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A Radio-Continuum Study of the Magellanic Clouds

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Abstract. We review all radio-continuum surveys of the Magellanic Clouds (MCs) and also present latest results from our new mosaic surveys.

1. Introduction

Radio-continuum investigations of the MCs started with the detection by Mills & Little (1953). Since that time, numerous radio surveys have been undertaken. The low-resolution observations helped to determine the large-scale structure and the total radio spectrum of the MCs (Haynes et al. 1991) whereas high-resolution studies concentrated on discrete sources in the Clouds.

2. Past Radio-Continuum Surveys

The first high-frequency radio-continuum detection of discrete sources in the MCs was made by Mathewson & Healey (1964). During the 1970s, McGee et al. (1972; 1976) made detailed observations of the MCs at various frequencies with the Parkes radio telescope and established catalogues of discrete radio sources. These observations became part of the PKSCAT-90 catalogue. Clarke et al. (1976) observed the MCs with the Molonglo radio telescope at 408 MHz and produced the MC4 catalogue of 227 sources towards the LMC and 75 towards the SMC. Milne et al. (1980) observed a number of interesting LMC sources at 14.7 GHz to estimate their radio spectral index. Mills et al. (1984) and Ye (1988) observed the MCs at 843 MHz with the Molonglo Synthesis Telescope (MOST). Following the first radio classification of sources in the MCs based on studies of the spectral index (McGee & Newton 1972), Milne et al. (1980) and Loiseau et al. (1987) provided the first detailed analysis of the spectra of some 40 LMC and 28 SMC sources, most of which were SNRs.

3. New Parkes Radio Surveys

In 1986, an international collaboration was launched using the Parkes 64-m telescope to survey the MCs at several radio frequencies with moderate angular resolution using a full polarization system. This project has produced several publications reporting the surveys (Haynes et al. 1991), the FIR/radio correlation (Xu et al. 1992), magnetic fields in the MCs (Klein et al. 1993), radio source catalogues at six frequencies (Filipović et al. 1995, 1997), the radio/X-ray discrete source correlation (Filipović et al. 1998a), the radio spectral index catalogue of sources in the MCs (Filipović et al. 1998b) and the radio/IR discrete source correlation (Filipović et al. 1998c). A total of 483 sources towards the LMC and 224 towards the SMC have been detected. Most of the MC's sources have been classified in one of three groups: SNRs, H II regions or background sources. In total, 209 discrete radio sources in the LMC and the 37 sources in the SMC are classified to be intrinsic.

4. The ATCA Observations of the MCs

The Australia Telescope Compact Array (ATCA) mosaic observations of the SMC were taken in October 1992. The baseline of 375 m was used at frequencies of 1.4 and 2.3 GHz with corresponding angular resolutions of $\sim 90''$ and $45''$. The total of 320 pointings covered area of $\sim$20 square degrees (Staveley-Smith et al. 1997). The LMC mosaic observations are underway and more details can be found in Kim et al. (1998). The SMC image at 2.3 GHz is available and "corrected" for missing short-spacing by adding Parkes survey data from corresponding frequency. Over seven hundred sources were found in this survey. As a continuation of Parkes radio-continuum investigations and as an addition to the ATCA mosaic surveys, we observed most of intrinsic sources using ATCA at λ=6 and 3 cm with the 375 m configuration. These observations together with the ATCA mosaic surveys of both Clouds at 20/13 cm and the MOST survey at 843 MHz will give us wide frequency coverage of these objects with sufficient resolution to resolve them. The aim was to image a large number of H II regions and SNR in the snapshot mode. Using this method we observed, so far, all SNRs and SNR candidates in both Clouds ($\sim$80). A general SNR-like morphology was clearly detected in all observed SNR objects.

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