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VLA Observations of the Galactic Centre at 74 MHz

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Abstract. We present a preliminary image of the Galactic Centre region at 74 MHz made using the Very Large Array (VLA)[3]

1. Introduction

Low-frequency observations of the Galactic Centre region are useful for studying the spectral characteristics as well as the geometry along the line-of-sight of the many unique radio feaures that are present in the central region (Pedlar et al 1989, Anantharamaiah et al 1991, La Rosa et al 2000). We are in the process of making a multi-configuration wide-field image of the Galactic Centre region at 74 MHz using the VLA.

2. Observations and Preliminary Results

The Galactic Centre region was observed simultaneously at 74 MHz and 327 MHz using all the four (A, B, C & D) configurations of the VLA. Data was taken in 64 frequency channels covering bandwidths of 1.5 MHz at 74 MHz and 3.12 MHz at 327 MHz. We present a preliminary image at 74 MHz made using only the B-array (maximum baseline $\sim$ 10 km) data. The angular resolution is $\sim 2.7' \times 1.4'$. After an initial calibration using a short observation of Cyg A, phase variation on a time scale of ~ 10 s was determined by self-calibration of the 327 MHz data which was taken coevally. These phase variations were scaled by the ratio of the wavelengths and applied to the 74 MHz data.

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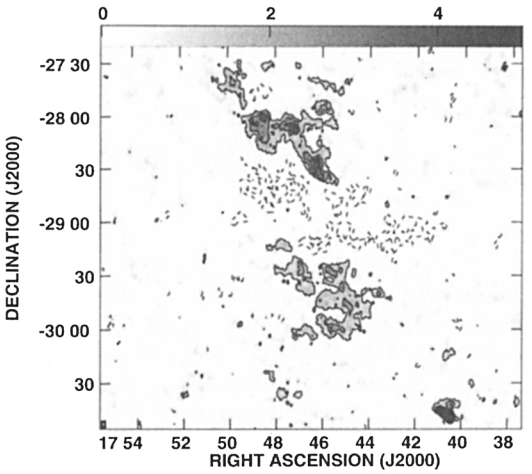

Figure 1. The Galactic centre Region at 74 MHz with a beam of 2.7'×1.4'. Contours are from -3 to -1 and 1 to 5 Jy/beam in steps of 1 Jy/beam. The grey scales is from 0 to 5 Jy/beam.

Fig 1 shows a $\sim 3^\circ$ region around the Galactic centre at 74 MHz. The central $\sim 45'$ region around the Sgr A complex, which includes the Radio Arc, the Arched filaments, Sgr C and various other radio features which are observed at higher frequencies (e.g. Anantharamaiah et al 1991) are completely absent at 74 MHz. The main cause for the disappearence of these radio features is free-free absorption by ionized gas which is present both near the galactic center and along the line of sight. As shown by Pedlar et al (1989), ionized gas with an optical depth of $\tau_{327MHz} \sim 1$ is present over at least a $10'$ region covering the Sgr A complex. This ionized gas will have an optical depth of $\tau_{74MHz} \sim 16$, and thus attenuate the signal by a $e^{-16} \sim 10^7$.

Absorption of the region containing the Radio Arc and Sgr C require $\tau_{74MHz} \sim 2$ which implies an EM $\sim 10^4$ pc cm^{-6}. Low denisty ionized gas along the line of sight, with about the above EM, is known to be present over $\sim 1^\circ$ region from observations of low-frequency recombination lines (e.g. Roshi and Anantharamaiah 1996). The features that can be identified in the 74 MHz image are mainly supernova remnants which are not free-free absorbed.

References

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