

# Aurorae Borealis Studia Classica

Vol. VI

*Under Nordlysets Straaler (1885)*  
*Under the Rays of the Aurora Borealis (1885)*

by Sophus Tromholt

digitized by UiT, with a biographical introduction  
and summary of contents by Kira Moss

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The series would not have been possible without the aid of scholars willing to write the introductions; in this case, Kira Moss, currently working as a librarian at the University Library, UiT. I also acknowledge technical support and guidance from my colleagues Stein Høydalsvik, Aysa Ekanger, and Jan Erik Frantsvåg at Septentrio Academic Publishing, University Library, UiT; and graphic design by Mark Stenersen, RESULT, UiT.

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# SOPHUS TROMHOLT (1851–1896)

## Biographical introduction by Kira Moss

Sophus Peter Tromholt was born on 2 June 1851 in Husum (at that time Danish, now a German town in Schleswig-Holstein). Tromholt started writing about the northern lights already at the age of nineteen, with a series of articles in the Danish newspaper *Dags-Telegraphen*; his first scientific paper on the phenomenon came out in 1873. Having grown up in Husum, Oldenburg, and Randers, Tromholt moved in 1868 to Copenhagen to receive formation as a schoolteacher. After several years of teaching in Denmark, he moved to Bergen in Norway, where he worked as a teacher from 1875 to 1882 at Tank's School. At the same time he wrote several articles on the aurora. From 1882 Tromholt quit teaching to concentrate fully on his interest in the phenomenon. Thanks to funds from among others I.C. Jacobsen in Copenhagen, he was able to manage a polar station in Kautokeino/Guovdageaidnu during the International Polar Year 1882/83. From his station in Kautokeino, Tromholt made observations corresponding to the official Norwegian station in Bossekop. He later embarked upon an expedition to Reykjavik (1883/84) to test theories that had been put forward by Finnish physicist Selim Lemström (compare *Aurorae Borealis Studia Classica*, vol. III). In 1887, he left Norway and went to live in Germany. He subsisted as a writer and lecturer in astronomical subjects for about a decade, until he died in Blankenhain in Germany on 17 April 1896, at the age of 44.

Sophus Tromholt published several textbooks on natural science, as well as riddle books for children. Among his works on the aurora borealis the following are particularly noteworthy. In a methodological paper in the journal *Archiv for Matematik og Naturvidenskab* [‘Archive for Mathematics and Natural Sciences’] (1882), he discusses the problem of measurement of the height of the aurora. He also drew a star atlas for use during observation of northern lights and published a bilingual paper on the periodicity of the phenomenon, *Om Nordlysets Perioder / Sur les périodes de l'aurore boréale* (Copenhagen 1882; see *Aurorae Borealis Studia Classica*, vol. II). His comprehensive catalogue of auroral observations recorded from Norway up until the year 1878 was published posthumously (Christiania 1902; see *Aurorae Borealis Studia Classica*, vol. I).

*Under the Rays of the Aurora Borealis. In the Land of the Lapps and Kvæns* (London 1885; Danish version: *Under Nordlysets Straaler. Skildringer fra Lappernes Land*, Copenhagen 1885) is essentially a popularized account of the Kautokeino Expedition of 1882/83. In the book, Tromholt tells about his experiences in Northern Norway, with special emphasis on his observations of Sami people and their culture. Tromholt is today known for his fine portraits of Sami people, many of which were included in this book. The aurora borealis does not only figure in the title, however. In the course of the narrative, Tromholt includes lengthy explanations about the state of affairs in northern lights research and his own contributions to the field.

### **Bibliography**

Moss, Kira & Peter Stauning: "Sophus Peter Tromholt: an outstanding pioneer in auroral research", *History of Geo- and Space Sciences* vol. 3, issue 1 (2012): 53–72.

<https://doi.org/10.5194/hgss-3-53-2012>

Moss, Kira & Peter Stauning: *Sophus Tromholt: "Skæbnen og nordlyset er jo lige uransagelige"*. Copenhagen: Forlaget Epsilon, 2012.



· SOPHUS TROMHOLT .

Portrait of Sophus Tromholt. Courtesy of Tromsø Geophysical Observatory, UiT

# UNDER NORDLYSETS STRAALER

## Summary of Contents (Danish edition)

by Kira Moss

The book is basically a travel account, describing in a popular form Tromholt's Kautokeino Expedition during the winter 1882/83. Richly illustrated, it also reviews the nature and cause of the aurora borealis and the current state of research into the phenomenon. A series of travel letters, first published in the Norwegian newspaper *Morgenbladet*, form the core of the book. The original material has, however, been revised and substantially expanded with new chapters dealing with specific themes. Regarding the northern lights, chapters II, IV, X, and XV are of particular importance.

While recounting the background for the expedition and his personal experiences during the journey to and stay in Kautokeino, Tromholt also includes vivid depictions of the region's ethnography, history, and natural history, with a special emphasis on the local Sami population (or Saami, Sámi, formerly known as "Lapps"). Furthermore, the book entails personal accounts of excursions to various places in the region, including a visit to the Polar Station led by Selim Lemström in Finnish Sodankylä.

Note that the summaries below are more extensive for chapters that deal with the aurora than those that do not. Reference to the English two-volume edition (hereafter referred to as ENG) is found in [brackets].

### **[Title page], Indhold, & Forord (pp. [1]–[5]) [=ENG, vol. I, (i)–xv]**

Full title: *Under Nordlysets Straaler. Skildringer fra Lappernes Land* (The English edition bears the title: "Under the Rays of the Aurora Borealis. In the Land of the Lapps and Kvæns"). The author's own Preface (pp. [3]–[4] = ENG, iii–v) gives details about the book and the main purpose of the Kautokeino Expedition, namely, to measure the height of the northern light. Note that the Tables of Contents at the start of each volume in ENG are far more detailed than the corresponding table ("Indhold") in the Danish edition.



**I. Fra Bergen til Alten (pp. 5–31) [=ENG, vol. I, 1–31]**

“From Bergen to Alten”. Description of Tromholt’s voyage with a postal ship from Bergen to Alten (Alta) from the end of August to the beginning of September 1882.

**II. Bossekop og Alten (pp. 32–56) [=ENG, vol. I, 32–54]**

“Bossekop and Alten”. Description of Bossekop, and how Bossekop also housed the French La Recherche Expedition, with physicists Lottin and Bravais, in 1838/39. Why Bossekop is a very good place for studying the northern light and geomagnetic phenomena in general. The plan for, and intention with, the polar stations in connection with the International Polar Year 1882/83, based on a description by Capt. Hoffmeyer [Director of the Danish Meteorological Institute]. Detailed description of the Norwegian polar station in Bossekop.

**III. Fra Bossekop til Koutokæino (pp. 57–75) [=ENG, vol. I, 55–74]**

“From Bossekop to Koutokæino”. Travel description of a strenuous journey from Bossekop to Koutokæino (Kautokeino) on horseback and in Sami canoe.

**IV. Koutokæino (pp. 76–95) [=ENG, vol. I, 75–93]**

About Kautokeino and its surroundings and the reasons why Tromholt has chosen this place for a station corresponding to the station in Bossekop. These reasons include the distance between the two places, since by measuring the same auroral arc from two stations of suitable distance one has the possibility to measure its height, as well as local climatic and geophysical conditions. A description – and photo – of his observatory and its instruments is included.

**V. Koutokæino (pp. 96–107) [=ENG, vol. I, 94–104]**

“Koutokæino in November”. Description of Kautokeino in wintertime and of Tromholt’s Sami clothes.

**VI. En Tur til en Renby (pp. 108–125) [=ENG, vol. I, 105–123]**

“A visit to a Reindeer Camp”. About a trip to a nearby Sami camp, about Sami sledges and how it is to be treated in a Sami tent.

**VII. Om Lapperne (pp. 126–162) [=ENG, vol. I, 124–158]**

“About the Lapps”. Long description of Sami people and their way of living, based on Gustaf von Düben: “Om Lappland og Lapparne, foreträdesvis de svenske”. With many fine portraits of Sami individuals.

**VIII. Om Renen (pp. 163–177) [=ENG, vol. I, 159–173]**

“About the Reindeer”. On the natural history of the reindeer and their use by the Sami.

**IX. Ved Juletid i Koutokæino (pp. 178–194) [=ENG, vol. I, 174–191]**

“In the Land of the Lapps at Christmas”. Description of the loneliness felt when everybody except Tromholt went to the market in Bossekop in December, followed by the vicar’s arrival, Christmas celebrations, and a wedding.

**X. Om Nordlyset (pp. 195–308) [=ENG, vol. I, 192–288]**

“On the Aurora Borealis”. About the Northern Lights and the results of Tromholt’s research on this topic. Refusal of old theories of the aurora, about its extension, periodicity and connection with sunspots, and description of old sources that mention the northern light.

1. “Nordlysets Optræden i Almindelighed” (“Principal forms of the Aurora Borealis”; pp. 205–221 [=ENG, 195–209]). Description of the various types of appearance.
2. “Nordlysformer” (“Classification of Forms”; pp. 221–237 [=ENG, 209–228]). Different forms of the northern lights – arcs, bands, auroral coronae, auroral clouds, auroral waves – and their optical effects. Discussion of the colours of the aurora, including Biot’s statement that the Northern Light shows no sign of polarization and Ångström’s examination of the auroral spectrum.
3. “Nordlyset i Koutokæino” (“My Observations at Koutokæino”; pp. 238–248 [=ENG, 228–239]). Description of the Northern Lights seen in Kautokeino, their direction, forms, deviation from the magnetic meridian, and colours.
4. “Nordlysets geografiske Optræden” (“The Geographical Extension of the Aurora Borealis”; pp. 248–259 [=ENG, 239–249]). Presentation of Hermann Fritz’s map of auroral frequency; discussion of similar results from Scandinavia 1879/80.
5. “Nordlysets Højde” (“The Height of the Aurora Borealis”; pp. 259–274 [=ENG, 250–260]). Sophus Tromholt’s method to measure the height of the aurora by triangulation, exemplified by a measurement from 17 March 1880. The result was a mean of 146.95 km over ground. Comparison of this height with the height of other phenomena. Discussion of other attempts to measure the height of the phenomenon. Preliminary examination of the results from Kautokeino-Bossekop gives a mean of 113 km above the ground. Discussion of problematic methods for measuring the height. Assessment of reported observations of Northern Lights close to the surface of the earth.
6. “Nordlysets Perioder” (“The Periods of the Aurora Borealis”; pp. 274–283 [=ENG, 260–267]). The frequency of the aurora, both according to the time of day and its yearly periods. For lower latitudes, its periods of maximum frequency are in October and March, with a minimum in June/July and December/January. For higher latitudes, there is an opposite maximum at winter solstice. Discussion of the 11-year cycle and its connection with the sunspots as found by Fritz.
7. “Nordlyszonens Bevægelser” (“The Periodical Movements of the Auroral Zone”; pp. 284–291 [=DAN, 267–274]). Examination of data collected by Samuel Kleinschmidt in Godthaab (Nuuk), Greenland. There is a contradiction between the frequency of the Northern Lights and sunspot activity in Nuuk. This frequency is opposite to that of lower latitudes. This leads to a confirmation of Weyprecht’s theory about the movement of the auroral belt during the year, plus as suggested by Tromholt that this is also the explanation of the daily period, and

the 11-year cycle. 8. “Slutningsbemærkninger” (“General Observations on the Influences, the Sound, etc. of the Aurora Borealis”; pp. 291–308 [=ENG, 274–288]). Discussion of the connection with disturbances of the magnetic needle as examined by Hjorter and Celsius, Cotte, Humboldt, and Hansteen. Some of Weyprecht’s results in this field. Discussion of the connection between the aurora and electricity in the air, and telegraph disturbances, followed by considerations about the aurora in connection with other meteorological phenomena, and finally, the sound of the Northern Lights. At the end, some theories to explain the northern light, including, cosmic theories, theories about the northern light as an electrical phenomenon, and Edlund’s theory about uni-polar induction.

**XI. Udflugter fra Koutokæino (pp. 309–331) [=ENG, vol. II, 1–27]**

“Winter Excursions in Pulk”. About excursions to Autzie and Gargovarre.

**XII. Rædselsperioden i Koutokæino (pp. 332–378) [=ENG, vol. II, 28–85]**

“The Reign of Terror in Lapland”. About the Kautokeino Rebellion of 1852. Tromholt has gone through various interrogation protocols.

**XIII. På Rejse (pp. 379–411) [=ENG, vol. II, 86–115]**

“Journeys to Häтта, Muonioniska and Karesuando”. An excursion to places in northernmost Finland and Sweden.

**XIV. Thingugen i Koutokæino (pp. 412–434) [=ENG, vol. II, 116–143]**

“Assize Week at Koutokæino”. About the arrival of strangers for the Kautokeino market; of a hearing and a wedding; about the priest from Häтта [Hetta] and a trip to the sacrificial site at Gargovarre [Gárgovárri].

**XV. Reise til Sodankylä (pp. 435–467) [=ENG, vol. II, 144–182]**

“Journey to the Finnish Polar Station at Sodankylä”. About a strenuous trip to the Finnish polar station. Description of the polar station and professor Lemström’s attempts to manufacture artificial aurorae, which Tromholt criticizes and rejects.

**XVI. Fra Koutokæino til Bossekop (pp. 468–485) [=ENG, vol. II, 182–202]**

“From Koutokæino to Bossekop”. Tromholt describes different Sami characters; Kautokeino in general; and his travel back to the Polar Station in Bossekop.

**XVII. Fra Alten til Hammerfest (pp. 486–520) [=ENG, vol. II, 203–235]**

“From Alten to Hammerfest”. About small excursions in the Alten Fiord. About “Sea Lapps” and Kvæns. Travel to and description of Hammerfest.

**XVIII. Fra Hammerfest til den russiske Grænse (pp. 521–569) [=ENG, vol. II, 236–299]**

Corresponding to two separate chapters in ENG: “From Hammerfest to Vadsö” and “From Vadsö to Russian Lapland”. About the midnight sun and photographing this at Vardøhus [Vardø], visiting among other places Nordkapp, Gjesvær, Kjelvik, and Sværholt before going to Vadsø, where Tromholt experiences the cutting up of a whale. Travel from Vadsø to Boris-Gleb in Russia.

**Anmærkninger (pp. 571–572) [*missing in ENG*]**

Brief apology on the quality of the illustrations, followed by a list of books and articles that the author has consulted.

**Alfabetisk Register & Rettelser (pp. 573–579) [=ENG, vol. II, 301–306]**

Index and Errata (no list of errata in ENG, however).

**Forfatterens Reiseruter [Map, 1 p.; *found also in ENG, at the end of vol. I*]**

“The Author’s Journeys”. Tromholt’s map showing his itinerary and all important places visited during his expedition. ENG includes a two-page Guide to the Map; missing in DAN.

# UNDER THE RAYS OF THE AURORA BOREALIS

Summary of Contents (English edition)  
by Kira Moss

The two-volume book is basically a travel account, describing in a popular form Tromholt's Kautokeino Expedition during the winter 1882/83. Richly illustrated, it includes detailed descriptions of the local Sami population (or Saami, Sámi, formerly known as "Lapps") as well as the current state of research into the aurora borealis. A series of travel letters, first published in various Nordic magazines, form the core of the book. The original material has, however, been revised and substantially expanded with new chapters dealing with specific themes. Regarding the northern lights, chapters II, IV, and X in the first volume and chapter V in the second volume are of particular importance.

Note that the summaries below are more extensive for chapters that deal with the aurora than those that do not. Reference to the Danish single-volume edition (hereafter referred to as DAN) is found in [brackets].

## **VOL[UME] I.**

The first volume deals primarily with the background for the expedition and personal experiences during Tromholt's journey to and stay in Kautokeino; a scientific discussion of the nature and cause of the aurora borealis rounds it off.

**[Title page], Preface, Addendum, Contents & List of Illustrations (pp. [i]–xv)  
[=DAN, (1)–(5)]**

Full title: *Under the Rays of the Aurora Borealis. In the Land of the Lapps and Kvæns* (The Danish title reads "Under the Rays of the Aurora Borealis. Impressions from the Land of the Lapps"). The author's own Preface (pp. iii–v [=DAN, (3)–(4)]) gives details about the book and the main purpose of the Kautokeino Expedition, namely, to measure the height of the northern light. The editor's Addendum (p. vii) deals with the translation and other editorial work undertaken for the English version. Note that the English Tables of Contents at the start of each volume are far more detailed than the corresponding table in the Danish edition.

**Chapter I. From Bergen to Alten (pp. 1–31) [=DAN, 5–31]**

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**Chapter II. Bossekop and Alten (pp. 32–54) [=DAN, 32–56]**

Description of Bossekop, and how Bossekop also housed the French La Recherche Expedition, with physicists Lottin and Bravais, in 1838/39. Why Bossekop is a very good place for studying the northern light and geomagnetic phenomena in general. The plan for, and intention with, the polar stations in connection with the International Polar Year 1882/83, based on a description by Capt. Hoffmeyer [Director of the Danish Meteorological Institute]. Detailed description of the Norwegian polar station in Bossekop.

**Chapter III. From Bossekop to Koutokæino (pp. 55–74) [=DAN, 57–75]**

Travel description of a strenuous journey from Bossekop to Koutokæino (Kautokeino) on horseback and in Sami canoe.

**Chapter IV. Koutokæino (pp. 75–93) [=DAN, 76–95]**

About Kautokeino and its surroundings and the reasons why Tromholt has chosen this place for a station corresponding to the station in Bossekop. These reasons include the distance between the two places, since by measuring the same auroral arc from two stations of suitable distance one has the possibility to measure its height, as well as local climatic and geophysical conditions. A description – and photo – of his observatory and its instruments is included.

**Chapter V. Koutokæino in November (pp. 94–104) [=DAN, 96–107]**

Description of Kautokeino in wintertime and of Tromholt's Sami clothes.

**Chapter VI. A visit to a Reindeer Camp (pp. 105–123) [=DAN, 108–125]**

About a trip to a nearby Sami camp, about Sami sledges and how it is to be treated in a Sami tent.

**Chapter VII. About the Lapps (pp. 124–158) [=DAN, 126–162]**

Long description of Sami people and their way of living, based on Gustaf von Düben: "Om Lappland og Lapparne, foreträdesvis de svenske". With many fine portraits of Sami individuals.

**Chapter VIII. About the Reindeer (pp. 159–173) [=DAN, 163–177]**

On the natural history of the reindeer and their use by the Sami.

**Chapter IX. In the Land of the Lapps at Christmas (pp. 174–191) [=DAN, 178–194]**

Description of the loneliness felt when everybody except Tromholt went to the market in Bossekop in December, followed by the vicar's arrival, Christmas celebrations, and a wedding.

**Chapter X. On the Aurora Borealis (pp. 192–288) [=DAN, 195–308]**

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Cotte, Humboldt, and Hansteen. Some of Weyprecht's results in this field. Discussion of the connection between the aurora and electricity in the air, and telegraph disturbances, followed by considerations about the aurora in connection with other meteorological phenomena, and finally, the sound of the Northern Lights. At the end, some theories to explain the northern light, including, cosmic theories, theories about the northern light as an electrical phenomenon, and Edlund's theory about uni-polar induction.

**The Author's Journeys [Map, 1 p.; *found also at the end of DAN*] & Guide to the Map [2 pp.; *missing in DAN*]**

Tromholt's map showing his itinerary and all important places visited during his expedition.

**List of Books for sale (30 pp.) [*missing in DAN*]**

Advertisement from the publisher, Sampson Low & Co.

**VOL[UME] II**

The second volume consists primarily of vivid depictions of the region's ethnography, history, and natural history, as well as personal accounts of excursions to various places in the region, including a visit to the Polar Station led by Selim Lemström in Finnish Sodankylä.

**[Title page] & Contents (pp. i–x)**

Detailed overview of the contents of volume II.

**Chapter I. Winter Excursions in Pulk (pp. 1–27) [=DAN, 309–331]**

About excursions to Autzie and Gargovarre.

**Chapter II. The Reign of Terror in Lapland (pp. 28–85) [=DAN, 332–378]**

About the Kautokeino Rebellion of 1852. Tromholt has gone through various interrogation protocols.

**Chapter III. Journeys to Häтта, Muonioniska and Karesuando (pp. 86–115) [=DAN, 379–411]**

An excursion to places in northernmost Finland and Sweden.

**Chapter IV. Assize Week at Koutokæino (pp. 116–143) [=DAN, 412–434]**

About the arrival of strangers for the Kautokeino market; of a hearing and a wedding; about the priest from Häтта [Hetta] and a trip to the sacrificial site at Gargovarre [Gárgovárr].

**Chapter V. Journey to the Finnish Polar Station at Sodankylä (pp. 144–182)**  
[=DAN, 435–467]

About a strenuous trip to the Finnish polar station. Description of the polar station and professor Lemström's attempts to manufacture artificial aurorae, which Tromholt criticizes and rejects.

**Chapter VI. From Koutokæino to Bossekop (pp. 182–202) [=DAN, 468–485]**

Tromholt describes different Sami characters; Kautokeino in general; and his travel back to the Polar Station in Bossekop.

**Chapter VII. From Alten to Hammerfest (pp. 203–235) [=DAN, 486–520]**

About small excursions in the Alten Fiord. About "Sea Lapps" and Kvæns. Travel to and description of Hammerfest.

**Chapter VIII. From Hammerfest to Vadsö (pp. 236–276) [=DAN, 521–545]**

About the midnight sun and photographing this at Vardøhus [Vardø], visiting among other places Nordkapp, Gjesvær, Kjelvik, and Sværholt before going to Vadsø.

**Chapter IX. From Vadsö to Russian Lapland (pp. 277–299) [=DAN, 545–569]**

Tromholt experiences the cutting up of a whale in Vadsø. Travel from Vadsø to Boris-Gleb in Russia.

**Chapter X. (pp. 300–306) [=DAN, 569–578]**

"Good-bye" and Index.