I. INTRODUCTION

Radio continuum emission is received from relativistic cosmic ray electrons radiating in the interstellar magnetic field. At high frequencies thermal emission is an additional component. Multifrequency observations are needed to separate the different thermal and non-thermal components in the line of sight. Studies of the galactic continuum radiation need two types of observations. Considering our unfavourable position inside the Galaxy absolutely calibrated all-sky surveys are needed to study the general structure of our Galaxy. The strong concentration of objects in the disk, however, requires high resolution observations of the Galactic plane to separate the different components.

II. ALL-SKY SURVEYS

As shown in Table 1 the 408 MHz survey is so far the all-sky survey with the highest angular resolution and sensitivity. Beside the concentration of strong emission in the Galactic centre region and along the plane arising from the disk and spiral arm complexes, various large loops, spurs, supernova remnants and HII regions are visible outside the plane region. A physical interpretation of all these features needs spectral index information. These will be provided by combination with a survey at 1420 MHz (see Table 1) which matches the 408 MHz survey.
in angular resolution and sensitivity, considering even steep nonthermal features with $\beta$ up to 3 ($T_B \sim \nu^{-\beta}$). The sensitivity for thermal emission at 1420 MHz is higher, of course. First results from spectral studies of the northern sky may be summarized as follows:

(a) the general spectral index outside of known local features is near $\beta = 2.7$,
(b) the radio loops I and III and some spurs have steeper spectral indices ($\beta \sim 3$) than their surroundings.
(c) an intensive local feature located in the Cassiopeia-Perseus region ($\ell \sim 115^\circ$ to $\sim 165^\circ$) shows a spectral break above 820 MHz which may be connected to the break of the local electron spectrum near 10 GeV (Kallas et al., 1983),
(d) there is a clear tendency of a flattening of the spectral index towards cold regions in high galactic latitudes (Kupczak 1983).

<table>
<thead>
<tr>
<th>Telescope</th>
<th>Frequency [MHz]</th>
<th>HPBW [°]</th>
<th>$\Delta T_B$ [K]</th>
<th>Coverage</th>
<th>Reference/Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parkes 64 m,</td>
<td>150</td>
<td>≥2.2</td>
<td>25</td>
<td>all sky</td>
<td>Landecker and Wielebinski, 1970</td>
</tr>
<tr>
<td>Cambridge Array</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effelsberg 100 m,</td>
<td>408</td>
<td>0.85</td>
<td>2</td>
<td>all sky</td>
<td>Haslam, Salter, Stoffel and Wilson, 1982</td>
</tr>
<tr>
<td>Jodrell Bank 76 m,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parkes 64 m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dwingeloo 25 m</td>
<td>820</td>
<td>1.2</td>
<td>0.5</td>
<td>northern sky, $\delta \geq -8^\circ$</td>
<td>Berkhuijsen, 1972</td>
</tr>
<tr>
<td>Stockert 25 m</td>
<td>1420</td>
<td>0.6</td>
<td>0.05</td>
<td>$\delta \geq +20^\circ$, $\delta \geq -19^\circ$</td>
<td>Reich, 1982. reduction stage</td>
</tr>
<tr>
<td>Argentina 30 m</td>
<td>1440</td>
<td>0.5</td>
<td>0.05</td>
<td>$\delta \geq -90^\circ$</td>
<td>observations started</td>
</tr>
</tbody>
</table>

If the latter finding is interpreted as typical for the galactic halo emission, it would be different to observations of nearby galaxies which show steeper spectral indices in the halo than in the disk. The contribution of steep spectrum loops and spurs to the halo emission, however, is unclear up to now.

It seems unlikely today that higher frequency all-sky surveys will be carried out which match the 408 MHz and 1420 MHz surveys in sensitivity and angular resolution. The observing time for such a project will take several years even with the best equipment available. Present observations at high frequencies are restricted to the regions of stronger emission along the Galactic plane and some selected regions outside.

III. RECENT SURVEYS OF THE GALACTIC PLANE

The strong emission along the Galactic plane has been mapped since the early days of radio astronomy. Comparison of the many different maps published so far demonstrates the progress in antenna design, receiver sensitivity and reduction software. The Effelsberg 100-m telescope has been used at 4875 MHz by Altenhoff et al. (1978) to map the Galactic plane between $357^\circ \leq \ell \leq 60^\circ$, $|\ell| \leq 1^\circ$ with a high resolution of 216. At present the Nobeyama 45-m telescope is used at 10.2 GHz to map a similar area with the same resolution (Sofue et al., 1983). Both surveys outline thermal emission complexes and compact HII regions quite well. Supernova remnants (SNRs) however can be better identified at longer wavelengths. A fast survey at 21 cm wavelength with the Effelsberg 100-m telescope of the area $93^\circ \leq \ell \leq 162^\circ$, $|\ell| \leq 4^\circ$ (Kallas and
Reich 1980) shows up several new SNRs with apparent diameters of ⋍ 1° (e.g., Reich et al., 1979; Reich and Braunsfurth 1981). At present observations at 2695 MHz are carried out which at least will cover the Galactic plane visible from Effelsberg in the range |b| ⋍ 5°. The angular resolution is about 4'3, the sensitivity is ⋍ 40 mK T_B, and linearly polarized emission is observed simultaneously. A first section (358° ⋍ l ⋍ 76°, b = 175) is completed and will be published in the near future (Reich et al., in preparation). Two new plerion-type SNRs (Reich et al. 1984) and two shell-type objects seen in projection to the Galactic centre region (Reich and Furst 1984) have been confirmed so far by additional high frequency observations.

The Effelsberg data will be combined with current 2.7 GHz observations at the Stockert 25-m telescope, where the Galactic plane is observed in a range |b| ⋍ 20° with a resolution of 19' (Reif et al., 1984). The method of observation is the Nodding-Scan technique (Haslam et al., 1974), which allows quite accurate corrections for atmospheric and ground radiation effects, so that the large-scale structure can be mapped with high reliability. Comparison with the existing surveys at longer wavelengths will outline spectral index variations more pronounced due to the large frequency interval. A determination of the thermal-to-nonthermal emission ratio can hopefully be done with greater accuracy than before.

REFERENCES


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