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# Preliminary results from Toruń polarization survey of our Galaxy

Stanisław Ryś[1], K. T. Chyży[1], A. Kus[2], E. Pazderski[2],
M. Soida[1], and M. Urbanik[1]

[1]Astronomical Observatory, Jagiellonian University, ul. Orla 171, 30-244 Kraków, Poland
[2]Toruń Centre for Astronomy, Nicholas Copernicus University, Torun, Poland

**Abstract**

We present first results of a radio continuum and polarization survey of the Milky Way at 4.7 GHz carried out with the 32-m radio telescope in Toruń. The survey is less affected by depolarization effects than previous ones at lower frequencies and enables the study of magnetic field structure and its interrelations with the interstellar medium. The first preliminary maps from this survey are presented together with some details of the polarimetric facility.

## 1 Introduction

We are performing 4.7 GHz polarimetric measurements of our Galaxy using a new polarimetric facility at the Toruń 32-m radio telescope. The survey is planned to cover selected fields of the Galaxy plane up to $\pm 10°$. A comparison with similar data obtained with the Effelsberg telescope at 1.4 GHz with similar angular resolution (Uyaniker et al. 1999, Duncan et al. 1999) is planned. This will enable us to estimate Faraday rotation measures and depolarization effects.

With these data we will study the small scale magnetic field structure and we will be able to reconstruct the structure of the magnetic field in the vicinity of the Solar system - in particular in the local spiral arm. The data will make it possible the separation of thermal and nonthermal Galactic radio emission and spectral index study. A comparison of radio with optical and X-ray data is also planned to associate particular magnetic field structures with features in the interstellar medium.

## 2 Receiving system

The Toruń 32-m radio telescope used for the polarimetric program is equipped with 4.7 GHz receiver which was additionally furnished with switching devices. Its backend is connected to a polarimeter provided by MPIfR in Bonn. Some details of the receiving system are presented in Figs 1, 2 and in Table 1 .

The polarimetric facility was tested by observing the polarized calibrator 3C286 at various paralactic angles. The uncertainties introduced by the instrumental polarization were estimated to be less than 10%.

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More details about Toruń radiotelescope can be found at the web page http://www.astro.uni.torun.pl/

Table 1: Parameters of the receiving system

| | |
|---|---|
| Frequency center: | 4.7 GHz |
| Bandwidth: | 500 MHz |
| Integration time/point | 1 s |
| System temperature: | 22 K |
| Typical RMS noise: | 6 mJy/ba |
| Tb/S | 0.2 K/Jy |
| HPBW | 7.'2 |

## 3 First results

By this work we scaned the Galaxy equator near the longitude $50°$ with the scan length of $\sim 12°$ and scans spaced with $2'$. The scans are made along R.A. For amplitude and polarization calibration we use 3C286 as the primary calibrator and 3C138 and 3C48 as the secondary standards.

Two coverages of the first field were obtained during 11 nights in August 2004. The data were combined into the preliminary map of total intensity and polarized intensity presented in Figure 3. The distribution of the total power emission is in good agrement with published map of the same region at 1.4GHz (Reich et al. 1990). The polarized intensity distribution suggests that large scale and relatively strong magnetic structures are seen far above the Galactic plane. These structures will be further analyzed by comparing with radio maps made at other frequencies and by determining the Faraday rotation measures. However, the polarized emission mainly corresponds to regions of strong total intensity close to the Galaxy plane and frequently reveals small-scale structures probably connected with particular star-forming regions and SNRS.

Some disturbances seen in Figure 3 are due to imperfect weather conditions causing some scanning effects. We are going to make orthogonal scans of the field (along R.A. and Dec.) and use *basket weaving* method to remove the scanning noise.

## Acknowledgment

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## References

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Reich W., Reich P., Fürst E., 1990,A&AS 83, 539

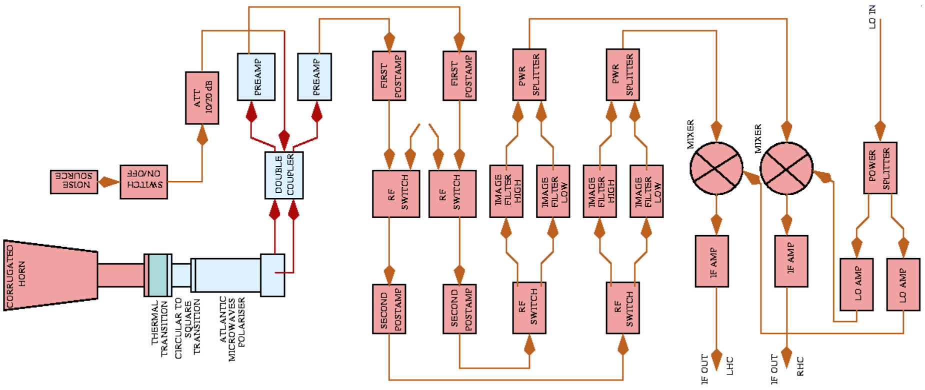


Figure 1: A block diagram of the 4.7 GHz receiver system.

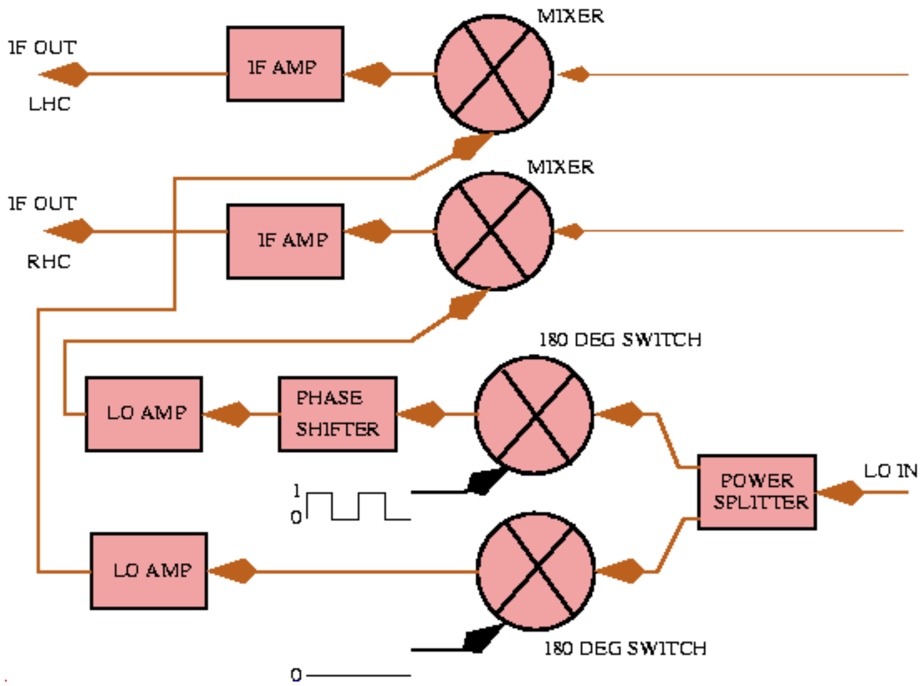


Figure 2: Modifications made to the Local Oscillator circuit

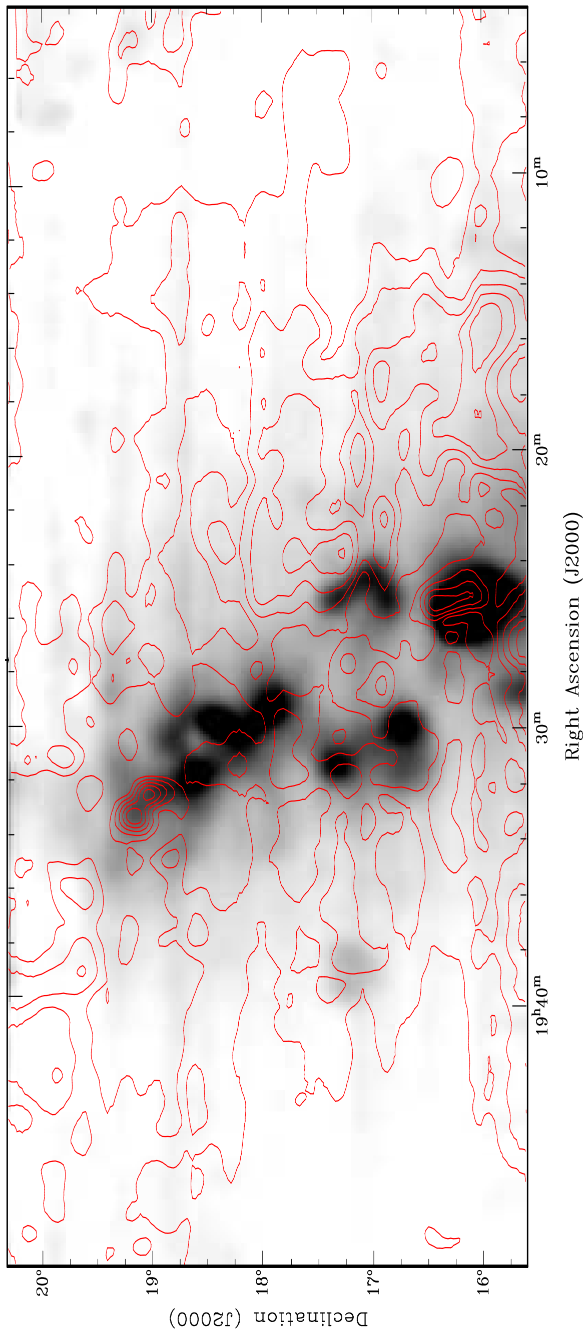


Figure 3: The grey scale map of the total intensity with overlayed contours of the polarized intensity in the Galaxy plane at a frequency of 4.7 GHz. The field was centered at R.A.: $19^{\mathrm{h}}20^{\mathrm{m}}$; Dec: $18°$(l=55°, b=0°).