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OH MASERS TOWARDS THE W49A STAR-FORMING REGION WITH MERLIN AND e-MERLN OBSERVATIONS

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ABSTRACT

We present preliminary results from OH ground state phase referenced observations carried out with the Multi Element Radio Linked Interferometer Network (MERLIN) and e-MERLIN towards the massive star forming region W49A. There are three active SFRs within this complex: W49 North (W49 N), W49 South (W49 S) and W49 South West (W49 SW). The first epoch of observations was obtained in 2005 with MERLIN while the second epoch was obtained in 2013 with the e-MERLIN upgraded system. In this paper, we present 1665 and 1720 MHz maser emission towards W49 S and W49 SW. Overall, both epochs show good agreement with the previous observations of Argon et al. (2000) carried out with the Very Large Array (VLA). The better sensitivity and wider velocity coverage of the MERLIN/e-MERLIN observations allowed us to discover a new 1720 MHz OH maser site in W49 S.

Key words: star-formation: OH masers: W49A, W49 SW, W49 S, magnetic field: polarization

1. INTRODUCTION

The W49 complex is found in the constellation of Aquila; it consists of a giant molecular cloud (GMC) W49A to the west and a supernova remnant W49 B ∼ 12′ to the east. W49A is one of the most massive star forming regions in the Galaxy with a total mass of $\sim 10^6 M_\odot$ within a radius of 60 pc (Galván-Madrid et al. 2013). It lies in the Galactic plane (l = 43.°17, b = +0.°00) at a distance of $11.11^{+0.79}_{-0.69}$ kpc (Zhang et al. 2013). W49A has ∼ 40 well studied UC HII regions associated with a minimum of 40 stars earlier than B3 (De Pree et al. 1997). It has three main far-infrared peaks; W49 N, W49 SE (also called W49 S) and W49 SW (Harvey et al. 1977).

OH masers have long been known to be associated with UC HII regions and bipolar molecular outflows from young stars, and are therefore recognised as signposts for active star formation and regions of extremely dense gas ($> 10^6 \mathrm{cm}^{-3}$, Cohen 1989 and reference therein). Studying the properties of OH masers will enable us to understand not only the physical conditions of the regions but also the magnetic fields, which may play a crucial role in the star formation process.

2. OBSERVATIONS AND RESULTS

The first epoch of phase referenced observations of all ground state OH masers towards W49A was carried out with MERLIN[1] in 2005, while the second epoch of observations was carried out in 2013 with the e-MERLIN upgraded system. In this paper, we describe preliminary results from the observations of 1665 and 1720 MHz maser lines in W49 S and W49 SW.

As shown in Figure 1, the line profiles and amplitudes of maser features observed in both epochs are similar. The 1720 MHz OH masers have a velocity spread of less than 5 km s^{-1} in both regions, while the 1665 MHz OH masers have velocities ranging from ∼ 5 to 25 km s^{-1} in W49 S and ∼ 2 to 16 km s^{-1} towards W49 SW.

We compared the spatial distributions of the masers for both epochs of observations, and found that they are in good agreement (see Figure 2). We also compared our positions with previous VLA observations by Argon et al. (2000) that have positional accuracies of 0.3 arcsec. As shown in Figure 2, the positional offset between both measurements is less than 0.15 arcsec, and therefore our positions agree with those of Argon et al. (2000) within this uncertainty.

[1]Multi Element Radio Linked Interferometer Network

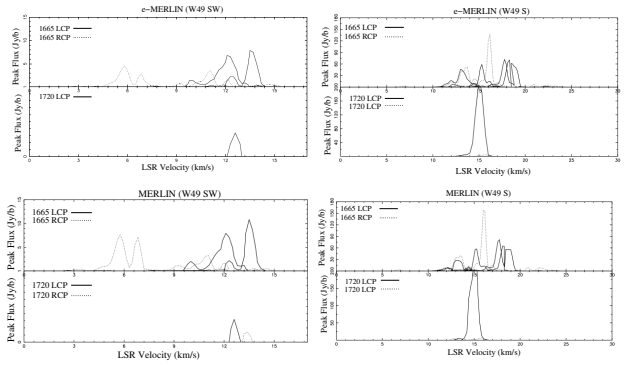

Figure 1. The MERLIN and e-MERLIN spectra of the 1665 and 1720 MHz OH masers towards W49 S and W49 SW.

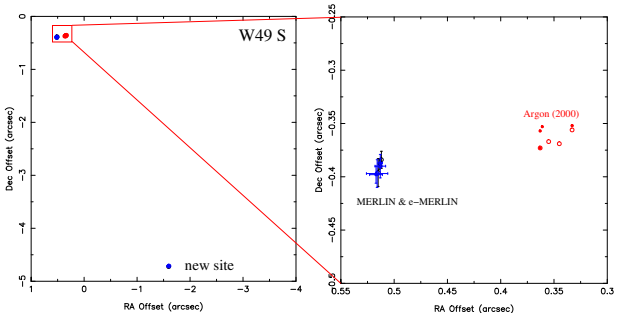

Figure 2. Position comparison of the 1720 MHz masers in W49 S as measured by MERLIN (in blue), e-MERLIN (in black), and VLA (in red, by Argon et al. 2000). The offset (0,0) is RA= $19^h\ 10^m\ 21.^s65$, Dec.= $+09^\circ\ 05'\ 02.''6$.

We discovered a new 1720 MHz maser site located at RA offset = −1.6 arcsec and Dec. offset = −4.7 arcsec south of W49 S (detected by MERLIN and confirmed by e-MERLIN; see Figure 2). This group of masers has velocities ranging from ∼ 12.98 to 13.53 km s^{-1} and has a peak flux density of ∼ 0.21 Jy beam^{-1}.

The spatial and velocity distributions of the e-MERLIN OH masers in W49 S and W49 SW are displayed in Figures 3 and 4, respectively. In both regions, the spatial distributions are within ∼ 6″× 6″ which is equivalent to ∼ 0.3×0.3 pc^2 (at the distance given by Zhang et al. 2013). However, the velocity distributions of the masers in both sources show complex velocity gradients which need to be studied in greater detail.

3. CONCLUSIONS AND FUTURE WORK

We have presented preliminary results from phase referenced observations of 1665 and 1720 MHz OH masers in W49 S and W49 SW obtained with MERLIN (in 2005) and with e-MERLIN (in 2013). Both position and velocity distributions of the masers from both epochs of observations agree well. Our maser positions also agree well with the previous VLA observations by Argon et al. (2000). We discovered a new 1720 MHz OH maser site in the Southern part of W49 S.

The data analysis of the other OH lines in both sources, and also those in W49N, is currently a work

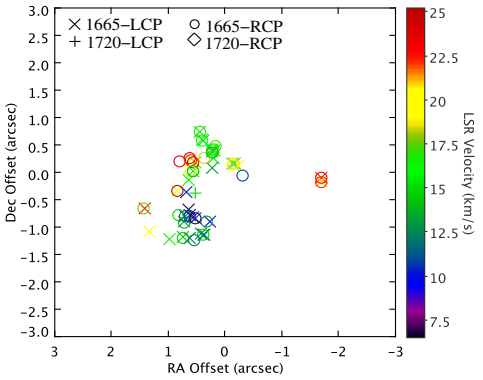

Figure 3. Positions and velocity distributions of the 1665 and 1720 MHz masers in W49 S.

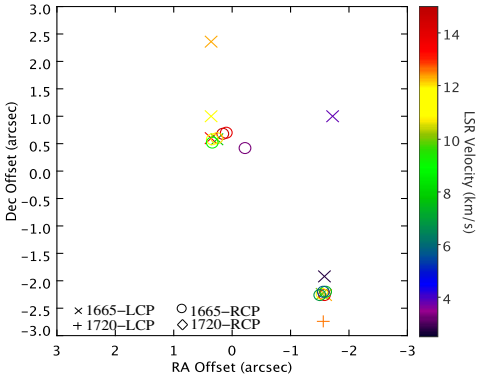

Figure 4. Positions and velocity distributions of the 1665 and 1720 MHz masers in W49 SW. The offset (0,0) is RA = $19^h\ 10^m\ 11.^s04$, Dec.= $+09^\circ\ 05'\ 20.''2$.

in progress. The overall spatial distribution and kinematics of the OH masers will be studied together with other signatures of the star formation process (e.g. CO outflows), allowing us to probe the physical conditions of these regions.

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