

THE IMPORTANCE OF TAKING AURORA PHOTOGRAPHS FROM A NETWORK OF STATIONS AROUND THE POLAR BASIN IN COLLABORATION WITH ROALD AMUNDSEN'S EXPEDITION

BY

CARL STØRMER.

As was shown in the circular »Geophysical Investigations in the Arctic Regions in Cooperation with Roald Amundsen's Expedition«¹⁾ there will during the years 1920—22 occur an exceptionally favourable opportunity of extending our knowledge of the nature of the aurora borealis.

For this purpose the following stations must be considered very desirable for the study of the aurora borealis:

Youngoksky
Dikson
Franz Josephs Land
Sodankylä
Northern Sweden
Spitsbergen
Tromsø
Kristiania
Jan Mayen
Iceland
Angmagsalik
Godthaab
Thule

and a series of stations along the aurora belt in *Canada, Alaska*, and if possible *Siberia*. In this manner a network of stations will be erected along the aurora belt in the same manner as during the Polar year 1882—83, but in the present case the network will be far more dense on the European side, and the study of the aurora has made far more progress both theoretically and practically than in 1882—83. The corpuscular theory²⁾, assuming aurora to be caused by electrical corpuscles coming from the sun, has shown itself to be excellent working hypothesis, and by the introduction of photography in the observations of aurora a fully objective and reliable method has been secured. In another paper³⁾ will be seen an account of this photographic method as it was introduced and used on my expeditions in 1910 and 1913. As the exact hour is supposed to be observed for each photograph, the orientation of the aurora on the heavens can be calculated

¹⁾ See this publication p. 5.

²⁾ See: Corpuscular Theory of the Aurora Borealis, *Terr. Magn. and Atm. El.*, Vol. XXII, No. 1.

³⁾ See this publication p. 19.

exactly from the stars on the same photograph. If the same aurora is photographed simultaneously from two stations connected by telephone, its height and position in space can be calculated, as I mentioned in the reports from 1910 and 1913.

Among the above-mentioned stations, Sodankylä, Spitsbergen, Tromsø and Kristiania are secured for double photographs of aurora, giving height and situation, and probably the same is the case as regards the station Godthaab an North Sweden. It is to be hoped that as many as possible of the other stations will erect such a base with simultaneous double photography of the aurora.

Let us for the sake of simplicity call stations with double photography of aurora »stations A«, and those where only single photographs can be taken, »stations B«.

At all these stations aurora photographs should as far as possible be taken continuously on fixed days, in order to get as completely as possible *simultaneous records* of the aurora displays around the Polar basin.

On other days the following programmes should be followed:

At stations A, good double photographs of characteristic aurora forms are important for determinations of height and situation in space, and especially for exact determination of lower and upper limits in the atmosphere, and of the situation of long arcs and bands. At stations B, photographs of arcs and bands of long extent, especially their summits and ends near the horizon. Further, photographs of aurora corona for determination of the point of radiation. Also photographs of every characteristic aurora form.

At stations A and B notes on the colours, spectrum, intensity, motion, and general appearance of the aurora are very desirable. Exact hours of each observation very important. If possible photographs to be taken 7 am, 1 pm, 7 pm Greenwich.

Materials can then be collected from the above-mentioned network of stations for the answering of the following important questions:

A. As to the vertical extension of aurora borealis: Is the vertical extension of the different aurora types the same at all places, or is it variable with the geographical position of the place? Especially as regards the lower limits of the auroral curtains, are these the same everywhere as they would appear to be from photographic observations in Spitsbergen, Finmarken and at Kristiania? On the other side, is the height of the upper parts of auroral rays the same everywhere or not? At Kristiania it was much greater in 1916—1918 than in Finmarken in 1910 and 1913.

For the theory of the nature of the aurora, the determination of the lower limits of curtains is of special importance. The determination of the upper limits of aurora rays is also of importance for the question of the upper limits of the atmosphere, and of its constitution.

B. As to the horizontal extension of the aurora borealis:

The long arcs which are often seen at the beginning of the auroral displays, how far do they extend? — If the height is about 100 km., the photographic determination of its summit and the two ends near the horizon, from a series of stations about 1000 to 1500 km. apart long the auroral belt, will give very important information.

C. As to the time of occurrence of special forms of aurora at the different stations:

It will be of great interest to know if the formation of curtains takes place simultaneously or successively at the different stations. The same question applies to coruscations and other special forms. Observations from the Antarctic will here be of great interest as a supplement to those from the Arctic.

D. The exact determination of the point of radiation of the corona streamers,

with simultaneous determination of the direction of the magnetic force of the place, will give important contributions to the question of the physical nature of the aurora.

If it is possible by simultaneous photographs from two stations to determine the shape of the corona streamers (to decide for instance whether they are straight or curved) this will also give important information.

E. Exact determination of the spectral lines of aurora and of the distribution of colours and intensity along aurora rays is another very important subject for study that could perhaps be undertaken at some of the best equipped stations.