PAPER 23

OBSERVATIONS OF DISCRETE SOURCES WITH THE 22 MC./S. MILLS CROSS

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The 22·2 Mc./s. crossed array of the Carnegie Institution of Washington has been in use since 20 July 1954. This antenna system consists of two linear arrays 2047 ft. in length, each composed of sixty-six half-wave folded dipoles. The amplitude gains of the two arrays are, in effect, multiplied together by a phase-switching system similar to that used in phase-switching interferometers (Ryle, 1952) [1]. The design differs somewhat from the arrangement first used by Mills (Mills and Little, 1953) [2] in that the arrays are arranged in the form of a slightly flattened X. The resulting pencil beam is slightly elliptical in cross-section, measuring 1°.6 by 2°.4 at half-power points, and is directed by inserting lengths of line into the feeder system of each array, phasing the dipoles such that the maximum response is at the desired zenith angle.

Initial efforts were directed at improving the side-lobe response of the arrays, which causes particular difficulty in this system, since amplitude gains, not power gains, are involved. A conventional Tchebyscheff illumination was used which reduced all side responses to 30 db. below the main beam, a level which has proved tolerable. Of course, whenever a source passes through one of the fan-beams of either array, but not through the main beam, the actual rejection is only 15 db., and hence a strong source can cause confusion in certain positions. Since total power received is also recorded, it is easy to tell when a strong source is passing through one of the fan-beams, and consequently these troublesome side-lobe effects can be identified. In practice, only the Cygnus and Cassiopeia sources have caused difficulty, all other sources being too weak to cause a noticeable response.

A number of the principal radio sources have been observed for purposes of testing the instrument. We have preferred to assign relative intensities only, since these can be measured more accurately. Some corrections are needed, even for relative measurements, because the gains of the arrays are not the same for all phasings, while the polar diagrams of the individual elements are affected by the finite ground conductivity. An error of ± 10 % can probably be safely assigned to the results, except for the weakest sources, where the uncertainty is greater.

Table 1. *Relative source intensities at 22·2 Mc./s.*

Source	NGC4486	M1	IC443	NGC1275	Cyg A	Cas A
I.A.U. no.	12N1A	05N2A	06N2A	03N4A	19N4A	23N5A
Relative intensity	1·00	0·75	0·16	0·31	5·7	14·5

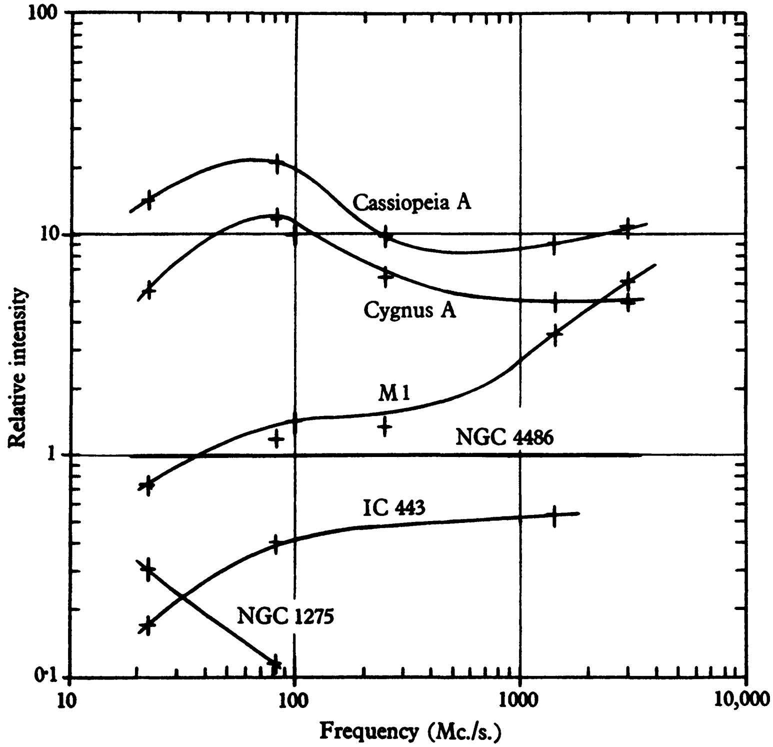

Fig. 1. Source intensities at various frequencies relative to NGC4486.

The intensities of six sources are given in Table 1, where the Virgo source, NGC4486, is taken as unity. These results are compared with observations at other frequencies in Fig. 1, where the relative intensities were computed from the values listed in the recent I.A.U. catalogue of reliably known discrete radio sources (Pawsey, 1955) [3].

It is interesting to note that no two sources have identical spectra, although the Cygnus and Cassiopeia sources are similar in qualitative behaviour. The intensity derived from the Perseus source, NGC1275, includes the integrated intensity received from the associated cluster of galaxies. While this contribution at higher frequencies represents only 25% of the total intensity (Baldwin and Elsmore, 1954) [4], the percentage may be higher at 22·2 Mc./s. Even with as much as half the intensity due to the cluster, however, this source appears to be increasing in intensity with increasing wave-length even more rapidly than the Virgo source. The other sources plotted in Fig. 1 all seem to be decreasing, relative to the Virgo source, as frequency decreases.

REFERENCES

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