the case

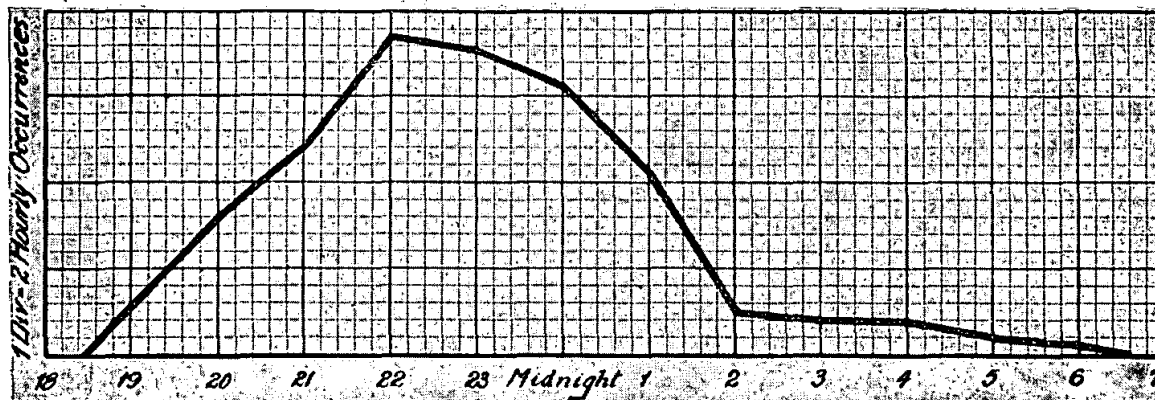


Fig. 3.—Total Number of Hourly Occurrences in all Sectors—Macquarie Island Station—Year 1913.

at the Antarctic stations where the maxima comparable to this does occur, but is supplemented by other maxima following departure of daylight and preceding the advent of daylight.

At Macquarie Island the period of brilliant auroræ corresponded closely with that of Adelle Land. The hour between 10 p.m. and 11 p.m. was specially favoured, though very brilliant displays appeared at all hours between 8 p.m. and midnight.

(b) *Total occurrences in all Sectors—Mean hourly value for observable occasions.*

The preceding discussion concerning the relative hourly abundance of auroral phenomena seen in the sky during the dark hours has been based on the total number of hourly occurrences in all sections actually logged. But in the case of the Adelle Land station where a continuous record was kept, a more correct estimate of hourly distribution can be got by dividing the total number of hourly occurrences in all sectors as observed by the number of occasions in the case of each hour that the sky was not obscured. That is to say, the figure got by dividing that for any particular hour in column eleven of the tables of hourly distribution by the figure for the corresponding hour in column thirteen. The quotient which appears in column fourteen is a truly comparative figure.

On account of the interference of twilight with the observation of any but strong demonstrations, it is best to group the months into pairs of about equal duration of darkness, or, what is the same, of equal distribution on either side of midwinter. In this mean figures for 1912 and 1913 for the daily mean of observable occasions (column fourteen) have been prepared and are tabulated as follows:—

TABLE VI—Mean value for 1912–1913.

Total occurrence in all sectors as the mean hourly value for observable occasions.

Hours	16	17	18	19	20	21	22	23	Mdt.	1	2	3	4	5	6	7	8
March–Oct.	1.3	1.1	1.0	0.9	0.5	0.8	1.7	...	...	...	...	...
Apl.–Sept.	0.2	0.4	0.7	1.1	1.3	0.7	0.8	0.8	1.0	1.1	0.8	0.7	0.5	...	...
May–Aug.	0.5	0.7	0.6	0.8	1.0	1.4	1.2	0.9	0.8	0.6	0.9	1.6	1.8	1.7	0.7	...
June–July	0.4	1.0	1.5	1.0	1.2	1.2	1.3	1.5	1.3	1.4	0.8	1.0	1.6	1.8	2.4	1.9	0.9
All months	1.0	1.0	0.8	0.8	1.0	1.3	1.1	1.0	0.8	0.8	1.0	1.3	1.8	2.0	1.9	...

In arriving at these figures, in the case of the pairs of months which cover two years, the mean figure is adopted for the four occasions if all are represented in the tables of hourly distribution; but in the case of the earlier and later hours where only three, two, or one record may be forthcoming the mean of the three, two, or one observations, as the case may be, is taken. In securing the mean of means, the “all months” figures, the mean of the month-couple has been reckoned, but in every case the first hour and the last hour (twilight hours) of the figures for the month-couples have been discarded.

This is necessary in order not to mask the true features by superimposing fallacious figures referring to twilight periods. This latter distortion of facts does not of course, enter where only months of similar daylight hours are considered, though the first and last hours will refer only to very strong auroræ.

These mean figures are plotted as Fig. 4. In the case of the "all months" curve, a maximum after dark in the evening and again before daylight in the morning is

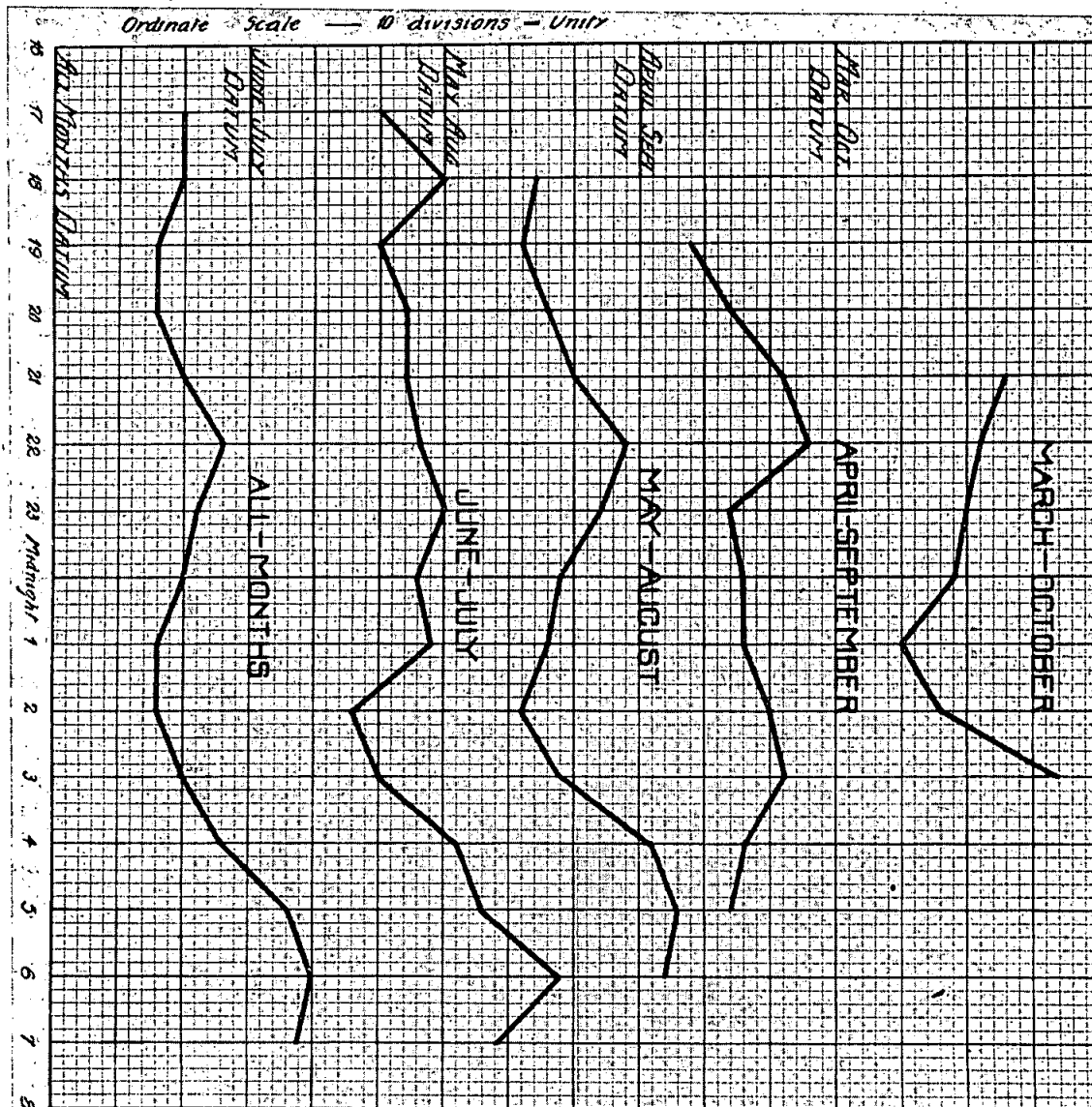


Fig. 4.—Total Occurrences in all Sectors—Mean Hourly Value of Observable Occasions.
Cape Denison—Year 1912 and 1913.

indicated, also another in the late evening hours culminating at 10 p.m. The greatest maximum is round about 5 a.m., 6 a.m., and 7 a.m., but it should be understood that though that certainly was a period of prevalent and widely distributed aurora the intensity was weak compared with many of the demonstrations of the later evening hours.

(c) *Aurora visible as a percentage of observable occasions.*

The considerations just traversed have to do with the abundance or spread of aurora in the sky. The next question is the presence or absence of auroral manifestations at particular hours. The last column in the hourly distribution tables supplies this information. There the figures express the occasions when aurora was visible as a percentage of observable occasions. By this is meant as a percentage of all occasions

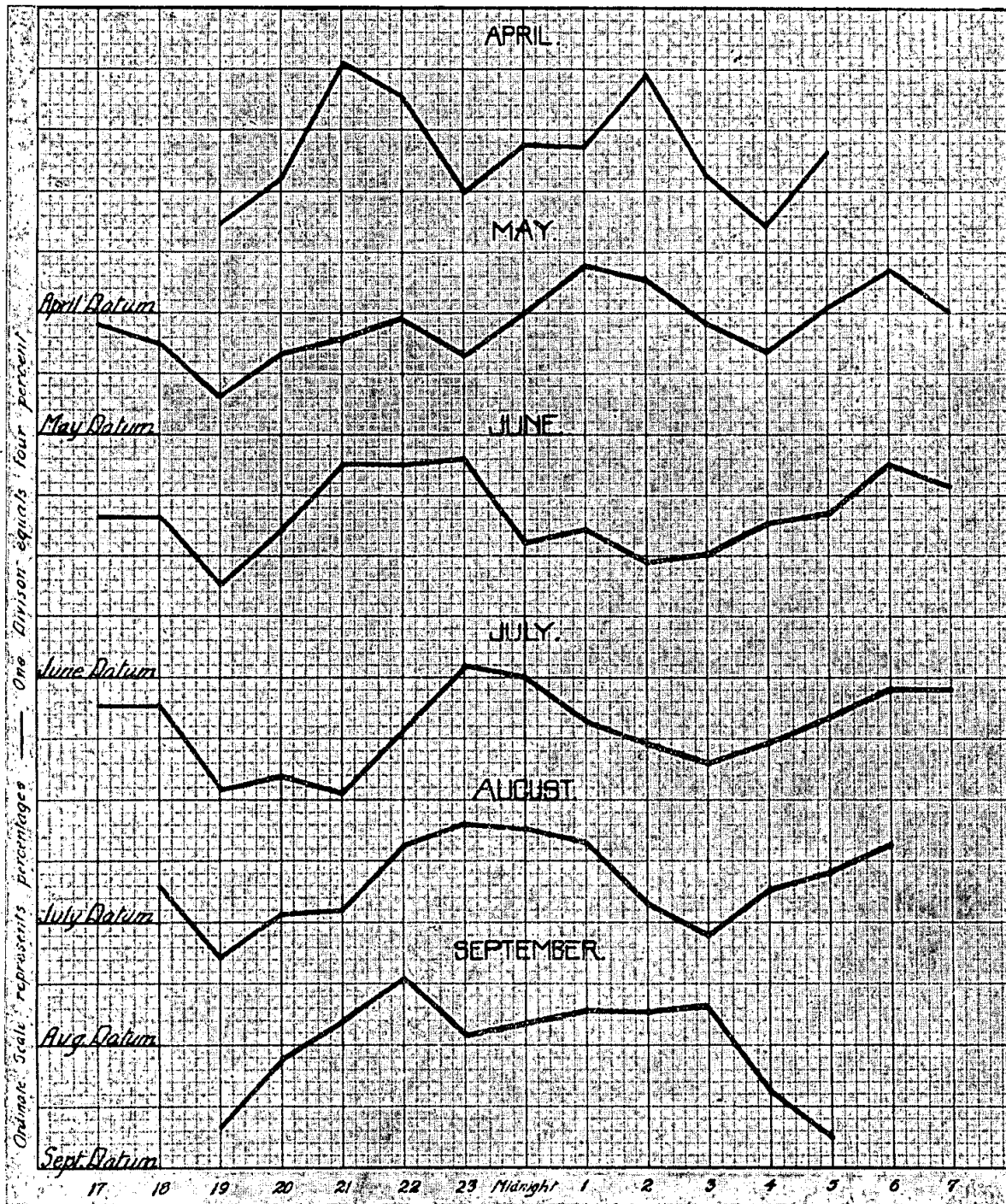


Fig. 5.—Aurora Visible as Percentage of Observable Occasions—Cape Denison—Year 1912.

when observations were made and the view of the sky found to be unobstructed by cloud or drifting snow. Of course, no allowance has been made for the presence or absence of moonlight.

The figures in the final column of the table have been plotted in Figs. 5 and 6. It is to be noted that there is a general tendency towards the same maxima as are expressed in Fig. 4, but very considerable irregularities occur in the case of many of the months. But such must be suspected on account of the several variables affecting

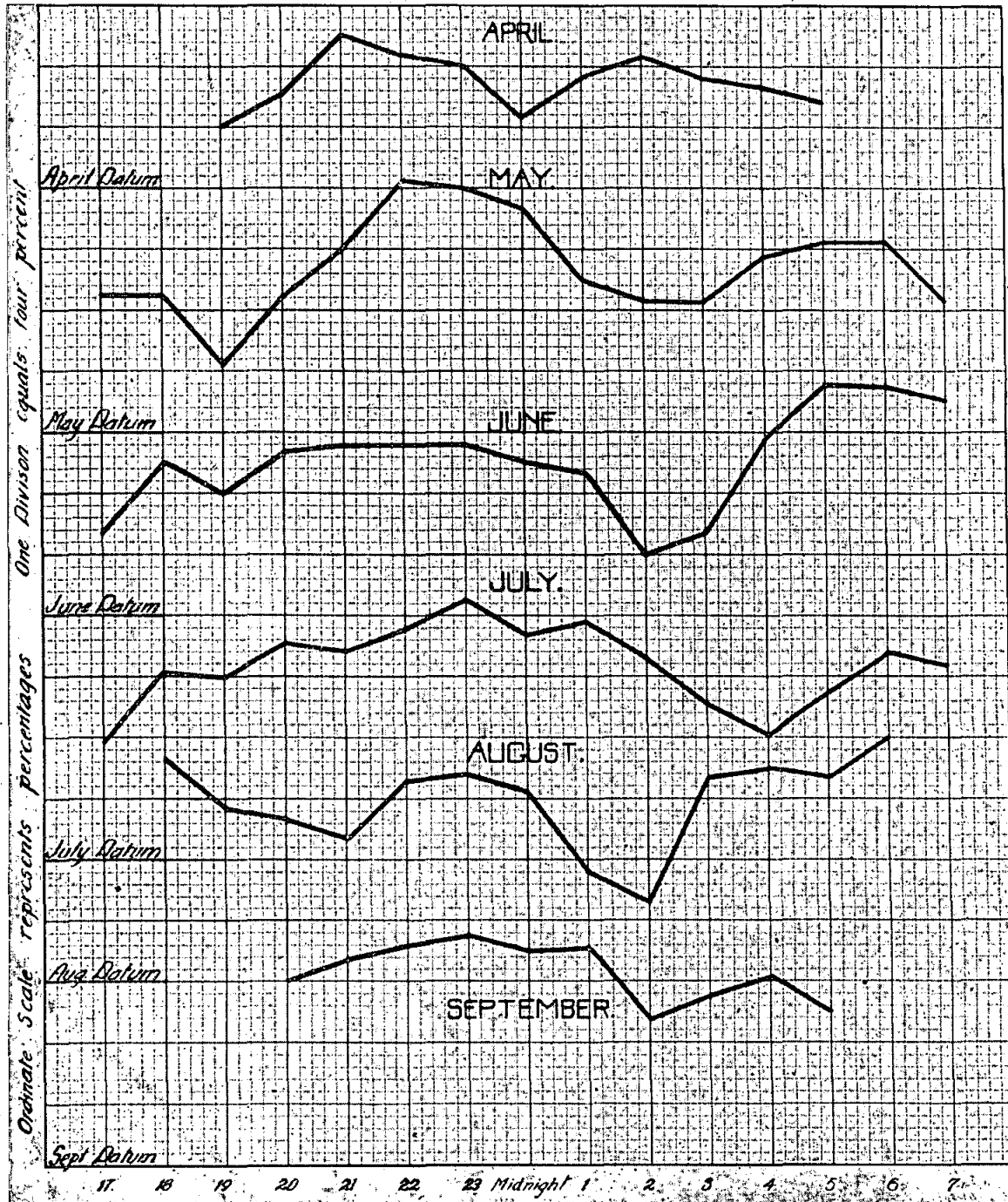


Fig. 6.—Aurora Visible as a Percentage of Observable Occasions—Cape Denison—Year 1913.

the registration each month, chief of which are the relation of moonlight periods to obscured sky periods. If, for instance, moonlight days happened to be also the clear weather days, when auroral observations were possible, the record would differ somewhat from the case where the clear days were also moonless, for then abundance of weak effects that were typical of certain particular hours would show up and receive equal weight in the log with the fewer strong ones, the only ones visible during moonlight periods.

In order, therefore, to arrive at a better conception of the auroral frequency typical of each month as it should be under undisturbed conditions, the means for both years have been reckoned combining months of equal dark hours. These means are plotted as Fig. 7. There also appears a mean of means, a curve resulting from the

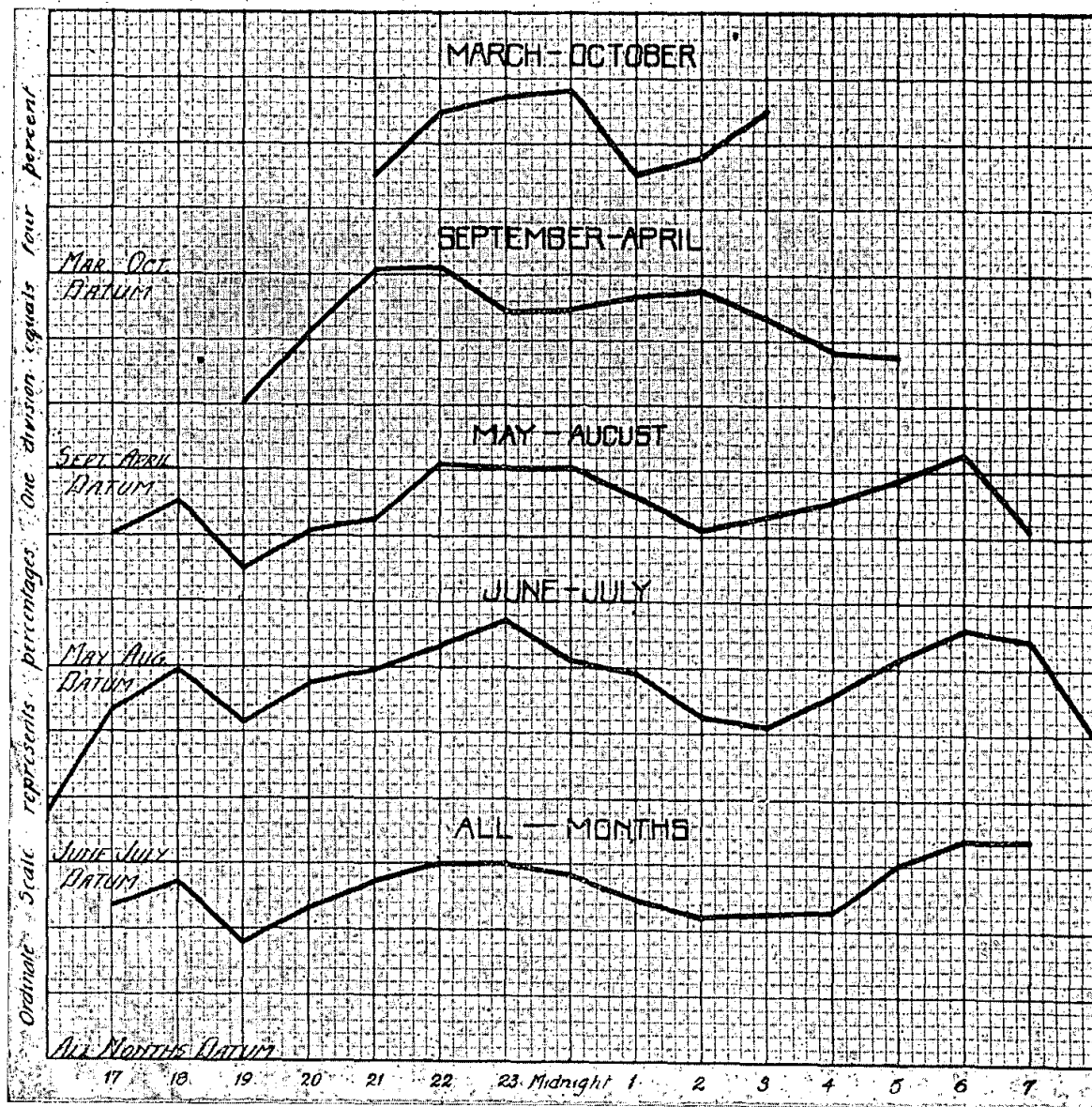


Fig 7.—Aurora Visible as a Percentage of Observable Occasions—Mean Curves for Cape Denison, Years 1912 and 1913.

combination of all months. The drop at the ends of the monthly combination curves is of course the effect of twilight. In arriving at the all-months curve, the first and last hours figures of each monthly combination have been omitted. This procedure is necessary in order to arrive at an all-months curve unaffected by twilight interference.

TABLE VII—Mean Figures for Cape Denison—1912–1913.

Aurora present as a percentage of visible occasions.

Hours	16	17	18	19	20	21	22	23	Mdt.	1	2	3	4	5	6	7	8
March–Oct.	30	49	54	56	31	36	50	...	...	...	...	...
April–Sept.	21	42	61	62	49	49	53	55	47	37	35	...	...	...
May–Aug.	40	50	30	41	45	62	61	61	52	42	46	51	57	65	42	...
June–July	16	47	59	43	55	59	66	74	62	59	45	42	52	63	72	68	39
All months	47	54	36	46	55	60	60	57	49	44	45	46	60	68	68	...

Comparison of the twin-month curves established the fact that there is a progressive change from the March-October curves to the mid-winter June-July curve. The midwinter curve shows a very definite maximum at 11 p.m., separated by minima from maxima respectively just after the passing and just before the advent of daylight. The rapid decrease at the limits is again to be ascribed to increasing twilight obscuring weaker effects, and it seems probable that were the darker hours of longer duration the rise of the curve would continue on either hand instead of reversing at 6 p.m. and 6 a.m. as shown.

8. DISTRIBUTION IN AZIMUTH.

(a) *Adèle Land.*

The figures from the tables of hourly distribution have been meaned for the two years, with the results as tabulated below. The figures represent hourly appearances.

TABLE VIII—Mean of 1912–13.

Monthly azimuthal distribution of hourly appearances.

Sector.	N.-N.E.	N.E.-E.	E.-S.E.	S.E.-S.	S.-S.W.	S.W.-W.	W.-N.W.	N.W.-N.
March–Oct.	16.5	6.2	0.5	1.9	1.0	0.0	4.2	12.9
April–Sept.	38.6	14.2	4.8	3.0	1.6	2.6	12.4	27.6
May–Aug.	47.8	23.5	10.6	6.7	1.5	3.0	14.5	40.2
June–July	94.1	47.7	27.2	11.7	6.1	9.5	48.9	72.7
All months	49.2	22.9	10.8	5.8	2.5	3.8	20.0	38.3

These figures have been plotted in Fig. 8. It is to be noted that a very small proportion of the demonstrations ever appeared in the southern sky. The most frequented sector is between N.W. and N.E. and more abundantly between N. and N.E. than between N. and N.W. It will be seen, also, that the curves for the several

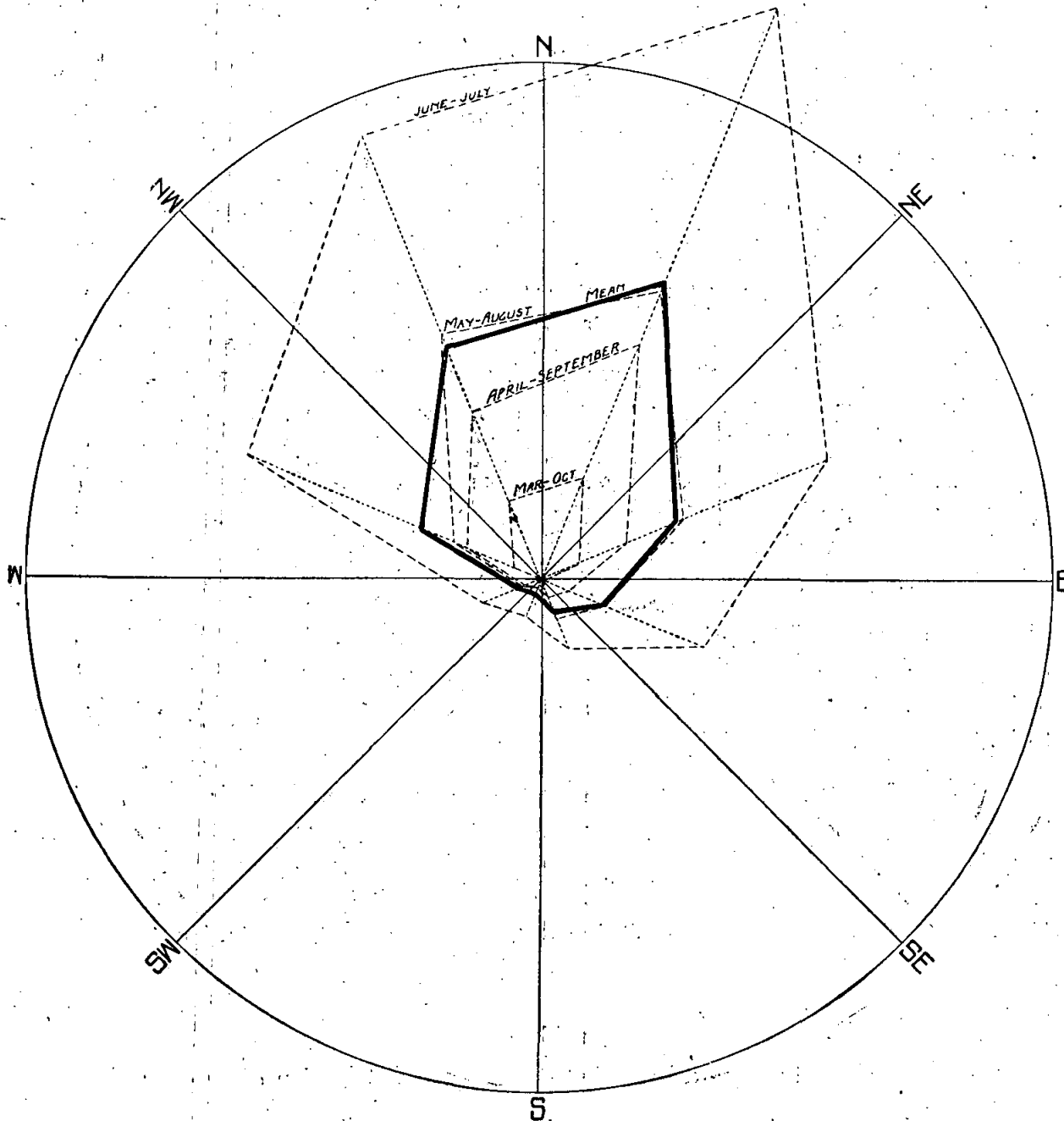


Fig. 8.—Distribution in Azimuth of Aurora—Cape Denison Station—Years 1912 and 1913.

months differ little from each other. As was found to be the case at Cape Royds,* aurorae were most abundant over the ocean and most seldom over the land mass which extended away to the south, but of course this relationship to the land mass may be merely a coincidence.

* *Loc. cit.*

Considering the appearances of auroral phenomena in the zenith, the mean monthly figures are as follows :

March-Oct.	April-Sept.	May-Aug.	June-July.
1.7	9.1	16.4	40.9

For the full two years, the hourly record of zenith appearances amounts to a total of 272 occasions. In these estimates manifestations which approached within 20° of the actual zenith are taken as zenith appearances.

An analysis of the tabular data furnishes the following mean figures:—

TABLE IX—Mean Hourly occurrences of Aurora in the Zenith.

Hour	16	17	18	19	20	21	22	23	Mdt.	1	2	3	4	5	6	7	8
March-Oct. ....	...	...	...	...	...	0.25	0.00	0.00	0.00	0.25	0.75	0.5	...	...	...	...	...
April-Sept.....	...	...	...	0.25	0.5	0.62	0.75	0.25	0.25	0.25	1.50	2.00	1.25	1.25	0.25	...	...
May-Aug. ....	...	0.25	0.25	0.25	0.50	0.25	0.62	0.25	0.50	0.00	0.00	1.25	2.80	4.00	3.72	1.75	...
June-July	0.50	1.60	1.60	0.10	1.10	0.50	0.40	1.10	0.75	0.50	0.25	1.00	4.10	6.75	7.10	5.50	3.00
All months ...	0.50	0.92	0.92	0.20	0.70	0.40	0.37	0.40	0.42	0.25	0.62	1.18	2.72	4.00	3.68	3.62	3.00

The system of meaning adopted in arriving at these figures takes consideration of such hours only as fell within the observational dark period. For instance, the mean all-months value for 8 a.m. is given as 3.00, which is the figure for the June-July period for, on account of daylight, it was not possible for the other twin month periods to contribute.

These figures are presented as graphs in Fig. 9. The most obvious feature is the extreme frequency of zenith aurora in the early morning hours immediately preceding daylight. There is a tendency, though much less marked, for zenith demonstrations in the late afternoon and to a less extent in the evening between 8 p.m. and 11 p.m. A definite minimum period for such ranges about midnight and 1 a.m.

(b) *Queen Mary Land.*

An analysis of the record indicates the following distribution of auroræ :

TABLE X—Azimuthal Distribution. Queen Mary Land, 1912.

Sector.	N.-N.E.	N.E.-E.	E.-S.E.	S.E.-S.	S.-S.W.	S.W.-W.	W.-N.W.	N.W.-N.
Hourly occurrences	13	7	8	7.5	7	5.5	21.5	27.5

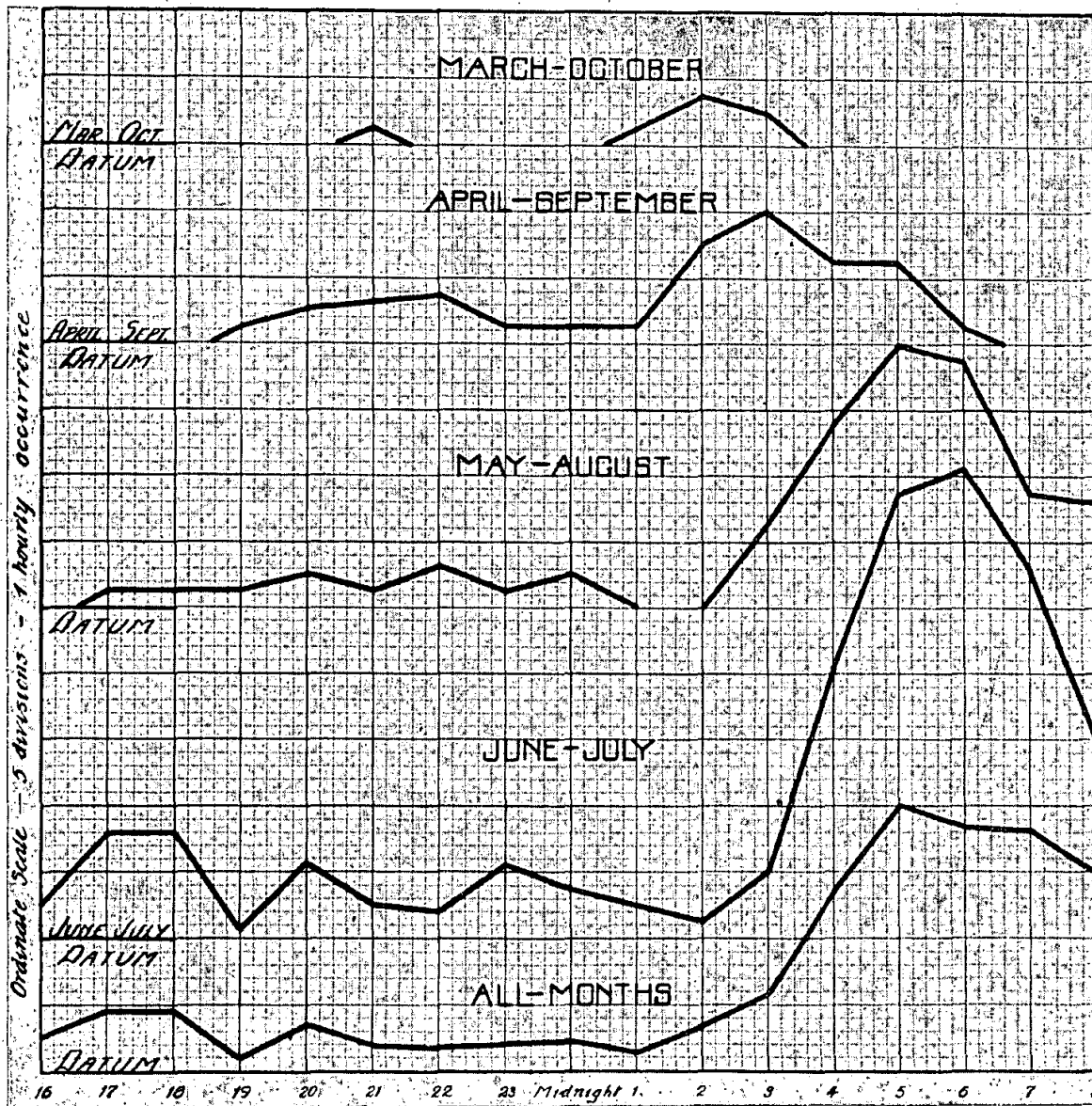


Fig. 9.—Frequency Curves for Zenith Appearances—Cape Denison—Years 1912 and 1913.

These figures are graphically illustrated in Fig. 10. The majority of the demonstrations were evidently centred in the N.W.* The auroral watch was not so rigidly kept as at Adelie Land, which deficiency would doubtless most affect the figures for the early morning hours, it may be that a little more weight is due to manifestations normal to those hours. Once again the direction of minimum appearance is in the direction of the land mass, and the region of greatest frequency is over

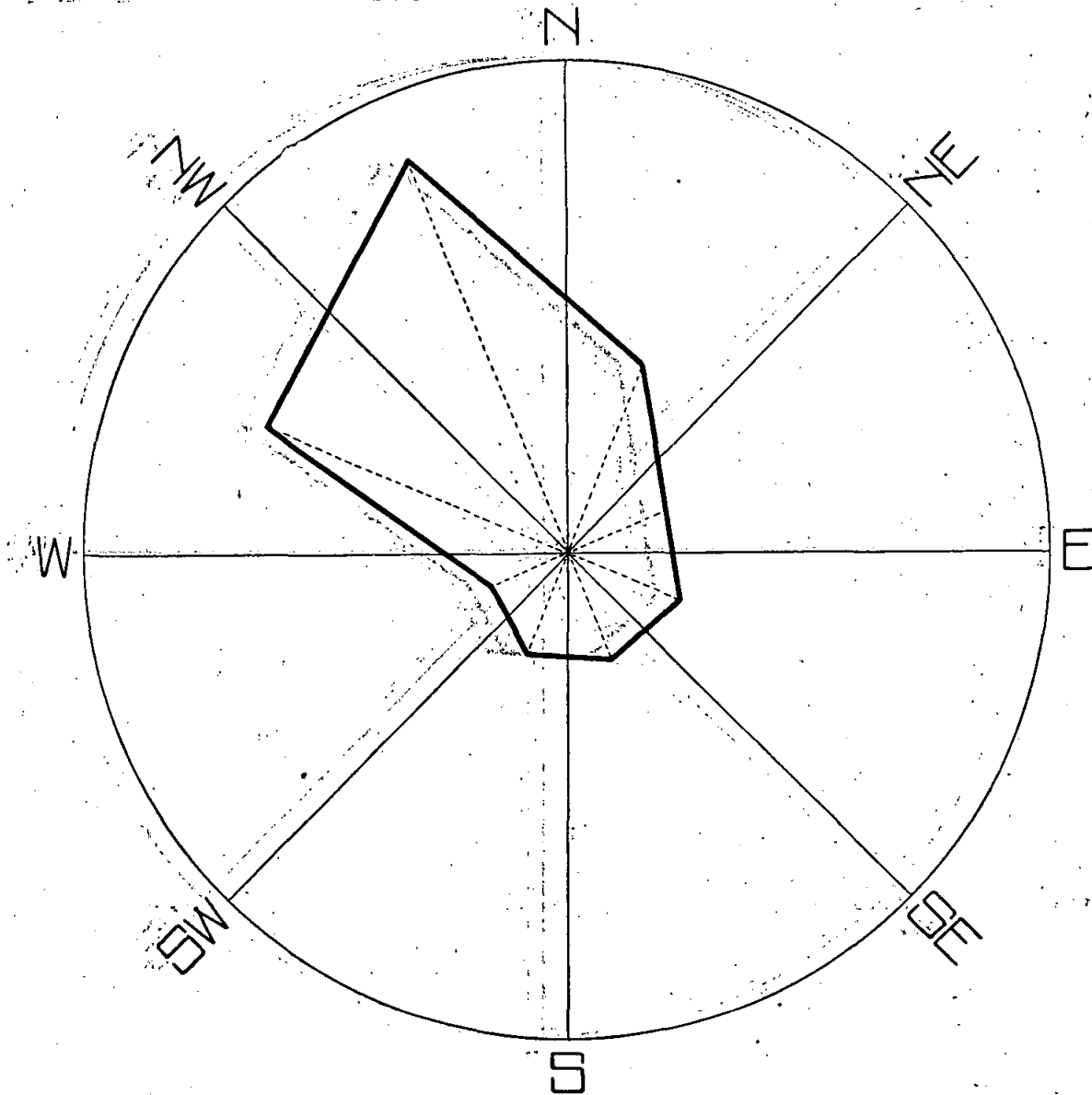


Fig. 10.—Distribution in Azimuth of Auroræ—Queen Mary Land—Year 1912.

the most ice-free portion of the ocean. This feature suggesting relationship to the distribution of land and sea is probably merely accidental but worth mentioning. A circumpolar distribution of aurora would, in the Antarctic, be at the same time in some definite relationship to the almost circumpolar land mass.

* A verbal communication from A. L. Kennedy, formerly of the Queen Mary Land Base Party, received now whilst this matter is going through Press, suggests that their auroral record and my interpretation of it, as indicated in Fig. 10, emphasises too strongly those appearing in the N.W. as compared with the appearances in the N. and N.E.—D.M.

As regards zenith appearances they may be tabulated as follows:—

TABLE XI—Zenith appearances, Queen Mary Land, 1912.

Hour.....	18	19	20	21	22	23	Mdt.	1	2	3	4	5
Hourly occurrences	0	1	1	2	0	0	3	0	0	1	0	1

Thus, occurrences in the zenith were frequently in the early evening hours culminating at 9 p.m. The hour of midnight was specially favoured, and, even though the observations were probably deficient, the morning hours between 3 a.m. and 5 a.m. constituted another favourable period.

(c) *Macquarie^{Is} Land.*

Though the record of the Macquarie Island station is but fragmentary, sufficient figures are available to give a good estimate of the distribution. An analysis of the 1913 and 1915 records gives the following figures:—

TABLE XII—Azimuthal Distribution, Macquarie Island.

Sector.	N.-N.E.	N.E.-E.	E.-S.E.	S.E.-S.	S.-S.W.	S.W.-W.	W.-N.W.	N.W.-N.
Hourly occurrences, 1913	14	68	77	22	3	.....
" " 1915	1	11	30	28	13	10	.....

The plot Fig. 11 brings out the fact that manifestations were very seldom indeed seen to the north. The sectors S.E. and S.W. were principally concerned, the latter being possibly more affected than the former. On account of the specially careful observations made by G. F. Ainsworth in 1913 somewhat more weight may be given to that curve than the other, though of course the distribution of the two years may have in fact actually differed.

The zenith appearances are not clearly indicated in the record, but so far as can be seen were distributed over the two-year periods 1913 and 1915 as follows:—

TABLE XIII.

Hour	20	21	22	23	Midnight
Hourly appearance in zenith	1	9	3	11	1

There was no continuous observation to establish whether arches preceding morning twilight appeared in the zenith, as was the case in the Antarctic stations. Bu...

such evidence as there is suggests that, in all probability, a return of the phenomenon in the later dark hours of the morning does not eventuate. It is difficult to see why the figure for the hour of 10 p.m. should be so low as it lies between hours of high

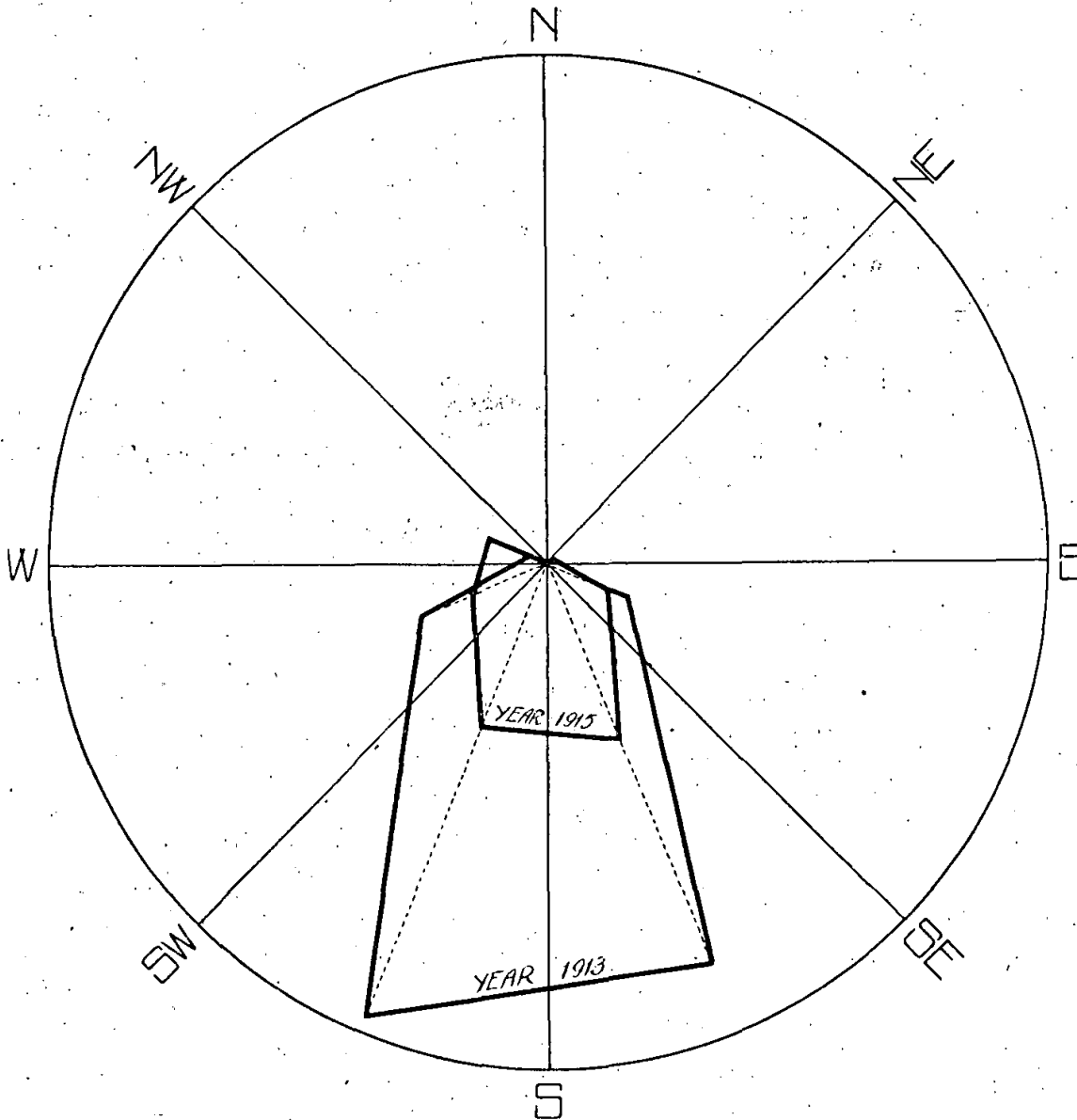


Fig. II.—Distribution in Azimuth of Aurora—Macquarie Island—Years 1913 and 1915.

frequency, and the conclusion is that it is a false indication owing to the imperfect record. It seems more probable that it should be comparable with the 9 p.m. and 11 p.m. figures.

9. PERIODICITY.

(a) Diurnal.

The general question of the distribution of auroral phenomena throughout the hours of the day has been dealt with under section 7. A further matter, namely, the

diurnal feature in the trend of arches, is reserved for discussion later on in connection with the detailed features of curtains and arches. It remains only to emphasise the facts illustrated in the graphs, Figs. 1, 4, 5, 6 and 7.

At Cape Denison a regular daily procession is apparent beginning, in the months of long darkness, by a period of relative abundance in the later afternoon hours when, at the same time, the average altitude of the manifestations above the horizon is considerable and zenith appearances are relatively numerous. After 6 p.m. the intensity and abundance of the aurora normally wanes and, at the same time, the manifestations recede to the north. At about 8 p.m. a revival appears low, near the horizon, in the north-east. On quiet nights the evening hours pass without any zenith appearances, the auroral phenomena keeping low down in the north, though noticeable rising between the hours of 9 p.m. and 10 p.m., then, later, receding. As the evening wears on the phenomena advance around the northern sky, spreading from the east further and further to the west, indicating that the aurora marches westward in the rear of the daylight hours. With the morning hours, usually round about 3 a.m., there is a distinct revival of aurora, and this is very prominent by 4 a.m., though the maximum is often at 5 a.m. or 6 a.m. This latter time is again a period of zenith appearances. In all cases early morning auroræ are characterised by regularity and the absence of the intense and spectacular element which is a feature of the storm period of evening auroræ. The appearance of many parallel bands in the zenith is characteristic of the morning hours. As the morning hours advance and grow into twilight, the auroral bands hold their own, though certainly waning to some extent and retreating to the west, until the last stragglers are swallowed up in the increasing light of day.

This daily periodic procession as outlined may be referred to as the normal cycle. The forms assumed are typically pale nebulous bands, often curtained, which on occasions of greater auroral intensity, may become brilliant and warm up the reddish tones below, and develop rippling motions of the filaments.

During auroral storm periods, which occur at least a few days each month, though the afternoon and early morning features are strengthened, the most intense manifestations are reserved for the evening hours. On such occasions between the hours of 9 p.m. and 11 p.m. intense coloured curtains rise slowly from the north towards the zenith, often passing 10 degrees or even more to the south beyond the zenith, then waning and retreating to the north again. At about the period of maximum southerly progress the curtain or curtains may rapidly spread themselves in the heavens as a sheet of brilliant nebula.

So irregular in their appearance and so intense are the phenomena of these auroral storms of the evening hours, that they give the impression of being special phenomena superimposed upon a regular and normal quiet cycle. They are the spectacular elements of auroral manifestations and grip the mind, diverting attention from the more natural and regular sequence of diurnal events.

(b) Recurrence of Similar Displays on Successive Days.

As an observer one soon recognises that periods of unusual auroral activity normally run through a course of several days together; sometimes as much as five days in succession. During such a period the diurnal cycle, as regards hours of appearance of auroral phenomena, remains approximately normal; but the intensity, at all hours is heightened, and more particularly so in the case of the evening hours, when some very striking and remarkable manifestations may appear. It is found that, during the several successive days, a similarity exists in the phenomena presented. The peculiarities of the first appearance, no matter how fantastic, are likely to be repeated each successive night, with but minor modifications.

Such features for repetition are peculiarities in the shape of a band, limitations in azimuthal distribution, colouration effects, and recurrence at approximately the same hour on successive nights. On the other hand, variation may take place in the average intensity on succeeding days, there being usually a day of maximum intensity, sometimes preceded by waxing intensity but always succeeded by waning repetitions. In the case of some of the greatest outbursts there is a sudden appearance of a grand display without apparent premonitory appearances on preceding evenings. Again, at the height of the period the demonstration may have culminated in the zenith, but fall successively short of the zenith on later occasions. Also the grand culmination of the evening performance may, on one occasion, be in the neighbourhood of the observing stations, whereas, on succeeding occasions, it may be noted to be in operation at some distance (perhaps several hundred miles) to the east or the west.

Reference to the log will reveal examples of recurrences of this kind, but it should be remembered that, at Cape Denison, so few days were continuously clear for observation that occasions would rarely present themselves for the observation of auroræ during a continuous succession of days. The best example contained in the log is that extending between the 8th and 12th of June, 1912, as follows:—

8th.—A very brilliant outburst at 10.55 p.m. in the region near the zenith. It all died down within an hour.

9th.—At exactly the same time as on the preceding evening another display appeared in the same region of the heavens. It rose to the zenith at the same time as before. Less colour effects, however, were exhibited, and the performance was over more quickly.

10th.—Again a vivid outburst at 11.15 p.m., lasting until 11.20 p.m., but continuing strong at a lower (angular) elevation for altogether about an hour. Generally speaking, this was quite similar to that of previous evenings.

11th.—On this occasion there was great general auroral activity, but more spread than formerly.

On 12th.—Between 9.20 p.m. and 9.40 p.m. a great blaze of luminescence appeared in the E.N.E. about 25° above the horizon. Thus the locus of the performance had drifted to the E.N.E., and the hour was earlier. The latter, for its location, probably corresponded closely, in local meantime, to the former 11 p.m. occurrences at Cape Denison itself.

In the case of the remarkably disposed and curved curtain of 9th September, 1913, a similar outline of curtain was repeated three days later.

(c) *The Solar Period.*

The foregoing observations on the recurrence of similar displays on successive days are in accord with such a causal explanation as sunspot bombardment. This being so, it is of interest to explore the possibility of repetitions at successive sunspot rotation periods, presuming that at least some of the sunspots would continue active for long enough to reappear 27 days later, after a revolution of the sun. A search of the record reveals cases that could be taken as supporting evidence, but such are very few indeed and not sufficient to lend much weight to the supposition. The question, therefore, of a solar period is not to be demonstrated by this necessarily fragmentary record, but can best be discussed from an examination of the magnetograph records, presuming that the relation of auroræ to magnetic perturbations is first established.

X.—SPECIAL CHARACTERISTICS OF AURORAL ARCHES.

(a) *Form.*

Generally speaking, auroral arches are more or less continuous luminous bands extending for a greater or less length around the sphere of the earth; apparently maintaining, in the case of any one display, a sensibly uniform minimum elevation in the atmosphere above sea-level.

There appear all gradations between the almost straight arch and the curved bands herein referred to as arcs. Arcs may be short in length and of small curvature or by degrees pass into closed curves, as represented in Plate II, fig. 1. When multiple arcs appear in the sky all usually exhibit, to some degree at least, any peculiarity of form, such as, for instance, a special kink. Very commonly only portions of concentric arcs are visible; indeed, it is only rarely that closed forms are seen.

Arches may be entirely nebulous as a limiting form on the one hand, or may illustrate every gradation to the other extreme represented by the perfect curtain, which is a more or less sinuous, approximately vertical plane of luminescence built up of closely-set vertical filaments (streamers), which coalesce to a greater or less extent, usually uniting at least along the lower margin. The same arch may, during the same display, assume these extreme forms, and all gradations between them. The nebulous phase is normally an aftermath of the clear-cut, filamented type.

The general form at Cape Denison is, therefore, much in the nature of an approximately vertical, luminous plane of which the apparent height greatly exceeds the apparent breadth. In the case of nebulous forms, however, they tend to broaden out considerably, at the same time maintaining a much reduced vertical range.

The vertical extension of arches and curtains is measured by the angle subtended at the eye, between the bottom selvage and the extreme upper edge, provided that, at the same time we know the height in miles above sea-level of its lower margin and the angular elevation of the same above the horizon.

In a number of cases these angular elevations are mentioned in the Cape Denison record. Such have been incorporated in Table XIV, where deductions as to distance from the observer and as to actual vertical extension of the luminous phenomena are also entered. No particular accuracy is claimed for these figures, but they should serve as an indication of the probable vertical range of such auroral forms.

TABLE XIV.—VERTICAL DEPTH OF ARCHES AND CURTAINS.

Date.	Time.	Observation.	Distance from Observer.	Depth of Arch.
	h. m.		Miles.	Miles.
1912. March 21	21 0	Nebulous arch extending between N.W. and E.N.E., about 5° above the horizon. Vertical depth, 2°.	370	13
April 18	20 10	A curtained band, 10° up, between N.E. and N.N.W. Depth, 4°.	260	18
„ 27	4 0	A faint curtain, 15° up, and a uniform depth of 6° ...	210	22
June 11	22 50	Curtain, 30° up in N. Streamers rise to a height of 10° above base of curtain.	107	19
„ 13	6 7	Nebulous band between W.N.W. and E.S.E., 15° above the horizon. Vertical depth, 5°.	210	18
Sept. 4	20 45	Bright curtain from the E. to horizon in W. Maximum elevation, 15°; streamers rising, 15°.	210	56
Aug. 9	0 37	Curtain, 5° up. Depth, 3°	370	19
1913. June 6	22 42	Nebulous lower edge of curtain, 25° up. Streamers reach to 45° up (20° in depth).	133	48
Aug. 1	3 46	Curtain W.N.W. to E.S.E. Maximum elevation, 30°. Streamers rise 5° above.	107	10
Sept. 23	22 10	Curtain 6° up. Streamers, 2° high ...	340	12
„ 23	22 27	Same curtain risen to 30°. Streamers, 9° high. ...	107	17
„ 24	0 50	Bright curtain, 10° up. Streamers, 2° high....	260	8

To begin with, the deduced figures are based on the assumption that the arches, at their lower edge, are 105 kilometres above the earth's surface, which is the mean figure obtained by Störmer.* Judging by the results obtained by Störmer for different types of aurora, the fainter auroral bands, such as those of the early morning hours, are more probably elevated to greater heights above the earth's surface than the figure 105 km.

* "Preliminary Report on the Results of the Aurora-Borealis Expedition to Bosseskop in the spring of 1913," by Carl Störmer. *Terrestrial Magnetism and Atmospheric Electricity*, Vol. XXI, Nr. 4, pp. 163-168.

The distance given of the auroral bands from the observer is the arcs, in miles, of earth's surface between the observer and spot perpendicularly below the arch in question. The miles of arc are but roughly determined. They are nevertheless within the limits of accuracy set by the assumption of height above earth's surface, and the crude methods adopted in the field for determining the angular values. No account is taken of refraction or certain other features which somewhat affect the result.

Though some of these records undoubtedly do refer to normal average cases, yet it should be borne in mind that the tendency was to specially observe and log this feature on such occasions as the recorder was struck by the unusual height of the streamers. Very low arches would not attract the same attention, and would doubtless be passed by unrecorded. Bearing this possibility in mind, it seems likely that arches as seen from Adelie Land are most usually in the neighbourhood of 18 miles in vertical extension. It is indicated, however, that the vertical streamers of curtained arches may range in length between the limits of about 10 miles to 50 miles.

On several occasions where arches were observed in situations only a little removed from the zenith, indications of a parting were recorded as parallel planes set at an angle with the length of the band. The general appearance of such is roughly indicated in Plate IV, fig. 2. This has been referred to as "cross cleavage." For examples refer to the Cape Denison Record on the following dates:—

7th July, 1913, at 20 h. 19 m.

9th September, 1913, at 22 h. 10 m.

10th October, 1913, at 22 h. 13 m.

Good examples of the kind were also noted at the Cape Royd's Station, and appear in that log under dates:—

4th June, 1908, at 20 h. 20 m.

18th June, 1908, at 14 h. 10m.

8th July, 1908, at 24 h. 00 m.

The observation on the evening of 9th September, 1913, appeared to afford a possible explanation. On that occasion the band rose to the zenith, and it became apparent that throughout its whole length it was constituted of a closely packed series of small convolutions, all similarly extended at an angle with the length of the curtain. Seen at a somewhat lower angular elevation, the effect would be to lose sight of the convolutions, but to remark a striation at an angle with the length of the form.

(b) *The Lateral Spacing of Parallel Arches.*

The repetition of arches and curtains in parallel formation is a feature of common occurrence. On occasions, notably during the early morning hours in the neighbourhood of 6 a.m., the entire heavens may be traversed by straight parallel arches appearing in Noah's Ark arrangement, owing to perspective effect. At other times, sinuous and

bowed curtains are exactly paralleled by one or more others, regularly spaced. There appears to be a regularity and orderly arrangement in each particular manifestation, so that determinations of the lateral spacing should have some significance. Accordingly cases of the kind have been incorporated in Table XV, and, on the assumption that the height of the lower edge of the arches is 105 km. above the earth's surface, the distance of the several arches from the observer is reckoned in miles of arc on the earth's surface. Here again only a roughly approximate method of calculation has been employed.

TABLE XV.—THE LATERAL SPACING OF PARALLEL ARCHES.

Date.	Time.	Observation.	Arc distance of Arches from Observer, in miles.		
			No. 1.	No. 2.	No. 3.
1913.	h. m.				
May 29 ...	23 37	Two parallel bent bands in N. One reaching 70° up; the other 45° up.	17	64	...
May 29 ...	24	One in zenith, and another 30° up	0	107	...
May 31 ...	6	Three parallel curtains. One in zenith, another 30° up, and a third one intermediate.	0	?	107
July 7 ...	19 54	Two haze arches. One 30° up, the other 50° up	54	107	...
July 7 ...	20 19	Two faint arches. One in zenith, the other 30° up	0	107	...
July 8 ...	5	Two parallel arches. One 30° up, the other 15° up	107	210	...
Aug. 9 ...	4 54	Three faint bands, respectively 75°, 35° and 20° up	17	90	165
Sept. 8 ...	4 10	Two arches, respectively 45° and 25° up	64	133	...
Sept. 9 ...	0 4	Two bands, respectively 70° and 60° up.	23	37	...
Sept. 19 ...	21 21	Two detached streamer curtains, respectively 50° up and 30° up.	54	107	...

The closest arrangement indicated by this table is in the vicinity of 14 miles and the farthest is 107 miles. The mean figure for the distance between arches in the case of all the arches in the table is 67 miles. This is closely in agreement with that indicated at 6 a.m. on the 9th August, 1913, which was an occasion when a maximum packing of the sky with parallel arches was observed. In this case six distinct bands appeared in the northern sky, and therefore separated by intervals of something like 70 miles. As there are 69 statute miles in one degree of latitude, the mean spacing of the arches may be said to be about equal to one degree of latitude.

The data are not sufficiently numerous or accurate to determine whether the faint early morning types (probably situated higher above the earth) are more widely spaced than the more intense evening demonstrations. Nor can it be demonstrated that the width of the spacing bears any relation to proximity or otherwise to the magnetic Pole.

(c) *Trend.*

At the Cape Denison Station the mean orientation of linear auroral forms was carefully observed and regularly logged. The term "trend," where it appears in the record, always refers to this geographical orientation.

As a result of observations at Cape Royds on an earlier expedition an apparent relationship between trend and hour of the day had been already noted.* The indication was of a diurnal rotation, though pseudo-semidiurnal in actual character. As a consequence the matter of trend was given special attention at Cape Denison, with a view to further investigation of the question of rotation of arches.

The difficulty of ascertaining the true trend of arches when situated in the heavens at any distance from the zenith makes it imperative to leave out of the discussion all cases of the kind. Accordingly the following list table abstracted from the log includes only such as passed within 20 degrees of the zenith. From this Table XVI, mean figures have been reckoned and given as Table XVII.

TABLE XVI.—OBSERVED TIMES AND TRENDS OF ARCHES PASSING WITHIN 20° OF THE ZENITH. CAPE DENISON STATION: YEARS 1912-1913.

Trend.	Hour of Observation.
N.—S.	2-15, 23-30, 23-42, 0-30, 0-20, 23-42.
N. by W.—S. by E.	2-30, 0-35, 0-45, 3-00, 3-36.
N.N.W.—S.S.E.	2-07, 4-00, 4-35, 1-30, 1-42, 2-10, 2-41, 3-33, 4-00, 5-00, 2-00, 3-00, 2-00, 4-40, 6-00, 0-40, 2-00, 3-06.
N.W. by N.—S.E. by S.	4-25, 3-22, 5-20, 2-00, 2-50.
N.W.—S.E.	2-30, 3-30, 4-00, 3-00, 4-00, 5-30, 5-00, 6-00, 6-00, 6-00, 6-00, 24-00†, 3-18, 4-00, 4-00, 5-00, 5-00, 5-25, 6-00, 6-00, 6-00, 6-00, 7-00, 2-38, 3-35, 3-30, 3-34, 4-45, 4-30, 4-20, 4-45, 4-45, 5-23, 5-30, 5-25, 6-00, 5-50, 6-26, 6-00, 6-25, 3-00, 3-00, 4-00, 3-56, 4-36, 5-00, 4-45, 5-30, 5-23, 5-30, 6-00, 6-00, 6-00, 2-35, 2-40, 3-16, 4-25, 4-25, 22-09†, 5-10, 3-30, 3-45, 3-50, 4-30, 4-15, 5-30, 4-50, 5-25, 6-00, 6-00, 6-00, 6-30, 6-00, 7-05, 7-00, 2-30, 4-10, 4-05, 4-36, 5-00, 5-06, 5-20, 5-40, 6-00, 6-30, 6-00, 6-27, 6-00, 6-27, 6-43, 6-15, 7-30, 7-35, 7-30, 17-50, 3-17, 3-53, 4-29, 4-56, 4-30, 5-20, 5-00, 6-00, 6-43, 6-00, 6-00, 6-50, 7-45, 7-00, 8-00, 3-45, 3-48, 4-20, 4-50, 4-35, 4-55, 5-20, 5-33, 5-25, 5-40, 5-10, 6-05, 6-00, 6-00, 7-14, 22-30, 2-40, 3-30, 3-20, 3-04, 4-35, 4-28.
N.W. by W.—S.E. by E.	5-05, 7-03, 6-30, 6-00, 6-00, 5-30, 4-39, 5-40, 6-00, 6-00, 4-15, 4-00, 5-00, 4-30, 6-40, 4-50, 4-10, 5-30, 6-00, 7-00, 4-43.
W.N.W.—E.S.E.	2-15, 2-15, 3-40, 5-37, 6-00, 7-12, 7-20, 23-25†, 4-00, 4-00, 5-10, 5-00, 5-00, 5-27, 6-00, 6-00, 6-00, 5-35, 5-30, 5-07, 5-32, 6-00, 6-00, 4-20, 6-37, 7-00, 7-15, 6-40, 7-46, 6-40, 6-50, 6-00, 6-30, 22-55†, 4-55, 4-00, 4-30, 5-08, 5-43, 5-05, 5-15, 6-29, 6-30, 6-10, 6-26, 6-00, 6-45, 6-55, 16-05, 16-19, 16-45, 17-30, 22-27†, 4-30, 6-27, 4-00, 21-26†.
W. by N.—E. by S.	23-12†, 5-25, 6-30, 7-45, 7-42, 16-25, 16-45, 17-57, 20-56†, 21-30†, 22-25†, 6-30, 6-55, 7-00, 7-00, 7-00, 7-30, 8-05.
W.—E.	18-00, 7-30, 7-25, 7-00, 7-35, 7-58, 7-25, 16-55, 17-57, 18-08, 20-02, 7-00, 17-00, 23-04†, 7-12, 7-35, 19-41, 0-04†.
W. by S.—E. by N.	17-36, 21-51, 17-25, 7-45, 19-38.
W.S.W.—E.N.E.	18-11, 22-40, 19-10, 19-25, 20-40, 20-52.
S.W. by W.—N.E. by E.	18-00, 22-54.
S.W.—N.E.	19-25, 18-00, 19-04, 20-19, 17-15, 20-29.
S.W. by S.—N.E. by N.	20-39, 21-04.
S.S.W.—N.N.E.	22-58, 21-45, 22-18.
S. by W.—N. by E.	22-14.

It is to be noted that, in general, records of the time of appearance of arches oriented in any one direction, bunched themselves around two widely separated periods

* Loc. cit. † Brilliant storm aurora.

of the day, in the one case a.m. and in the other p.m. hours. Cognizance must be taken of this feature when deducing the mean of the recorded time of appearances. This results in mean hours respectively for a.m. and p.m. periods.

Owing to the fact of daylight obscuring the aurora during hours approaching midday, reports indicating a second daily period are wanting in the case of some directions of trend notably, for instance, the N. and S. trend which is very well indicated for midnight, but, of course, is unrepresented at midday. Further there were certain hours of the day when zenith appearances were common, whilst at other times manifestations restricted themselves to the lower sky only. Thus here again is a feature introducing great irregularity as regards the number of entries in the table under the respective geographic bearings. On account of these two obstructing conditions, the completeness of the data incorporated in the table leaves much to be desired. But, nevertheless, making due allowance for deficiency of data, a progressive rotation is evidenced by the mean figures of the table.

TABLE XVII.—MEAN TREND OF ZENITH ARCHES IN RELATION TO HOUR OF THE DAY.

Trend:	Mean Time of all A.M. Observations.		Mean Time of P.M. Observations.					
			Quiet Type.		Storm Type.		Both Quiet and Storm Types.	
	No.	Time.	No.	Time.	No.	Time.	No.	Time.
*N.—S.	6	h. m. 0 33	Nil.	h. m. ...	Nil.	h. m. ...	...	h. m. ...
N. by W.—S. by E.	5	2 5	Nil.	...	Nil.	...	...	...
N.N.W.—S.S.E.	18	3 2	Nil.	...	Nil.	...	...	...
N.W. by N.—S.E. by S.	5	3 55	Nil.	...	Nil.	...	Nil.	...
N.W.—S.E.	130	5 7	2	20 10†	2	23 5	4	21 36
N.W. by W.—S.E. by E.	21	5 29	...	...	...	...	...	...
W.N.W.—E.S.E.	49	5 37	4	16 40	4	22 33	8	19 36
W. by N.—E. by S.	11	7 2	3	17 2	4	22 1	7	19 53
W.—E.	9	7 24	7	18 15	2	23 34	9	19 26
W. by S.—E. by N.	1	7 45	4	18 52	Nil.	...	4	18 52
W.S.W.—E.N.E.	Nil.	...	6	20 10	Nil.	...	6	20 10
S.W. by W.—N.E. by E.	Nil.	...	2	20 27	Nil.	...	2	20 27
S.W.—N.E.	Nil.	...	6	19 3	Nil.	...	6	19 3
S.W. by S.—N.E. by N.	Nil.	...	2	20 51	Nil.	...	2	20 51
S.S.W.—N.N.E.	Nil.	...	3	22 30	Nil.	...	3	22 30
S. by W.—N. by E.	Nil.	...	1	22 14	Nil.	...	1	22 14

* The N.—S. Observations are a.m. and p.m. times approximating to midnight.

† Observations probably too few to yield to mean figure of value. The main demonstration in this direction would be expected about 3 p.m., when daylight too strong to offer opportunities for auroral record. It may be that all those recorded are aberrant types, and not normal "quiet" forms.

This is very much more to be remarked in the early morning hours than is the case in the evening period. It was, however, well apparent at the time of logging that the more intense evening auroræ (which are to be regarded as auroral storms and to some degree at least, abnormal) were the particular divergent element in the p.m. record. It appears better, therefore, to consider storm auroræ apart from the more normal

forms; a course which had been adopted in Table XVII. There special columns are provided for p.m. hours, but in addition the mean of both is given in a third column. The data of this table are plotted graphically in Fig. 12, where the centre of the diagram represents the South Geographic Pole and the radii are meridians spaced at intervals of one hour in time. The thick arrows shown correspond to the mean direction of auroral arches at the particular times indicated by the dotted meridional lines intersected by the arrows. The locus of the arrows is intended to correspond to the latitude of Cape Denison, which is just within the Antarctic Circle.

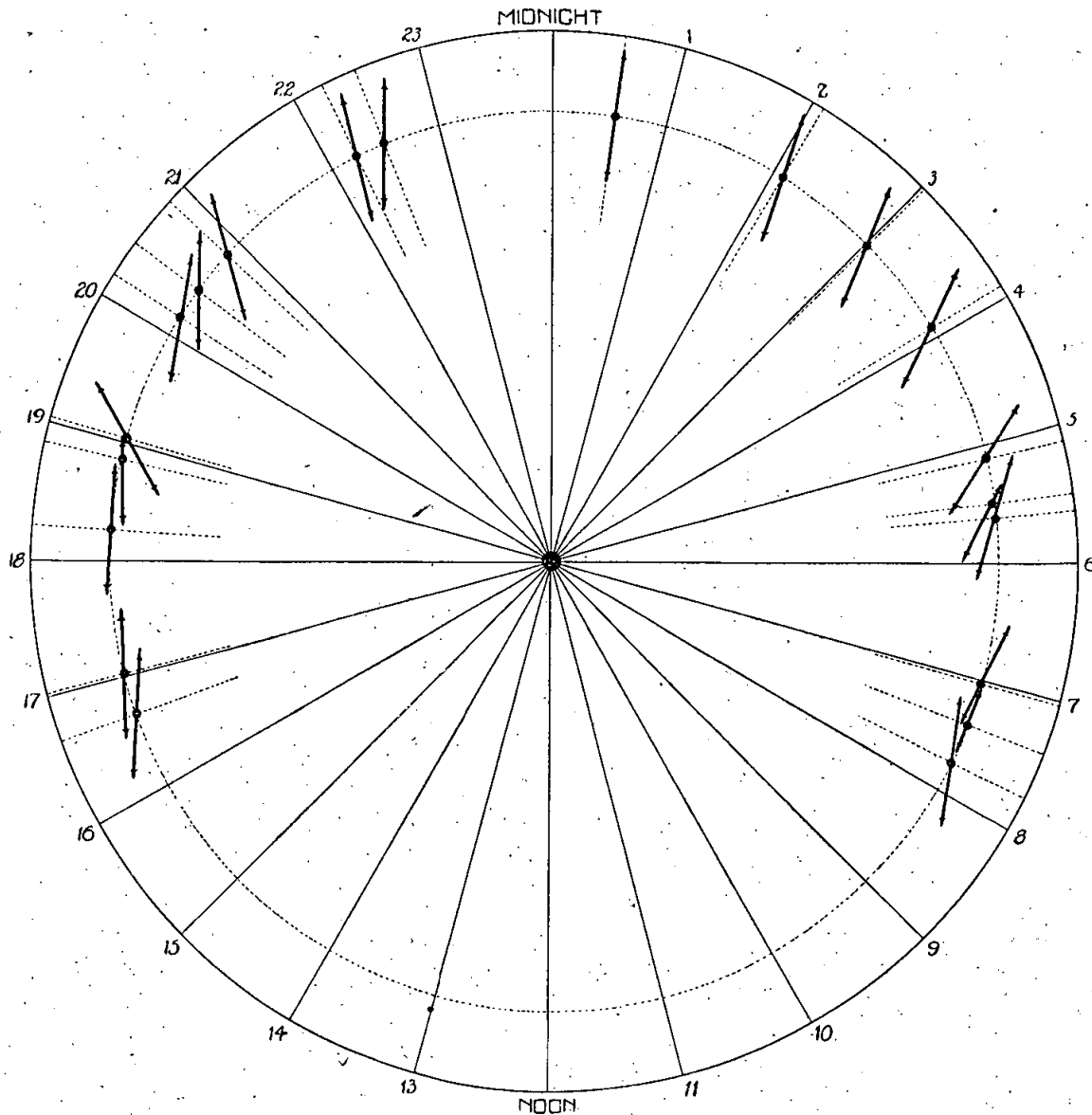


Fig. 12.—Graphic Representation illustrating the mean trend of arcs throughout the day. Cape Denison Station—Years 1912 and 1913.

A glance at this diagram is sufficient to demonstrate that, at least at Cape Denison, the mean trend of arcs does bear some relationship to the hour of the day. Further there does appear to be some connection, direct or indirect, between this trend and the

daylight hemisphere. The fact that these are mean results derived from a large volume of data should eliminate all chance that the result is merely a coincidence. More probably than this is that, given additional observations of such trends as are poorly represented in the table, the mean results would be still more in accord with the general order.

As already mentioned in an earlier publication* relating to the Cape Royd's observations, a rotation of the arches was indicated, wherein the trend throughout the day suggested some relation between the daylight and dark hemispheres, or, at any rate, between the location of the observer and that of the sun at any hour.

In his report on observations made by Scott's last expedition at Cape Evans, Dr. Wright† found only partial evidence of such an anti-clockwise swing of the arches.

From my own visual observations at Cape Denison I can testify that a general anti-clockwise rotation was a marked feature of the early morning hours, though not without some exceptions. The regularity of the phenomenon could not avoid arresting the attention of even untrained observers.

For actual examples recorded of visually counter-clock swinging movements refer to the following :—

Year 1912—27th May at 3 h. 30 m. ; 20th September at 2 h. 19 m.

Year 1913—4th April at 4 h. ; 9th May at 23 h. 13 m. ; 7th July at 19 h. 54 m.

At 22 h. 10 m. on the 9th September, 1913, the swing commenced in a clockwise direction, but within 5 minutes' time reversed to the usual counter-clock motion.

As an instance of the typical progressive change in direction of early morning arches with the advancing hour of the day refer to the record of 1st July, 1913.

In the case of the evening hours the relation of trend to time was, however, not so evident to the observer for the more brilliant auroræ did not conform thereto. On the whole, however, having regard for all observations, the analysis of the record seems to indicate definitely that there is some element in connection with auroræ which tends to cause linear manifestations to conform to a law of rotation bearing a relation to the sun's position at the particular hour of observation.

It may be remarked that if arising out of any terrestrial or solar influence, the arches everywhere tend to lie in planes perpendicular to the earth's surface, and including the observer and the sun, then for observers in successive latitudes there should be noted a progressive change in the prevailing trends proper to the respective hours of the day. In lower latitudes, for instance, trends in a more or less E. and W. direction would be by far the most frequent, whilst in the vicinity of the Pole trends approaching N. and S. should figure most. Further the trend would vary somewhat with the seasons of the year, a feature that would be most marked in high latitudes.

No useful data concerning this feature can be deduced from either the Macquarie Island or the Queen Mary Land logs, on account of the paucity of observations, and the fact that at those stations special attention was not paid to this matter.

* *Loco. cit.*

† *Loco. cit.*, p. 10.

(d) Body Movement.

Linear auroral forms are subject to two classes of movement. Firstly, a body travel, in which the whole of the luminous manifestation participates more or less equally. Secondly, travel of excitation along the length of the band, the form as a whole remaining stationary whilst stimuli travel from end to end, rekindling in succession one faded part after another; or, at other times when more active, causing bright vertical filaments to race along the length in rapid succession.

The first of these forms of movement is referred to in the log as "body drift" or "body movement." It is of the nature of a drift or march of the arches or other auroral forms across the heavens, always in some definite direction, most commonly at right angles to the length of the bands. This movement is commonly in such a direction and of such a nature as to suggest that it is a drift of ionised gas under the influence of the earth's magnetic force, the explanation usually given for this feature.

All the more powerful evening auroræ exhibited a quite definite body drift. Such, for instance, was the regular rise of arches from the northern horizon towards the zenith during the evening hours in their waxing phases. Included here also are cases where masses of auroral luminescence drifted across the sky in a definite direction exactly as do clouds under the influence of wind.

Analysis of the record has not resulted in the exposition of any general rule governing these movements. It may be, however, that undue confusion has been introduced owing to observers not having all clearly distinguished between body drift and travel of excitation. It should be understood, however, that arches do not persist in drifting always in one direction.

A rough idea of the rate of body movement of arches during evening demonstrations when rising from the north horizon towards the zenith is afforded in the case of the following loggings.

On 8th June, 1912, a curtain stood at 6° above the N. horizon at 22 h. 40 m. During the following fifteen minutes it had risen to 65° , and it reached the zenith, as a very brilliant display, after a further ten minutes. Assuming the elevation of the base of the curtains to be 105 k.m., then the rate of travel indicated is of the order of 21 miles per minute in the lower sky and 3 miles per minute near the zenith.

On the 18th September, 1912, beginning at 21 h. 20 m., a curtain rose from 15° above the N. horizon to 50° up in eight minutes, a rate of about 20 miles per minute. Five minutes later it had crossed the zenith, therefore travelling at the rate of about 10 miles per minute in this part of its course. After reaching a point 10° S. of the zenith this curtain began to recede to the N. at a slower rate than when advancing.

On the 9th September, 1913, a bent curtain stood at 60° up in the N. at 21 h. 51 m. Eight minutes later it was at 70° up, representing a rate of travel of 2 miles per minute. Twelve minutes after this it had reached the zenith, a speed equivalent to 2 miles per minute.

These can, of course, be but very rough figures, but they serve to illustrate—

- (1) the variability of the rate of movement;
- (2) the slowing down as the zenith of Cape Denison was approached;
- (3) the greater speed evidenced in the case of the more intense manifestations.

Of course, the validity of these deductions would be seriously affected should the assumption of 105 km. as the mean elevation of the base of the arches prove greatly in error.

(e) *Travel of Excitation.*

All linear auroral forms are subject to periodic waxing and waning. In some cases a band may remain sensibly constant in intensity for many minutes together, or even an hour or more. But in the vast majority of occasions, more particularly where weaker forms are concerned, the luminescence is continually fading and rekindling. Curtains may fade out of visibility and a few minutes later rekindle, the impulse or excitation beginning at one end and travelling at uniform speed towards the other. Cases are recorded where after several hours of invisibility a curtain has reappeared in the same location in the heavens, identifiable with the former by reason of certain unusual peculiarities of form specially remarked in the earlier appearance. This indicates that though the luminescence has disappeared some trace may remain as a basis for later resurrection of the form.

There are two kinds of longitudinal travel of luminescence in lineal auroral forms. In one a periodic impulse appears to pass along momentarily, stimulating the existing luminescent manifestation to greater brilliance. These intensity pulsations are often noticeably rhythmical, each successive waxing carrying the intensity of the manifestation as a whole to a higher pitch, until a maximum for the particular exhibition is reached. Thereafter successive pulsations cause a progressive waning of the general intensity.

The other case is the actual translational movement of the vertical filaments, whereby they appear to follow each other along the arch in endless procession from one side of the heavens to the other. The filaments march along at a regular pace, only quickening or slowing down their rate of travel should the intensity as a whole increase or subside. In the case of convoluted forms near the zenith, the moving filaments are seen to travel at even pace around all the intricacies of the curtain; now passing to the east, then temporarily to the West as they negotiate a sinuous curve; then again to the East, always progressing from one extremity of the band to the other.

In forty-one cases of arches, curtains or bands recorded in the Cape Denison journal, a definite statement is made as to the direction of travel of the excitation. Of these twenty-eight are p.m. and thirteen a.m. observations.

In the case of the p.m. observations, in every instance except one, the excitation was seen to travel along the bands from the western towards the eastern sky. The exception occurred at 22 h. 35 m. on the 19th October, 1913, on which occasion the vertical filaments of a curtain 7° above the N. horizon appeared to be in rapid motion from E. to W.

During the early morning hours the travel of excitation is logged as uniformly from the western to the eastern sky, but in the later a.m. observations three exceptions are noted. These occurred as follows:—

1912, 13th June, at 5 h. 37 m.—Excitation travelled along the band to the N.W.

1913, 1st July, at 5 h. 10 m.—A distinct rippling of the filaments along the arch to the N.W. A few minutes previously a slow movement to the E. had been recorded.

1913, 28th August, at 5 h. 23½ m.—Just before dawn an apparent movement of streamers noted along to the N.W.

It was very seldom, indeed, that the a.m. arches at Cape Denison were sufficiently intense to display a rippling of the filaments so that the exceptional cases logged above has a special significance. It would appear from the records that, in the later early morning hours, just before daylight appears, there is an increasing tendency for the excitation to travel from E. to W. or in other words, from the morning twilight area to the dark area. During p.m. hours the motion is almost exclusively W. to E. Here again the travel is from the twilight (evening) area to the dark area.

At Cape Denison, after about 23 h., auroral manifestations waned, and between midnight and 4 a.m. were very sluggish. However, such movements as were logged at this time indicated a travel of excitation from W. to E.

Examination of the record* made at Cape Royds in the year 1908 shows that out of fourteen p.m. observations where direction of excitation is logged nine are in agreement with the hypothesis that the flow is from the daylight to the dark side of the earth, four are against and one is indecisive. Of the a.m. observations, seven are in agreement and two contrary.

The suggestion that occurred at the time when viewing these manifestations was that the kindling effect which ran along the length of the arch was due to the flow of electric current from regions of one potential to regions of another. The question as to what in the first place caused the arch to develop is another matter, concerning which there is a fairly general agreement that it represents an ionised zone in the higher atmosphere. Birkeland, Störmer, and Vegard, have gone very far to prove that the ionization is due to cathode ray bombardment from the sun.

Frequently the filaments, or streamers, of curtains are so arranged, with dark spaces between them, as to suggest the striæ experimentally observed in the passage of electricity through gases, where they represent a local concentration of ions and form stepping stones for the linear passage of current.

With rise in the intensity of curtained forms the vertical filaments appear to march along the length with increasing rapidity, eventually moving so fast as to produce a rippling effect, and finally a characteristic "flicker." In the case of very powerful auroræ when a streamer arch arrives approximately at the zenith, the filaments can be noted racing around all the windings and intricacies in its form. On some occasions there was seen the distinct appearance of the filaments racing along its length, one way

on one side and the opposite way on the other; two parallel and very closely approximating chains of filaments with counter motion. This, of course, can only be observed when high in the heavens. This feature was observed several times at Cape Denison, and once at the Grottoes.

For illustrative examples, wherein the travel of excitation is referred to, see entries, Cape Denison log, under following dates:—

18th September, 1912, at 21 h. 41 m.

29th May, 1913, at 23 h. 41 m.

19th June, 1913, at 23 h. 16 m.

18th September, 1913, at 22 h. 10 m.

At the moment of culmination of a very powerful arch, a seething swirl of the filaments in a vortex-like motion may eventuate, the eddying vortex passing along the arch from W. to E. Such remarkable appearances can only be clearly noted when directly overhead.

Examples of such vortex motions are as follows:—

Cape Denison : 6th July, 1912, at 21 h. 26 m.

The Grottoes : 9th July, 1912.

Macquarie Island : 12th June, 1915.

The great vortex of the 6th July, 1912, seen from Cape Denison was a most amazing and astounding sight, and was apparently possessed of immense energy. In the space of a minute or less it traversed the heavens from the west to the east.

Some idea of the rate of movement at which excitation travels along arches can be got from the following two entries:—

On the 5th July, 1912, at 20 h. 19 m., a curtained arch, reaching a maximum elevation of 60° in the N., ran out across the sky from the western to the eastern horizon in a period of about fifteen seconds. Assuming the elevation of the lower margin of the arch to be about 105 kms., then the length of the arch clearly visible down to small elevation at either end (the length to which the observation doubtless referred), would be in the neighbourhood of 1,000 miles. The rate of progress across the sky of the developing arch must, therefore, have been in the neighbourhood of 66 miles per second.

On the 19th June, 1913, at 19 h. 16 m. there was in the northern sky at an elevation of 70° a very brilliant coloured curtain with flickering streamers. The vertical filaments (streamers) travelled from W. to E. at a very rapid rate. It was estimated that this rate of movement did not exceed an angular distance of 45° in 60 seconds, the 45° being reckoned evenly on either side of the perpendicular from the observer on to the curtain. This gives a rate of travel of the filaments of about 1 mile per second.

These are, of course, only haphazard cases, and it must be realised that there appears to be no fixed speed of movement excitation along arches. One is led to adopt the generalisation that as the intensity of the phenomenon increases so does the rate of travel of excitation and of the filaments.

(f) Colour Distribution in Curtains and Arches.

The colour of all weak auroral arches is the normal greenish-yellow tint. With increasing intensity the lower margin warms up in tone until eventually an intense crimson is reached. This rich colour is ordinarily restricted to the very bottom or lower edge of the curtain or arch, above which there is a quick passage into yellow, and then upwards by gradations, though fading in intensity, into bright green in the upper extensions of the component filaments of the curtain. This scheme of distribution is indicated in Plate V and in the sketch, Fig. 13.

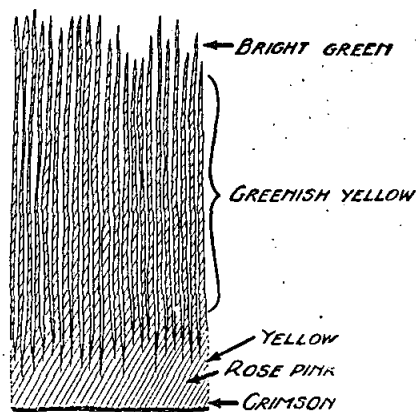


Fig. 13.

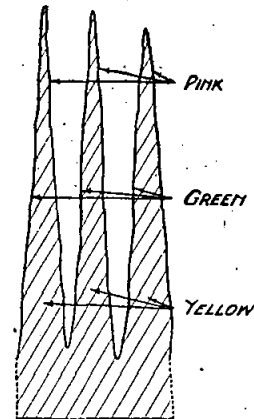


Fig. 14—Streamers advancing to the right.

As the curtains at Cape Denison hang practically vertically, these colour zones correspond to a vertical distribution of colour ranging from crimson below to green at the upper limit.

On several occasions further notable observations were made concerning the distribution of colour in auroral curtains. The first of these happened on 5th May, 1912, at 21 h. 30 m. when, in addition to the normal distribution of colour in intense curtains, as already outlined, green and red tints were observed in vertical streaks amongst the filaments. These colours were seen to be arranged in a regular fashion, the vertical filaments showing pink on their eastern side, normal auroral colour in the centre and greenish along their western margins; as indicated in the sketch, Fig. 14. On this occasion the trend of the curtain was from W.N.W. to E.S.E. An effort to illustrate this appearance is made in Plate V, Fig. 2, but the result is crude and must be regarded as more in the nature of a diagram than of a true representation.

A similar phenomenon was observed on 3rd June, 1912, at 21 h. 40 m., but this time the red tone was noted on the western margin of the filaments. Other examples are recorded under dates 8th June, 1912, at 23 h., 1st July, 1912, at 23 h. 17 m., and 7th July, 1913, at 23 h. 8 m. It was observed in all cases that the red colouration appeared on the side of the filament towards the direction in which the excitation was travelling along the curtain at the time.

There again, in the colouration of these filaments, is an analogy with the luminous striæ produced by the passage of an electric current through rarefied gases;

for, where mixed gases are concerned, such striæ are found to be tinted uniformly on the one side in conformity to one of the gases and on the other in accordance with the spectrum of the other. Reddish colours would seem most likely to be due to hydrogen.

Another notable feature of the distribution of colour in curtain auroræ is recorded under dates 8th June, 1912, at 23 h. 10 m. and 18th September, 1912, at 21 h. 20 m. On these occasions intense curtains were observed. When first seen they were situated well away from the zenith down in the northern sky, but gradually rose, eventually passing south of the zenith, but later in the waning phases, the curtains retreated to the north. As these curtains rose towards the zenith, the red lower border usually seen in the case of intense manifestations presented a normal appearance. When, however, the curtains came directly overhead, their lower margin which had appreciable width, was observed to be coloured red on the south side only, and passed over to a somewhat greenish tone on the other side. The sketch, Fig. 15, illustrates this point. A rather diagrammatic effort to illustrate this feature is shown in Plate V, Fig. 1. In both these cases, it is to be noted that the red colour appeared on the advancing face of the lower edge of the curtains.

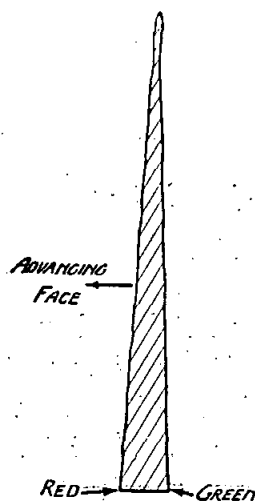


Fig. 15.

Although it did not occur to me at the time, it may possibly be that instead of hanging truly vertical, the curtains pitch slightly (along the lines of magnetic force) to the south. This being so, then the green colouration seen on the northern side of the curtain ribbons could perhaps be the upper greenish extension of the filaments of the curtain very much foreshortened owing to the peculiar view point.

After arriving at points a few degrees south of the zenith, the intense phase passed and the curtains waned as they retreated to the north. The intensity at this stage was not sufficient to produce colour phenomena, and so an opportunity was lost in this retreat, where a reversal of the red and green was to have been expected, of testing the theory that red appears on the advancing face.

V.—DESCRIPTION OF PLATES.

PLATE I.

Fig. 1.—Auroral light appearing as a typical *nebulous arch*, low down near the north horizon, as seen from Cape Denison. It is shown brighter at the eastern extremity and of weaker intensity to the west.

Such a demonstration was a very usual feature between the hours of 7-30 p.m. and 9 p.m.

Fig. 2.—A *streamer arch*, as distinct from a nebulous arch, extending a few degrees above the north horizon as witnessed from Cape Denison.

Such forms were frequently recorded in the early evening hours, most commonly between the hours 8-30 p.m. and 9-30 p.m. Frequently a nebulous arch low on the north horizon will assume the streamer form later, when risen to a greater attitude, indicating that the nebulous appearance of arches is sometimes due to excessive distance from the observer causing a blurring of detail.

Such a streamer arch when nearer the zenith may be termed a curtain. The draped convolutions so characteristic of the true auroral curtain, though present in distant manifestations, are not obvious.

Fig. 3.—View looking north from Cape Denison. The two luminous areas in the sky on the eastern side are of the type referred to as *nebulous patches*.

On the western side a very faint area of nebulous luminescence, is figured and to such the term *auroral haze patch* has been applied.

Such nebulous and weak patchy forms were often the last fading remnants of more intense demonstrations.

PLATE II.

Fig. 1.—*Concentric curtains*.—Here the higher curtain appears as an *arc* only, whereas the lower one is a closed ring. Arcs convex to north or south as in the case of the upper of these two were of common occurrence at Cape Denison, but the closed ring form was only rarely seen.

Fig. 2.—*Parallel curtains* crossing the heavens and appearing to converge at the horizon, due to perspective. This is the Noak's Ark effect.

PLATE III.

Fig. 1.—A *convoluted (draped) curtain* high in the heavens. Thus seen an opportunity is afforded to observe its sinuous course. Lower down is to be noted a fragment of another curtain.

Fig. 2.—Three *parallel curtained streamer arcs*, those at higher elevations being figured respectively each as of fainter intensity. Thus is illustrated firstly a *continuous curtain*, secondly a *discontinuous curtain*, and thirdly, the topmost, an example in which only *isolated streamers* are visible, but which are related in that they are all portions of a single, though mainly invisible, curtain formation. Within a few minutes these curtains may wax or wane in intensity so that for instance the topmost here figured may blaze out at intervals as a continuous line of luminescence such as is figured for the bottom example in the diagram. On the other hand the now bright bottom curtain may wane until perhaps represented merely by an alignment of isolated streamers or, may be, vanish altogether.

PLATE IV.

Fig. 1.—A curtain observed in the zenith. Here a convolution is depicted directly overhead. The vertical streamers extending upwards for a great height appear to converge, an illusion due to perspective. Such an appearance has sometimes been referred to as a *Corona*; but the term is applied by different observers to other manifestations in the zenith.

Fig. 2.—A *band* with streamers crossing the sky near the zenith; also several hazy fragments showing elsewhere. At its upper extremity it is so near the zenith that a view is obtained of its lower margin showing distinct lateral breadth. The figure is presented particularly to illustrate the phenomenon of the *cleavage* here shown as dark bands crossing the luminescence. Such appearances are to be noted occasionally.

PLATE V.

These coloured reproductions are intended to illustrate special colour features of auroral curtains. They need some apology as they are more in the nature of diagrams than of faithful representations of coloured curtains. The arrangement of the colours is much more delicate than here shown. For instance the red selvage below, though sharp at the bottom, shades off above rapidly, but by gradations, into rose and finally into yellow tones which, in their upper limits, become more and more definitely greenish. The vertical arrangement of colour in the streamers of Fig. 2 is likewise crude in the sketch, it is actually much less pronounced in this case and ever so much more delicate.

Fig. 1.—Two curtains above, showing colour effects, also a nebulous band at a lower elevation.

The lower curtain exhibits besides the general greenish yellow colour, a red selvage as a lower margin.

The upper curtain being near the zenith affords a better opportunity of studying the distribution of colour in the lower selvage. It is shown with a dominant green tone on one side and red on the other, a feature observed on several occasions, the red appearing on the side towards which the curtain was travelling bodily at the time of observation (actually, in this case the south side).

Fig. 2.—A streamer arc showing strong colour phenomena. Besides the continuous red selvage forming a basal termination to the mass of greenish yellow streamers, a number of the more intense streamers also show colour, being sometimes definitely tinted red on one side and green on the other. The side of the streamers with a red tone is always that towards which the luminescence is travelling along the arc. This phenomenon has been noted only in the case of certain particularly brilliant and active displays.

Fig. 3.—A curtained arch of the usual greenish yellow hue terminated sharply below in a red selvage. This is a form of less intensity than that illustrated in Figs. 1 and 2, and was of frequent occurrence at Cape Denison.

PLATE VI.

Photograph of two parallel auroral bands seen to the N.E. from Cape Denison. Exposure 10 seconds. All the sharp features are lost owing to the length of exposure, and the flickering motion of the luminescence.

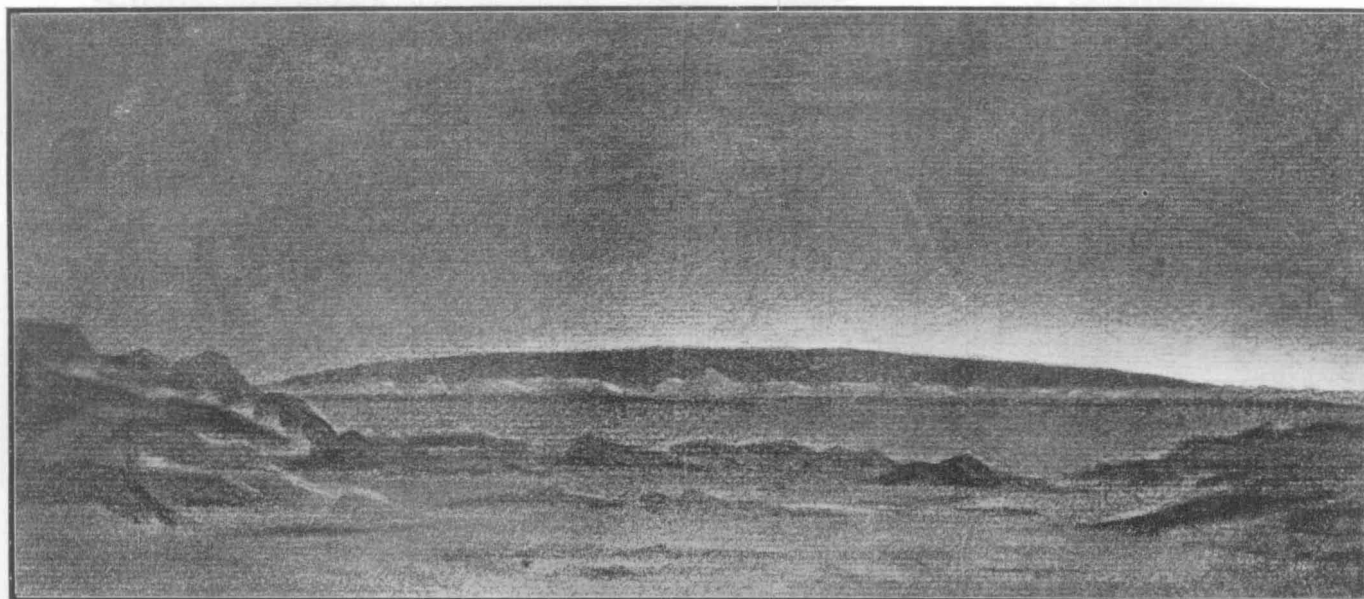


Fig. 1.—A Nebulous Arch.

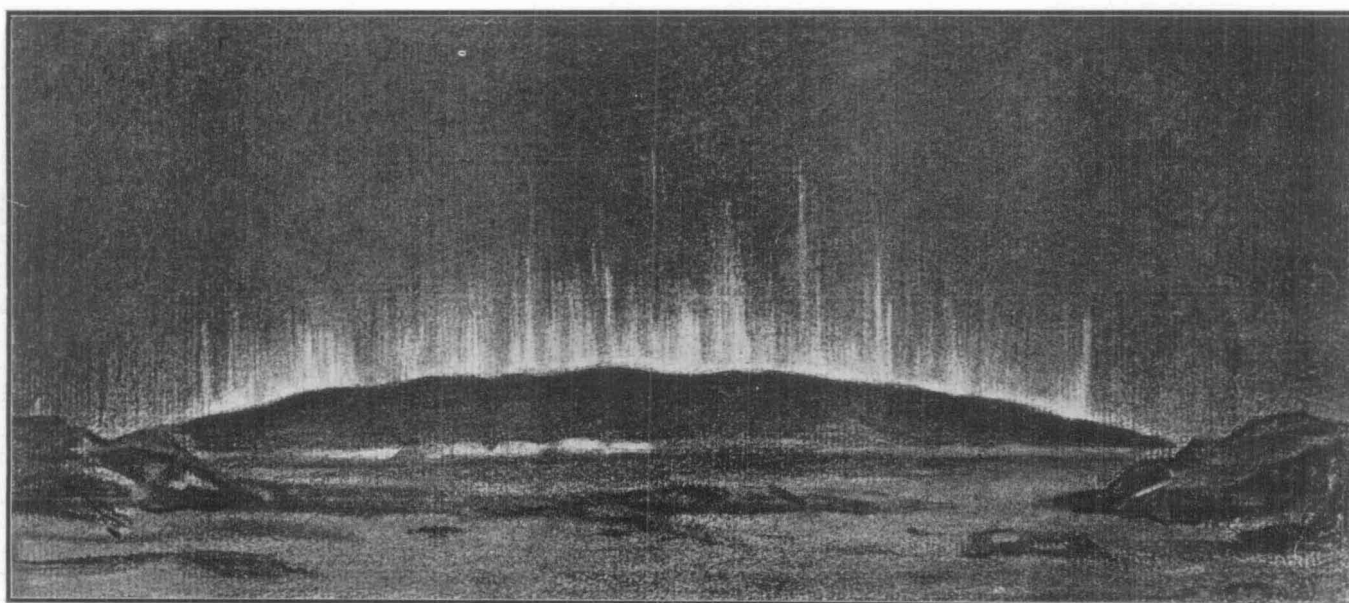


Fig. 2.—A Streamer Arch or Distant Curtain.

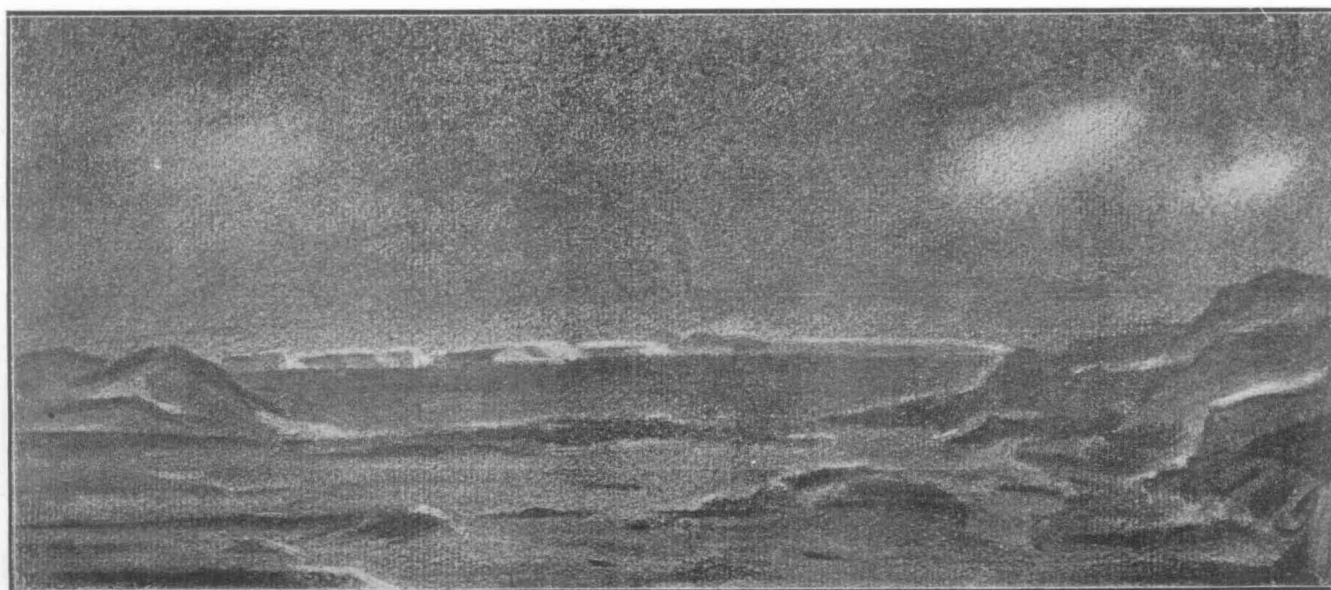


Fig 3.—Nebulous Patches and a Haze Patch.

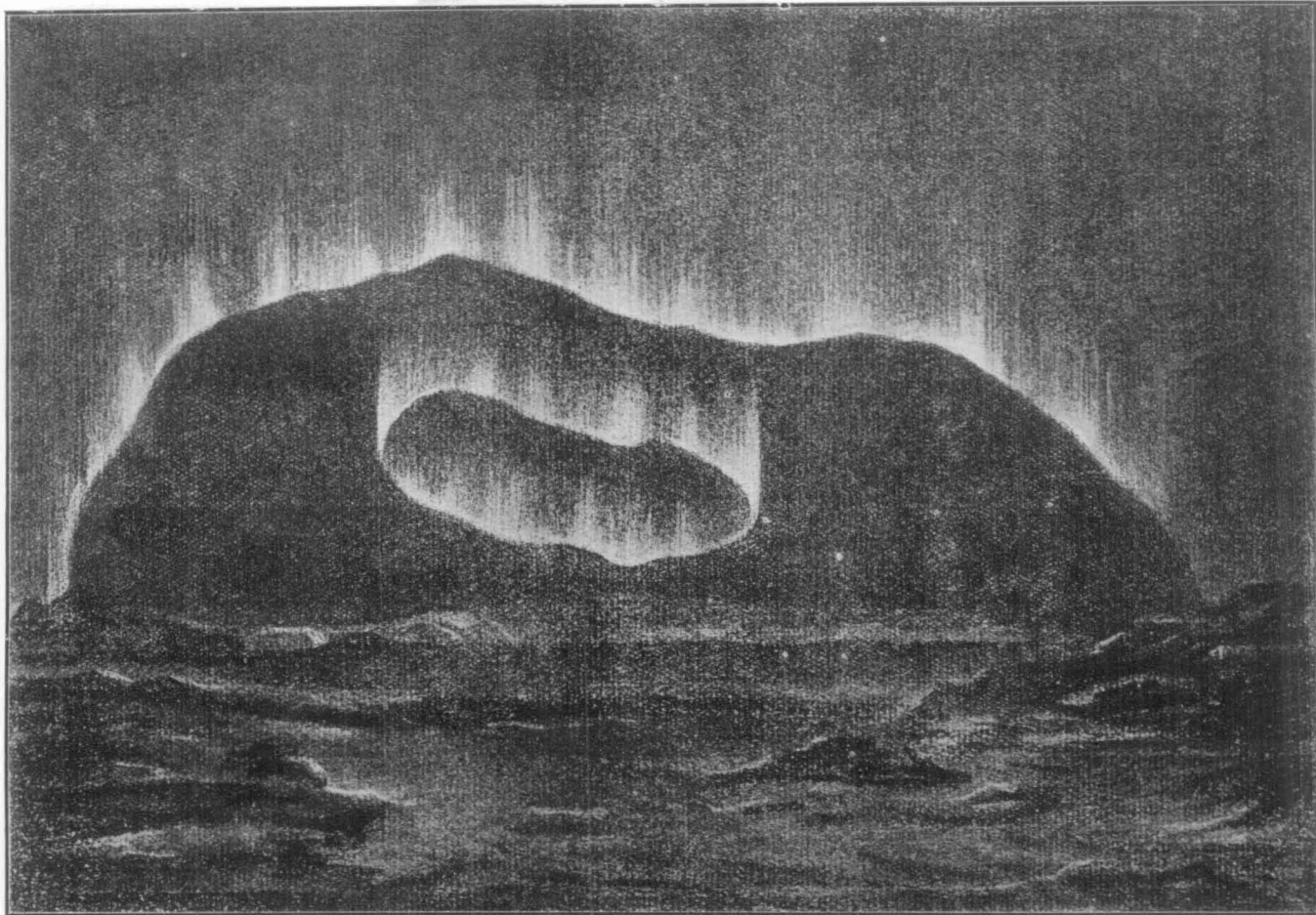


Fig. 1.—Concentric Curtains.

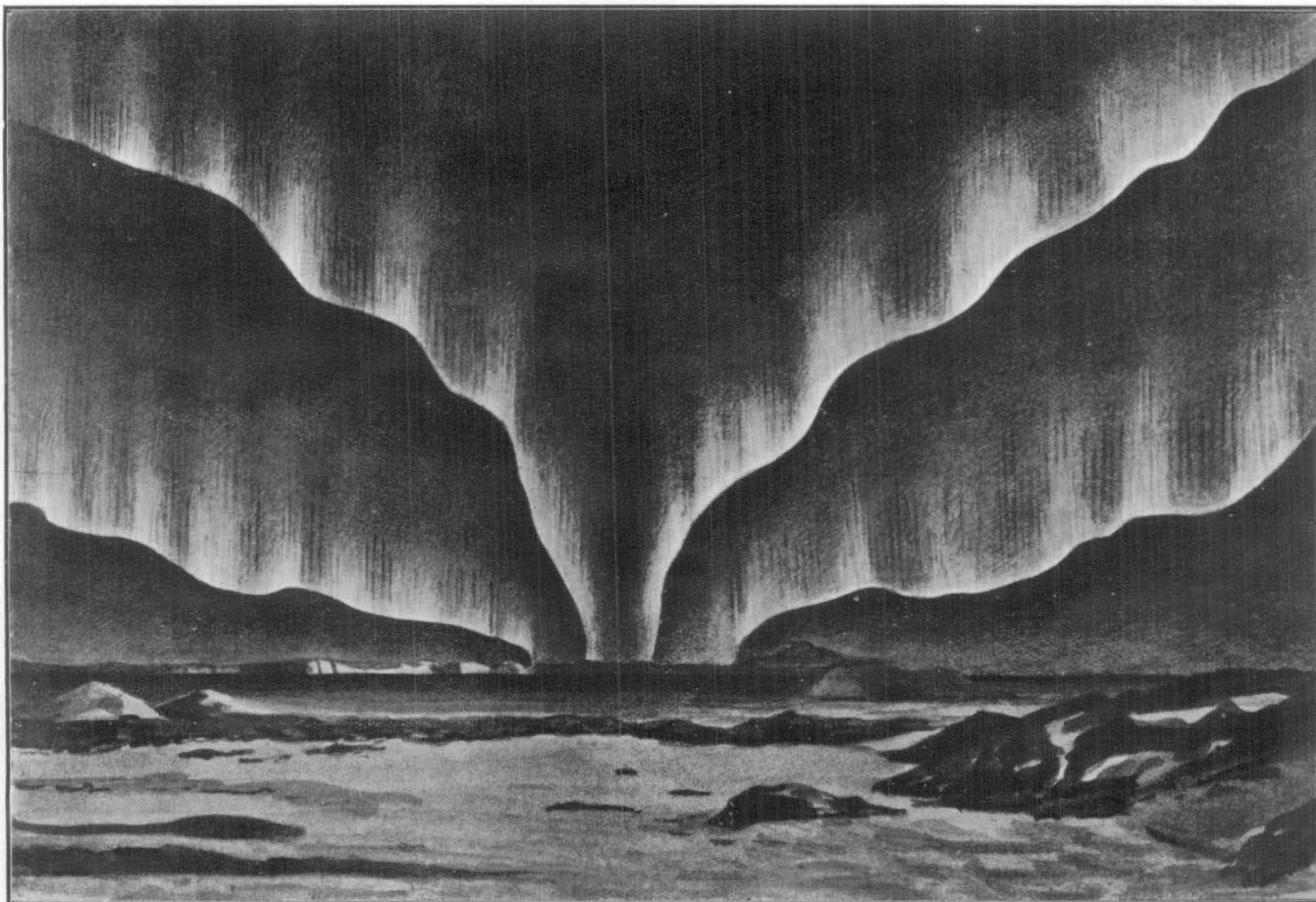


Fig. 2.—Parallel Curtains.

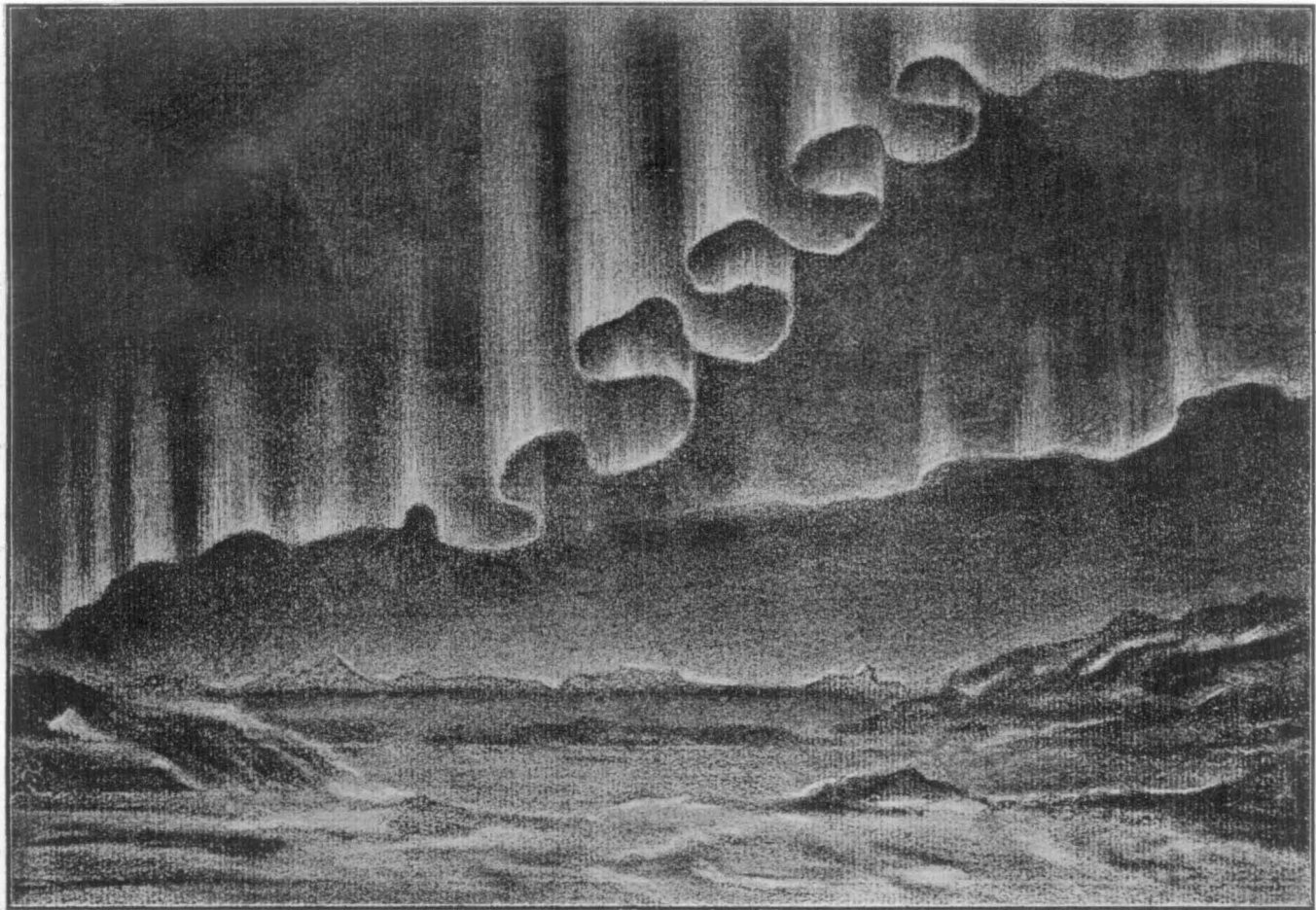


Fig. 1.—A Convoluted or Draped Curtain.

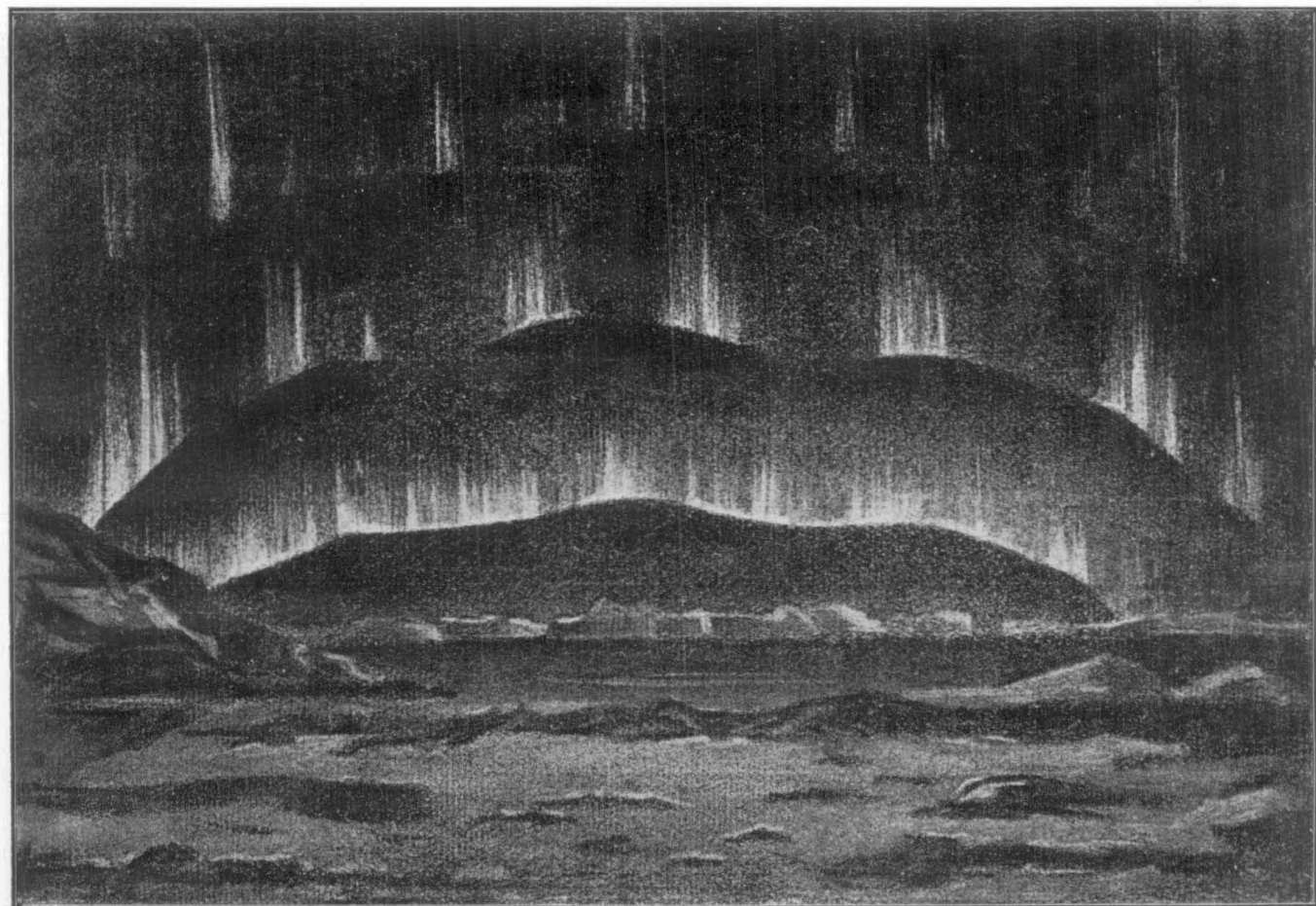


Fig. 2.—Concentric Arcs illustrating a Continuous Curtain, a Discontinuous Curtain and Isolated Streamers.

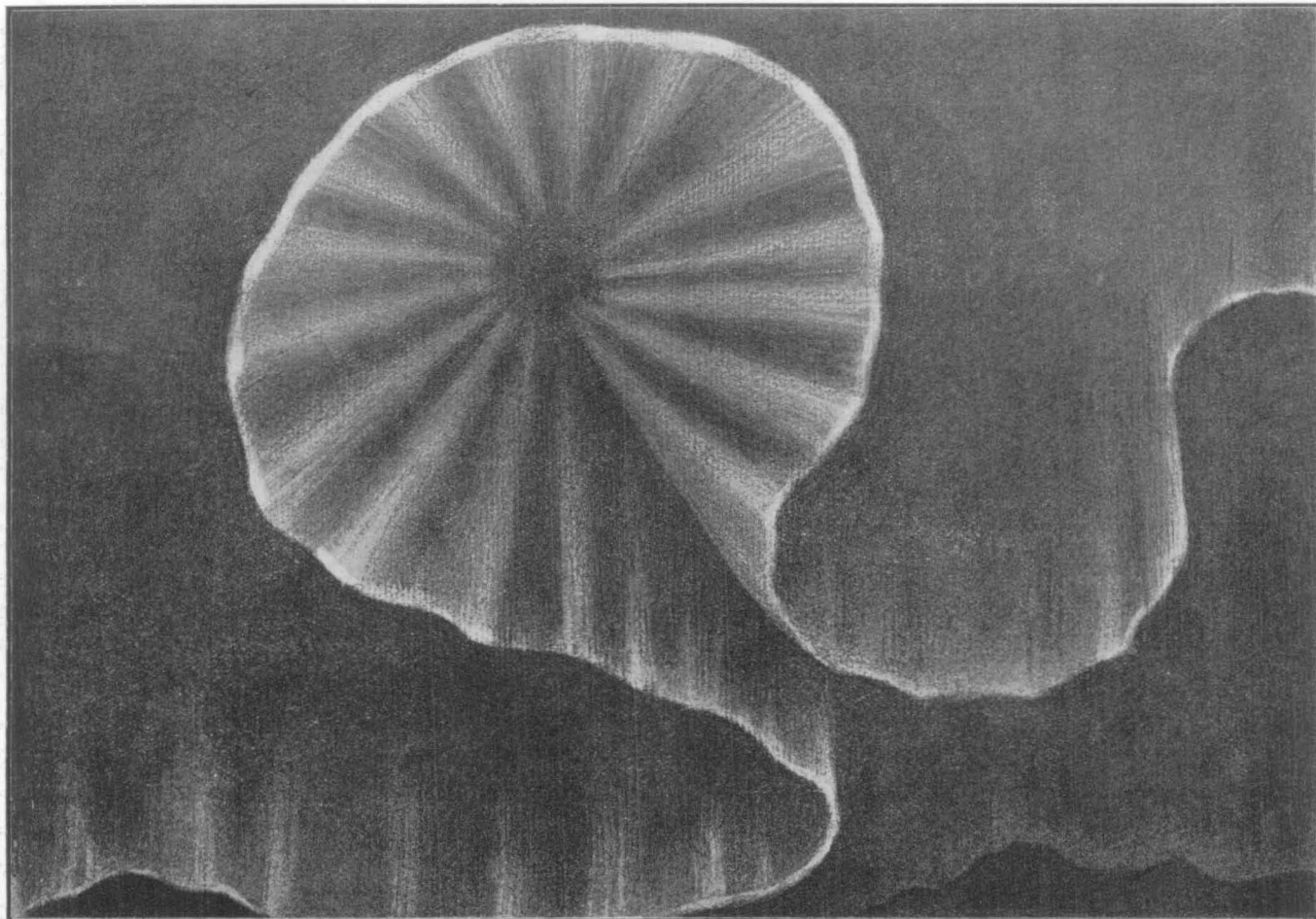


Fig. 1.—Convolution of a Curtain as viewed in the Zenith.

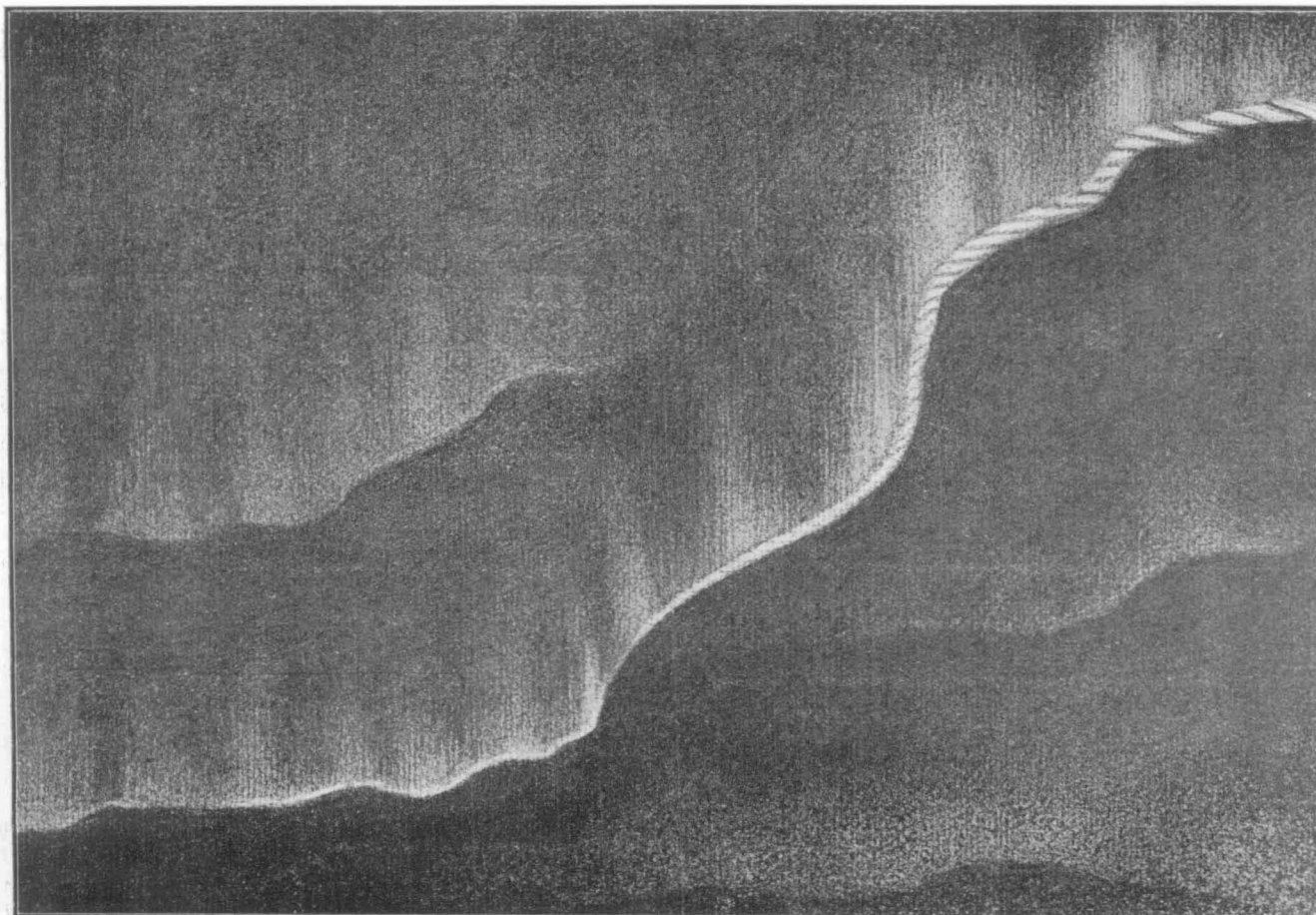


Fig. 2.—Streamer Bands reaching almost to the Zenith showing Cross "Cleavage."



Fig. 1.—Note Red and Green Edging to Base of Curtain in the Zenith.

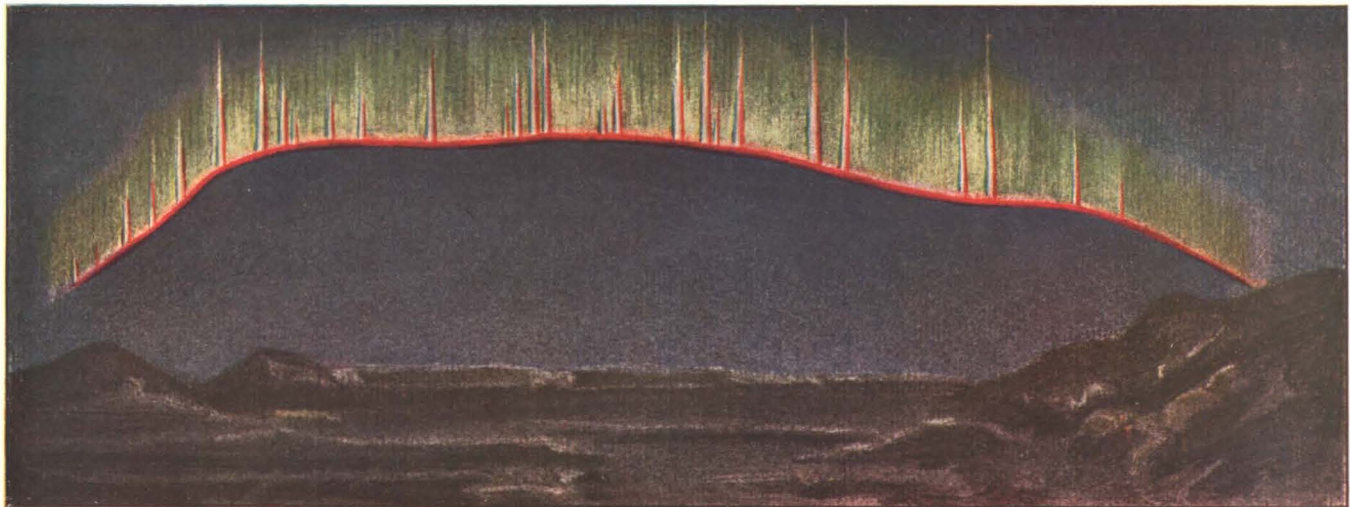


Fig. 2.—Showing Unusually Strong Colour Features notably in Vertical Streamers.

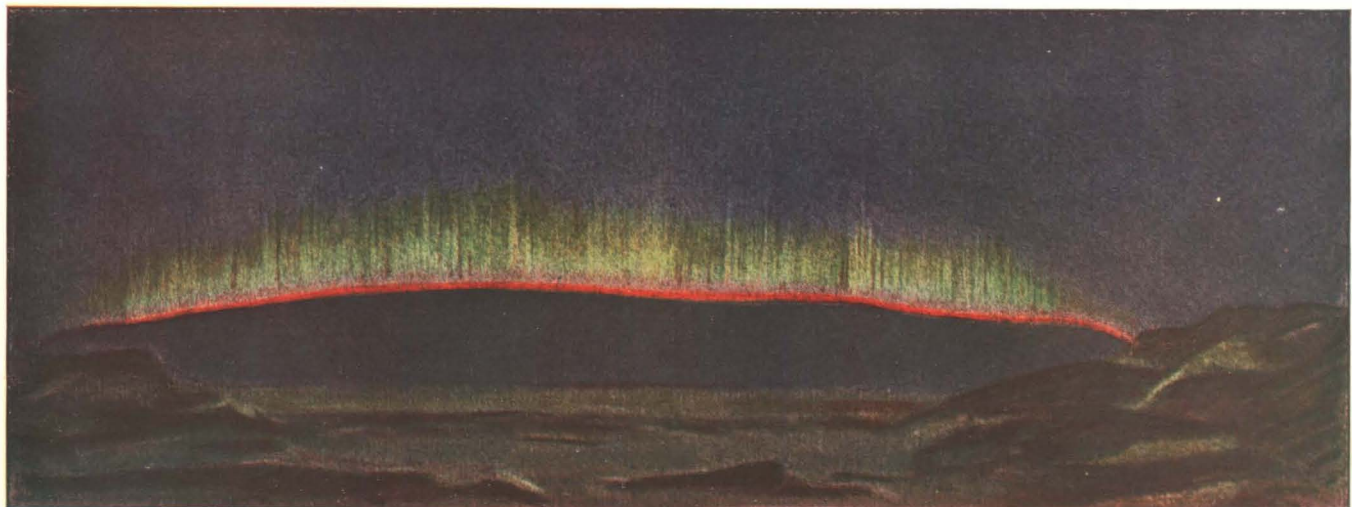
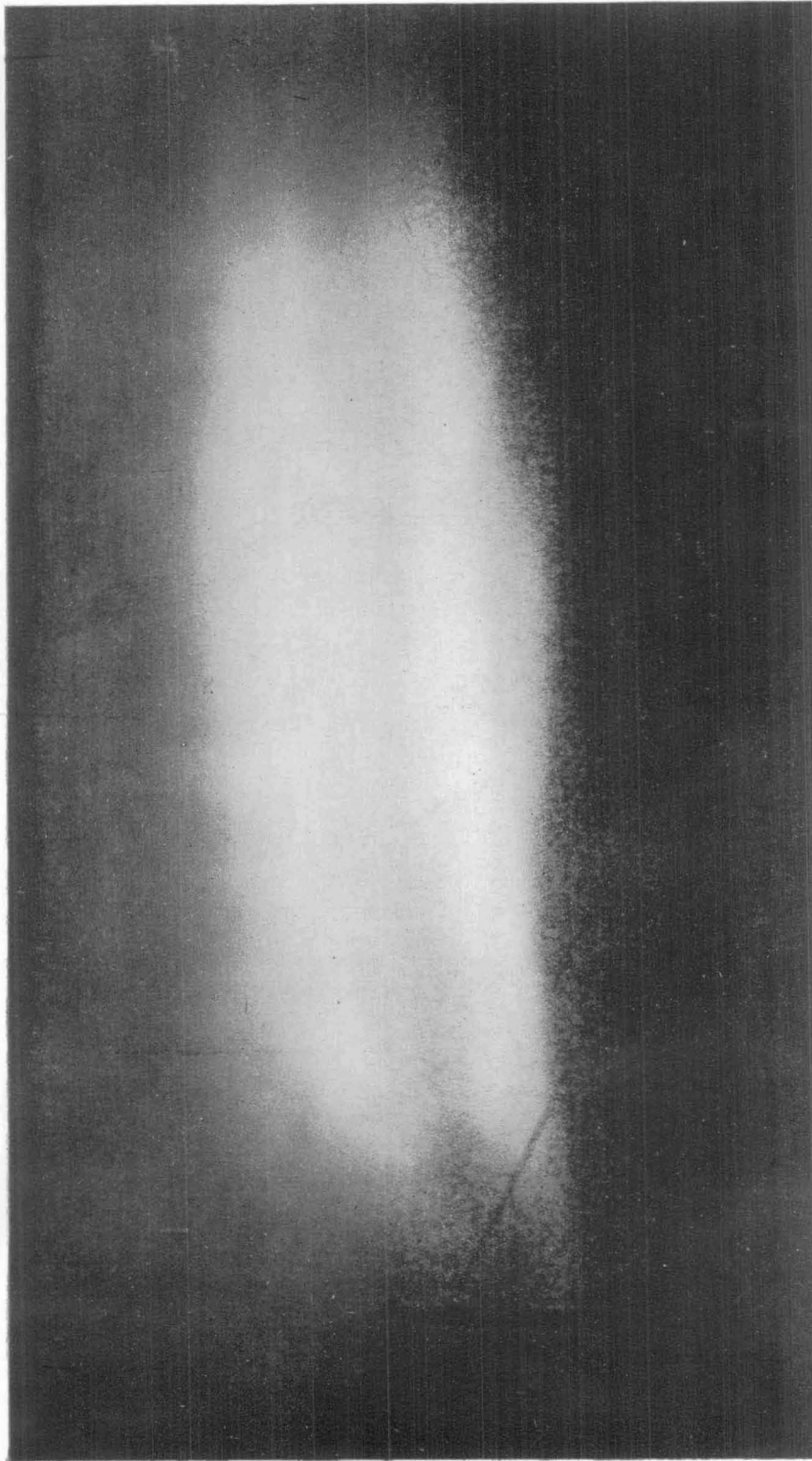


Fig. 3.—A Typical, Distant Coloured Curtain.



Hazy Photographic Result from 10 seconds exposure of a plate to two active parallel bands.

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