

22 GHz Water Maser Survey of the Xinjiang Astronomical Observatory

Jian-jun Zhou^{1,2} Jarken Esimbek^{1,2} and Gang Wu^{1,2}

¹Xinjiang Astronomical Observatory, CAS
150 Science 1 street Urumqi, Xinjiang 830011, China
email: zhoujj@xao.ac.cn

²Key Laboratory of Radio Astronomy, CAS,
150 Science 1 street Urumqi, Xinjiang 830011, China

Abstract. Water masers are good tracers of high-mass star-forming regions. Water maser VLBI observations provide a good probe for studying high-mass star formation and galactic structure. We plan to make a blind survey toward the northern Galactic plane in future years using the 25 m radio telescope of the Xinjiang Astronomical Observatory. We will select some water maser sources discovered in the survey and perform high resolution observations to study the gas kinematics close to high-mass protostars.

Keywords. Masers, surveys, stars: formation.

1. Introduction

High-mass star forming regions are usually distant and heavy obscuration makes it difficult to observe them. Water masers are good probes of the physical conditions and dynamics of star forming regions. Maser VLBI observations are the unique means by which one can explore the gas kinematics close (within tens or hundreds of AU) to forming high-mass protostars (Moscadelli *et al.* 2011). Measurements of the trigonometric parallaxes and proper motions of water masers found in high-mass star-forming regions using a VLBI phase reference method can provide very accurate distances to them. Combining positions, distances, proper motions and radial velocities yields complete 3-dimensional kinematic information on the Galaxy (Xu *et al.* 2006; Reid *et al.* 2009). Water masers are very rich in the Galaxy and they are reliable tracers of high-mass star-forming regions (Caswell *et al.* 2011). Therefore, it is valuable to discover more water masers associated with high-mass star-forming regions.

Earlier water maser searches have chiefly been made toward targeted sources, and many masers may yet be undiscovered. There are only a few unbiased water maser surveys (Breen *et al.* 2007; Walsh *et al.* 2008; Caswell & Breen 2010). Recently, one much larger blind survey toward 100 square degrees of the southern Galactic plane has been completed successfully (Walsh *et al.* 2011). However, no large blind water maser survey has been performed toward the northern Galactic plane. We will make a blind survey toward 90 square degrees of the northern galactic plane using our 25 m radio telescope. We hope to discover a large sample of water masers and high-mass star-forming regions at earlier stages, and study high-mass star formation and galactic structure.

2. 25 m radio telescope of Xinjiang Astronomical Observatory

The Nanshan 25 m radio telescope of the Xinjiang Astronomical Observatory was built in 1992 as a station for the Chinese Very Long Baseline Interferometry network. It is

located at the Nanshan mountains west of Urumqi city at an altitude of 2080m. Its front-end receiver system includes several receivers working at 18, 13, 6, 3.6 and 1.3 cm. At 1.3 cm, one dual-polarization cryogenic receiver has been installed on the telescope recently, the noise temperature of the receiver is better than 20 K. When the weather is good, the system temperature is better than 50 K. We built a molecular spectrum observing system in 1997. One digital filter bank (DFB) system is employed as the spectrometer. It is capable of processing up to 1 GHz of bandwidth with 8192 channels. Our telescope now can observe several molecules such as OH, H₂O, NH₃, H₂CO and H_{110 α} .

3. Our plan

We will make a large scale blind survey toward the Northern Galactic plane in order to have the opportunity to detect most water masers concentrated in the region along the galactic plane ($|b| < 0.5^\circ$). We plan to survey 90 square degrees of the northern galactic plane, covering the region between $l = 30^\circ$ and $l = 120^\circ$, and $|b| < 0.5^\circ$. In order to complete the project in a reasonable time, a scanning observation mode (on the fly) will be used for our observations. The final sensitivity of the survey is about 1.4 Jy.

On the other hand, many surveys at millimeter, submillimeter and infrared wavelengths have discovered a large sample of possible star-forming regions, e.g. Bolocam, Planck, Glimpse and MIPS. These sources provide us with good candidates for our water maser search. We can therefore also select some sources to make a targeted survey.

Acknowledgements

This work was funded by the National Natural Science Foundation of China under Grant 10778703, the China Ministry of Science and Technology under the State Key Development Program for Basic Research (2012CB821800) and The National Natural Science Foundation of China under Grant 10873025.

References

- Breen, S. L., Ellingsen, S. P., Johnston-Hollitt, M., *et al.* 2007, *MNRAS*, 377, 491
 Caswell, J. L. & Breen, S. L. 2010, *MNRAS*, 407, 2599
 Caswell, J. L., Breen, S. L., & Ellingsen, S. P. 2011, *MNRAS*, 410, 1283
 Moscadelli, L., Sanna, A., & Goddi, C. 2011, *A&A*, 536, 38
 Reid, M. J., Menten, K. M., Zheng, X. W., Brunthaler, A., *et al.* 2009, *ApJ*, 700, 137
 Walsh, A. J., Lo, N., Burton, M. G., *et al.* 2008, *PASA*, 25, 105
 Walsh, A. J., Breen, S. L., Britton, T., *et al.* 2011, *MNRAS*, 416, 1764
 Xu, Y., Reid, M. J., Zheng, X. W., & Menten, K. M. 2006, *Science*, 311, 54

