New Cosmological Data and the Values of the Fundamental Parameters
IAU Symposium, Vol. 201, 2005
Anthony Lasenby and Althea Wilkinson, eds.

Surveying the foreground sources for the Very Small Array, with the Ryle Telescope at 15 GHz

E. M. Waldram & G. G. Pooley

Astrophysics Group, Cavendish Laboratory, Madingley Road, Cambridge, CB3 0HE, UK

Abstract. The three fields chosen for the first observations with the Very Small Array (VSA), a total area of $\sim$ 200 deg^2, are being surveyed with the Ryle Telescope at 15 GHz. This is the only wide-field survey at a comparable radio frequency; its purpose is to investigate the source population and to define a catalogue of the foreground sources which must be monitored by the VSA during its observations. We present preliminary source counts.

1. Introduction

When making observations of the cosmic microwave background with the VSA (Scott, these proceedings), it is essential to take account of the foreground of discrete radio sources. In order that the confusion noise from the sources should be significantly lower than the flux sensitivity of the VSA, all those with $S > 80$ mJy at 30 GHz must be monitored during the observations, and their responses subtracted from the VSA data (Taylor, these proceedings). There is no existing catalogue at an appropriate frequency for identifying these sources and so we are using the Ryle Telescope at 15 GHz to scan the VSA fields. Our aim is to reach a completeness limit of 20 mJy at 15 GHz, to allow for the most extreme spectral index. Since the FWHM of the Ryle primary beam is only 6 arcmin, as compared with 4.°5 for the VSA, a new rastering technique has been devised to cover a sufficient area.

2. Observations and Analysis

The regions scanned are centred at RA 00^h20^m Dec $+30°$, RA 09^h35^m Dec $+30°55'$ and RA 15^h38^m Dec $+45°$ (all B1950.0), and each extends to a radius $\sim 4.°5$, corresponding to the first null of the VSA primary beam. In general, we use five aerials of the Ryle Telescope, spaced to give a resolution of $\sim$ 25 arcsec, and observe an area of $\sim$ 1 deg^2 in 12 hours. In that time, by using a raster scan, the pointing is moved to a hexagonal array of 240 different centres, with a separation of 5 arcmin. There is a return to each pointing 4 or 5 times per run and phase calibrators are observed periodically.

After the removal of noisy data samples, 240 small maps are made corresponding to the 240 pointing centres, each having a different – and very sparse – aperture coverage. These maps are then added, with weighting appropriate to the primary beam values at each map point, to form a single large map

($\sim$ 1 deg^2) with approximately uniform sensitivity. (In general, we do not apply CLEAN, unless there are any particularly bright sources, in which case the small component maps can be cleaned before combining them.) The noise level on the added map is usually 3 - 4 mJy and, where it is $>$ 4 mJy, a repeat observation is scheduled. We search the map for interpolated peak values $> 5\sigma$ and record them as possible sources.

The rasters simply provide a means of detecting likely source candidates; these are then followed up with pointed observations of $\sim$ 10 - 15 minutes to establish reliable flux densities – with an accuracy of $\sim$ 5 % – and to eliminate any false detections.

3. Preliminary Results

Our preliminary 15 GHz integrated source counts, derived in collaboration with Angela Taylor, are shown in Figure 1; at present, they are not complete below $\sim$ 25 mJy. For comparison, the dotted line indicates approximately the Green Bank 5 GHz counts, calculated from Gregory & Condon 1991. It is clear from our current catalogues that the 15 GHz flux densities of individual sources cannot be predicted reliably by extrapolation of their spectra based on lower frequency surveys. A number of sources have unexpected spectra and may be highly variable. (See Taylor, these proceedings, for further discussion.)

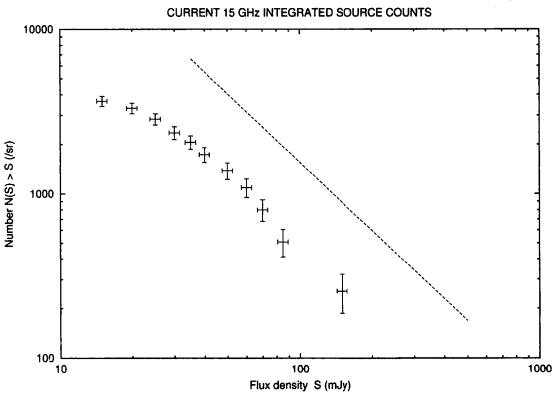

Figure 1. Preliminary integrated 15 GHz source counts (not complete below $\sim$ 25 mJy). The dotted line shows approximately the Green Bank 5 GHz counts.

References

Gregory, P. C. & Condon, J. J. 1991, ApJS, 75, 1011
Scott, P. F., these proceedings
Taylor, A. C., these proceedings

https://doi.org/10.1017/S0074180900216975 Published online by Cambridge University Press