A SYNTHESIS STUDY OF THE RADIO SKY AT DECAMETRE WAVELENGTHS

By

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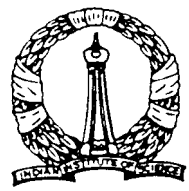

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DECLARATION

I hereby declare that the work presented in this thesis is entirely original, and has been carried out by me at the Raman Research Institute under the auspices of the Department of Physics, Indian Institute of Science. I further declare that this has not formed the basis for the award of any degree, diploma, membership, associateship or similar title of any University or Institution.

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CONTENTS

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SYNOPSIS

This thesis describes an all-sky survey made at 34.5 MHz using the low frequency telescope situated at Gauribidanur, near Bangalore (latitude $13^{\circ}36'12''$ N).

The antenna system is made up of 1000 dipoles arranged in the shape of the letter T with a 1.4 km long East-West arm and 0.45 km long Southern arm. It has a collecting area of ≈ 18000 m^2.

A 128 channel digital receiver system which was designed and built for the purpose of making an all-sky survey was used for the observations. Low frequency observations are rendered difficult due to the problems connected with the maintenance of large arrays, compounded by terrestrial interference, ionosphere and solar activity. In order to minimise these problems the telescope was used in the transit mode and by doing l-D synthesis along North-South, the entire sky has been mapped in one day's time. This survey covers the Declination ranges of -38° to $+64^{\circ}$ and the complete 24 hours of Right Ascension. The synthesized beam has a resolution of $21'$ along the Right Ascension and $33' \times \mathrm{Sec}(\delta - 14^{\circ}.1)$ along the Declination, δ. The sensitivity of the survey is 4 Jy (1σ). Special care has been taken to ensure that the antenna responds to all angular scale structures and is suitable for studies of both point sources and extended objects,

The problems in deconvolving the large angular scale maps which also contain the background emission are discussed in detail. A modified method of the conventional CLEAN has been adopted to deconvolve the dirty maps which contain both the point

sources and the background. This method leaves the extended emission unaltered.

The results of the survey are presented in the form of contour maps. The representation that has been chosen makes it easy to compare with the already available all-sky survey at 408 MHz. A smoothed (to 2°) map of the observed sky at 34.5 MHz is also presented, several large scale features in it are identified and their spectra between 34.5 MHz and 408 MHz have been estimated. Some new features previously unobserved at low frequencies have also been identified.

A comparative study of a few sources observed previously by the same telescope, but in the single beam mode, has been made. Problems with the earlier single beam observations are pointed out.

The main astrophysical discussion in the thesis centers around the discrete absorptions seen at 34.5 MHz. The nature of the gas causing these absorptions is discussed at some length. It is argued that this gas is nearby and can explain most of the galactic ridge recombination lines observed in the H166α and H272α lines. This has thrown some light on the long-standing puzzle about the gas producing the galactic ridge recombination lines. The low frequency survey has picked up the near-by diffuse gas seen in Hα but which is not seen in the high frequency continuum surveys.