

Radio-continuum study of the nearby Sculptor group Galaxies. Part 2: NGC 55 at $\lambda = 20, 13, 6$ and 3 cm

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Abstract A series of new radio-continuum ($\lambda = 20, 13, 6$ and 3 cm) mosaic images focused on the NGC 55 galactic system were produced using archived observational data from the Australia Telescope Compact Array. These new images are both very sensitive (down to rms = 33 μ Jy) and feature high angular resolution (down to $<4''$). Using these newly created images, 66 previously unidentified discrete sources are identified. Of these sources, 46 were classified as background sources, 11 as H II regions and 6 as supernova remnant candidates. This relatively low number of SNR candidates detected coupled with the low number of large H II regions is consistent with the estimated low star formation rate of the galaxy at $0.06 M_{\odot} \text{ year}^{-1}$. Our spectral index map shows that the core of galaxy appears to have a shallow spectral index between $\alpha = -0.2$ and -0.4 . This indicates that the core of the galaxy is a region of high thermal radiation output.

Keywords Galaxies: general · Galaxies: NGC 55 · Radio continuum: galaxies

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1 Introduction

At ~ 2.08 Mpc (scale of ~ 10 pc $''$) away (Dalcanton et al. 2009), NGC 55 is situated between our own Local Group of galaxies and the nearby Sculptor Group (Karachentsev et al. 2003). The proximity is an advantage as it allows for NGC 55 to be examined in great detail. Previous radio-continuum studies of NGC 55 (Condon et al. 1996; Puche et al. 1991) utilised the Karl G. Jansky Very Large Array (VLA) in compact array configurations as their primary instrument and thus suffer from low resolution. As a result, these studies did not provide source lists of objects within the NGC 55 field.

Until the next generation of radio telescopes such as the Australian Square Kilometre Array Pathfinder (ASKAP), Karoo Array Telescope (KAT & MeerKAT) and the Square Kilometre Array (SKA) become operational, we are restricted to consolidating a selection of NGC 55 radio observations. Part 1 of this paper (Galvin et al. (2012), Paper 1 hereafter) published a new set of highly sensitive and high-resolution radio-continuum images of the NGC 300 field at $\lambda = 20$ cm, created by combining data from the Australia Telescope Compact Array (ATCA) and the VLA (also see Payne et al. 2004). In this paper, we examine all available archived radio-continuum observations of NGC 55 conducted with the ATCA and the VLA at $\lambda = 20, 13, 6$ and 3 cm ($\nu = 1.4, 2.3, 5.5, 9.0$ GHz) with the intention of merging these observations to create a single radio-continuum image following a similar methodology as presented in Paper 1. By combining a large amount of existing data using the latest generation of computing power we can create new images that feature both high angular resolution and excellent sensitivity. The newly constructed images are analysed and the differences between each map of NGC 55 created at the observed wavelengths are discussed.