Dual-beam observations at 1417 MHz of the region of the North Polar Spur

Davis, M.M.; Katgert-Merkelijn, J.K.

I.A.U. Symposium no. 31, 1967

58. DUAL-BEAM OBSERVATIONS AT 1417 MHz OF THE REGION OF THE NORTH POLAR SPUR

M. M. DAVIS* and JEANNETTE K. MERKELIJN**

(*Sterrewacht, Leiden, Nederland*)

ABSTRACT

This is a preliminary report of a survey carried out with a dual-feed system, which measures the intensity *gradient* along a path in the sky swept by the motion of the telescope. The accuracy reached is 0·04 °K of antenna temperature per 2° beam separation.

Using the Jodrell Bank telescope at 240 MHz, Large *et al.* (1966) have found several sharp features in the North Polar Spur. Recent observations with the Dwingeloo telescope at 1417 MHz, in an area extending from 10^h20^m to 18^h20^m in right ascension and from 0° to + 20° in declination, have confirmed and extended these findings.

We measure the intensity gradient along a path defined by the sweep motion of the telescope, by using a dual-feed system with a synchronous detector. Features much wider than the beam separation of 2° are effectively suppressed, whereas ridges having a width of the same order as the beam separation stand out clearly.

The observations are distinctly more difficult to interpret than measurements of total intensity, since the measured gradient depends on the sweep path of the telescope. In particular, structure running parallel to the sweep path will be missed. On the other hand, for the ridges which can be seen, the peak can be located accurately from the positions of zero gradient, and some information on possible asymmetry of the ridge cross-section can be obtained from a comparison of the positive and negative gradients.

The use of the dual-beam method together with sweeping in azimuth has led to an accuracy considerably better than 0·1 °K of antenna temperature difference per beam separation (0·2 °K of brightness temperature).

Figure 1 shows a sample of our results. The North Polar Spur can be followed quite easily from the galactic plane through its peak latitude of + 75° down to $b = +62°$, where it runs off the map at $\alpha = 12^h20^m$, $\delta = 0°$. There appears to be a link between the two ridges found in this region by Large *et al.* (1966).

We find that we generally can follow the other ridges in the region of the Spur over a larger distance than was possible in the Jodrell Bank observations. The reality of these ridges is fairly certain, as the zero-gradient points, which were determined without reference to neighbouring scans, form virtually continuous features on the contour map.

The observations, which were obtained during a survey for discrete extragalactic sources, give a root-mean-square gradient of 0·043 °K of antenna temperature per 2° beam separation in regions far from the North Polar Spur and from the galactic plane.

*Present address: National Radio Astronomy Observatory, Green Bank, West Virginia, U.S.A.

**Present address: Division of Radiophysics, C.S.I.R.O., Sydney, Australia.

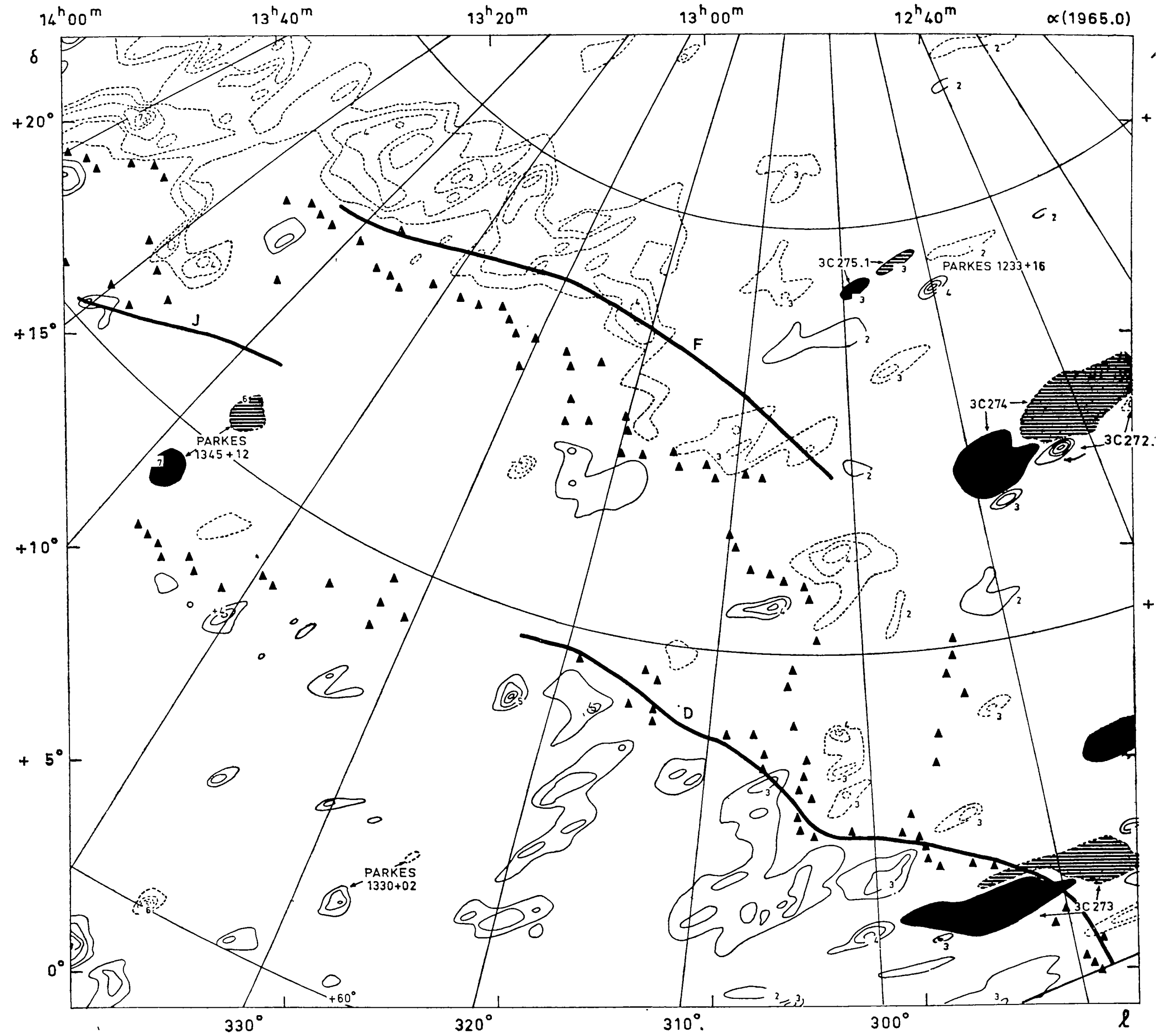

FIG. 1. Contour diagram of the high-latitude part of the North Polar Spur. The frequency of observation is 1417 MHz, the beam-width 0°.6. The scan direction is from upper right to lower left, and the spacing between two adjoining scans is $2^{m}.5$ in right ascension. The dashed contours correspond to a positive gradient in the scan direction, the solid contours to a negative gradient. One contour interval equals 0·058 °K of antenna temperature difference per 2° beam separation; the contours −1, 0 and +1 are not included as they were strongly affected by noise. For all strong features (steep gradients) the inner contours are omitted: the area of the feature is hatched for positive gradients and filled in for negative gradients. The peak values of the gradients are marked, except for those sources that were off-scale on the records. The known discrete sources are identified with a source number from either the 3CR or the Parkes catalogue. Points where the intensity gradient changes from a positive to a negative value, corresponding to ridge peaks, are indicated by triangles. For comparison the ridges in this area listed by Large *et al.* (1966) are indicated by heavy lines.

This residual gradient is a factor of three larger than can be explained by confusion due to weak extragalactic sources; it is probably galactic in origin.

A more complete report of this investigation is in press (1967).

This work was supported by the Netherlands Organization for Pure Scientific Research (Z.W.O.) and by the National Science Foundation in the U.S.A.

REFERENCES

Large, M. I., Quigley, M. J. S., Haslam, C. G. T. 1966, *Mon. Not. R. astr. Soc.*, **131**, 335.

Merkelijn, J. K., Davis, M. M. 1967, *Bull. astr. Inst. Netherl.*, **19**, no. 4, in press.