

NOTES

The Ionospheric and Radio Wave Propagation Observatory at Kiruna, 67°50' N, 20°14.5' E

During the last war the *Telecommunications Laboratory* of the *Chalmers University of Technology*, Gothenburg, started a small ionospheric observatory at *Askim* (57°14' N, 11°59' E) six miles south of the city. Fixed frequency recordings were begun in 1941 and a year later, in 1942, a semi automatic multi-frequency recorder was put in operation. Already during the first years of operation of the *Askim* observatory, which unfortunately had to be very irregular during the war, a definite need was felt for a recording sister-observatory in the very north of Sweden where the auroral disturbances are much more frequent than at Gothenburg.

On account of the often very transient conditions of the "auroral" ionosphere the *Research Laboratory of Electronics*, which now operates the *Askim* observatory, decided to develop a quick-sweep high power panoramic recorder for the proposed new observatory. It was felt that extremely valuable information could be obtained by such an instrument with a sweep speed of at least 2/3 Mc/s per second.¹ Preliminary construction work was begun in 1945 but was delayed by the lack of suitable tubes which were obtained from the United States first in 1946. The new recording equipment was ready early in 1948 and it was decided to move it to a temporary location at *Abisko*. At the suggestion of Professor ROLF M. SIEVERT, however, this plan was abandoned and the equipment was moved to temporary buildings near *Kiruna*, the iron ore city of the north. The buildings were erected on govern-

ment property where it is hoped that a Swedish geophysical research centre will be organized in the near future. The temporary buildings, which were almost completed by midsummer 1948, were placed at the disposal of the *Research Laboratory of Electronics* through the good offices of the *Interim Board of the Research Stations in northern Sweden of the Royal Swedish Academy of Sciences*. It is in no small measure due to the positive support by Professor SIEVERT, Chairman of the Board, that the *Kiruna* Ionospheric Observatory was created so rapidly. Regular operation at the new observatory was begun on Oct. 1, 1948, and has continued practically without interruption from that date.

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The new observatory is easily accessible by electric railroads as shown in fig. 1 and is situated at the south-eastern edge of the zone of maximum auroral intensity. The *Kiruna* observations therefore must serve as very valuable complements to those made at *Tromsø*. The geomagnetic co-latitude of the *Kiruna* observatory is about 24°21' with a magnetic dip of 77°03' and a total magnetic force at ground level of 0.515 CGS.

The international chain of ionospheric observatories is steadily being increased as shown in fig. 2 which depicts the location of all ionospheric observatories known to us to carry out regular or irregular observations. In the auroral zone the *Fairbanks*, *Churchill*, *Tromsø* and *Kiruna* observatories probably will play an important rôle. Of these observatories only the *Kiruna* observatory is equipped with high power panoramic recording equipment (as far as is known to us at the time

¹ The development of such an instrument was discussed already in 1939 by WM. O. REED and O. E. H. RYDBECK, both at that time working at HARVARD UNIVERSITY'S CRUFT LABORATORY.

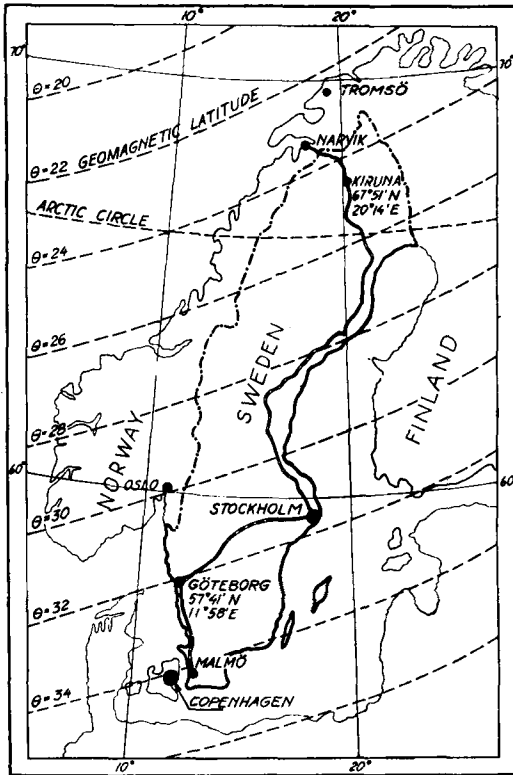


Fig. 1. The location of the Ionospheric and Radio Wave Propagation Observatory at Kiruna.
(θ = approximate geomagnetic co-latitude.)

of writing) but it is believed that the Churchill observatory soon will get equipment of that type.

A few words should be said in this connexion about the research activity and observational programme of the Kiruna observatory. As far as regular observations are concerned the results of these will be distributed monthly to interested observatories all over the world. The material is prepared in the standard fashion used by the *Central Radio Propagation Laboratory, Washington, D. C.* This material will also appear regularly in the *Reports of the Research Laboratory of Electronics, Chalmers University of Technology, Gothenburg*, where they can be obtained upon request either from the Laboratory or from the Chief Librarian of the University.

The ionospheric research at present concerns such important and for the practical radio communication vital questions as the correlation between sporadic E-ionization, Polar Black Out and Magnetic Bays. Further, if possible, the statistical

correlation between these phenomena and low-latitude fade-out effects caused by solar ultra violet light. Auroral radio echo forms and the connections between them and the lower ionosphere auroral current system are studied regularly. Special attention is being paid to abnormal low height reflections, sporadic echoes already having been recorded at such low heights as 70 km (special report in progress of publication). From a radio wave propagation point of view there is especially to mention the recording and study of geomagnetic triple splitting of the waves reflected from the northern ionosphere. The irregular and sometimes rapid motions of the upper ionosphere, the F₂-region, is a further object of repeated study. Very interesting motion pictures of such motions have already been demonstrated by members of the Staff of the *Research Laboratory of Electronics*¹.

Temporary magnetic recordings are carried out at the Kiruna ionospheric observatory as an aid to the local observer but it is hoped that the Royal Hydrographic Office soon will establish high-quality permanent recordings in the neighbourhood.

The observatory is further equipped with an auroral spectrograph, to which a photo-electric attachment will later be added. In order to study the long distance scatter of radio waves from the auroral arcs and draperies a fixed frequency recording equipment with about 500 kW pulse sending power will be installed this winter. This equipment is of the same type as that used for the recording of meteor trails at the Askim observatory and will be described in a forthcoming publication from the Research Laboratory of Electronics. The description of the panoramic equipment will appear very shortly.

It is further planned to open crystal controlled long base recordings between Kiruna and the mother-observatory in Gothenburg but these plans are not likely to be realized this year.

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Fig. 3 shows the general lay-out of the two main buildings of the observatory. The interested reader will note that the observatory has a guest room. Visiting scientists are always welcome as guests for shorter or longer periods.

Fig. 4 depicts a corner of the recording room showing the 6 kW panoramic recorder which sweeps from 1 to 20 Mc/s in 30 seconds or less.

¹ Nature, Vol. 164, Sep. 24, p. 512, 1949.

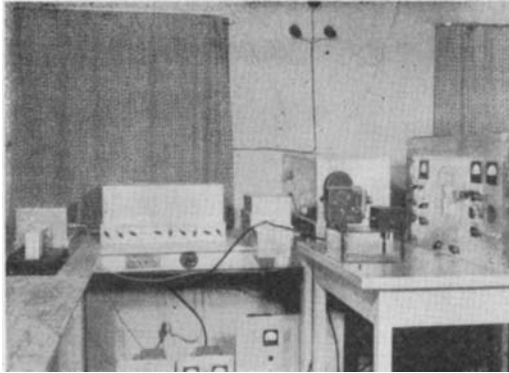


Fig. 4. A corner of the recording room showing the 20 kW panoramic recorder with 16 mm automatic film camera.



Fig. 5. General view of the main observatory buildings.

To the right automatic recording 16 mm film camera in front of 12GP7 scope tube.

Fig. 5 is a general view of the main buildings with the central mast carrying the aperiodic antennas for vertical broad band radiation. Fig. 6 finally is a picture of the observatory with the surrounding forests and mountain ranges which



Fig. 6. The observatory is surrounded by forests and long mountain ranges.

certainly must attract the attention of every nature loving scientist.

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We hope that this new observatory will be a valuable link in the international chain of ionospheric observatories and we hope that it will contribute both to our knowledge of the regular ionospheric phenomena and of the complicated and fascinating relations between solar, geomagnetic, auroral and ionospheric phenomena.

Our thanks are especially due to the *National Research Councils for the Technical and Natural Sciences* which have generously facilitated the development of the observatory equipment and the erection of the observatory itself. Our thanks are further due, and are cordially extended, to Professor ROLF M. SIEVERT for his encouraging support and to the *Wallenberg Foundation* for general support of our research activity.

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New publications

Glaciers and Climate

Among those scientists who in recent years have been particularly concerned with the progress of the glaciological science, Professor Hans W:son Ahlmann of the University of Stockholm has been one of the leaders and pioneers. On the fourteenth of November 1949 Ahlmann entered his sixty-

first year. At this anniversary his colleagues in different countries, his many friends and grateful pupils have wished to honour him and their homage has taken the form of a beautiful volume including geophysical and geomorphological articles dealing primarily with glaciers and their relation to climate, by thirtyfour scientists representing different parts of