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Radio Study of a Superwind-galaxy: NGC1482

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Abstract. We present GMRT and VLA observations of the superwind galaxy, NGC1482, which has been discovered to have a remarkable hour-glass shaped optical emission line outflow on both sides of the galactic disk. The central region has a prominent compact component, and suggestions of additional compact features.

Keywords : galaxies: active – galaxies: individual: NGC1482 – galaxies: nuclei – radio continuum: galaxies

1. Introduction

Galactic-scale outflows from nearby edge-on galaxies, which could be due to either a starburst or an AGN, have been observed over a wide frequency range extending from radio to X-ray wavelengths. In galaxies without a prominent AGN, these outflows are usually interpreted to be due to superwinds originating in regions of massive star formation. The mass and kinetic energy involved in these outflows are typically about 10^5 - 10^7 $M_\odot$ and 10^{53} - 10^{55} ergs respectively. As part of a study of such galaxies, we have made GMRT and VLA observations of NGC1482 which is at a distance of 19.6 Mpc, is rich in dust and molecular gas, and has a remarkable hour-glass structure of ionized gas flowing out along the minor-axis with a velocity of nearly 250 km s^{-1} and extending to approximately 1.5 kpc (Veilleux & Rupke 2002). The emission line ratio $[N_{II}]/H\alpha$ in the disk is similar to that of HII regions, while the outflowing wind appears to be shock ionized with the shocked gas lying on the surface of the symmetric biconical structure.

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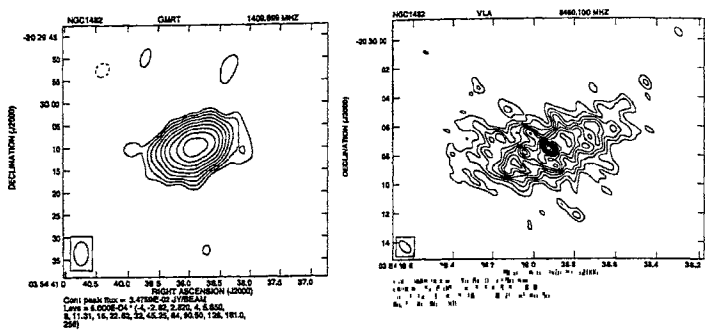

Figure 1. GMRT image at 1410 MHz with an angular resolution of ~4″ (left panel) and VLA image at 8460 MHz with an angular resolution of ~0″.8 (right panel).

2. Results and Discussion

The 1410-MHz image with the GMRT (Fig. 1) shows the radio emission from the central region to be well resolved and extended along a PA~110°. The overall spectral index of the central region between 365 and 1490 MHz is ~0.8, suggesting that the bulk of the emission is non-thermal. The 8-GHz image of the circumnuclear region reveals a number of distinct components which are likely to be a mixture of supernova remnants and HII regions. Although the central component is the brightest one, it is not clear whether this feature is associated with an AGN. The luminosity of the components would be dependent on the linear resolution of the observations. The typical luminosity of the knots is $\sim 2\times10^{19}$ W Hz^{-1}.

Veilleux & Rupke (2002) estimate the kinetic energy involved in the outflow to be $\gtrsim 2\times10^{53} n_{e,2}^{-1}$ ergs, where $n_{e,2}^{-1}$ is the number density normalised to 100 cm^{-3}. The basic driving force for this minor-axis superwind outflow is likely to be the starburst in the circumnuclear region of this disk galaxy. At radio wavelengths, the supernova rate estimated from the non-thermal luminosity (Condon 1992) is ~0.1 yr^{-1}. Adopting a value of 10^{51} ergs for the kinetic energy of a supernova, the available energy over the dynamical lifetime of the bubble, $\sim 6\times10^{6}$ yr, is $\sim 6\times10^{56}$ ergs. Thus the energy generated by the starburst is adequate to drive the outflow for reasonable values of the number density of particles. The energy input rate estimated from the infrared luminosity also leads to a similar conclusion.

References

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