From Interstellar Clouds to Star-Forming Galaxies: Universal Processes?, E85, 1 of 2
Proceedings IAU Symposium No. 315, 2016
P. Jablonka, Ph. André, & F. van der Tak, eds.

doi:10.1017/S1743921316008486

WISE properties of OH megamaser galaxies: Guide for future FAST OHM survey?

J.S. Zhang[1] and J.Z. Wang[2] and D. Li[3] and Q.F. Zhu[4]

[1]Center for Astrophysics, Guangzhou University, Guangzhou 510006, China
email: jszhang@gzhu.edu.cn

[2]Shanghai Astronomical Observatory, CAS, Shanghai 200030, China

[3]National Astronomical Observatory, CAS, Beijing 100012, China

[4] University of Sciences and Technology of China, CAS, Hefei 230026, China

Abstract. All 119 OH maser galaxies (110 out of them are megamasers, i.e., L_{OH} >10 $L_{\odot}$, OHMs) published so far were compiled and were cross-identified with the Wide-Field Infrared Survey Explorer (WISE) catalog. Our aim is to investigate intrinsic middle-infrared properties of OH maser galaxies and try to find some hints on sample selections on OHM surveys through the coming Five hundred aperture spherical telescope (FAST). In addition, enormous potentials for OHM surveys by future FAST are investigated, based on its innovative designs and its expected best sensitivity among single dish telescopes.

Keywords. middle infrared, OH megamaser, survey, FAST

1. Introduction

Extragalactic OH masers ($\lambda\sim$18 cm) have been reported from 119 galaxies **so far**, since the first detection in NGC 253 about 40 years ago (Whiteoak & Gardner 1974, Darling & Giovanelli 2002, Willett 2012). About 90% of all published OH maser sources (106/119) have an isotropic luminosity larger than 10 $L_{\odot}$, which is million times more luminous than typical Galactic OH masers. The hosts of OHMs are mostly all luminous infrared galaxies (LIRGs, L_{FIR}>10^{11} $L_{\odot}$, 102/106), where about one third of them are ultra luminous infrared galaxies (ULIRGs, L_{FIR}>10^{12} $L_{\odot}$, 35/106, Darling & Giovanelli 2002; Baan 1991). OHMs are believed to be related to galaxy interaction or merging. However, the majority of (U)LIRGs (∼80%) was not detected with OHM emission at all (e.g., Darling & Giovanelli 2002, Lo 2005). Do OHM (U)LIRGs represent some kind of distinct population? Here, comparison of middle-infrared properties on OHM and non-OHM ULIRGs were performed, based on data from much sensitive infrared satellite, the Wide-field Infrared Survey Explorer (WISE).

In addition, FAST detectability on OHMs were determined and the OHM sky number density by FAST detection were estimated, based on its innovative designs and its expected best sensitivity among single dish telescopes.

2. MIR properties of OHM hosts

Based on our analysis, some hints on sample selection of future FAST OHM searching were obtained (see details in Zhang *et al.*2014):

1) The Arecibo OHMs tend to have a lower luminosity at short MIR wavelengths than non-OHM sources. Thus (U)LIRGs sample excluding those with luminous sources at 3.4 μm or 4.6 μm should be good targets may improve OHM detection rate;

2) OHM fraction tends to increase with cooler MIR colors (larger $F_{22\,\mu m}/F_{3.4\,\mu m}$). Thus (U)LIRGs sample with cooler MIR colors may be better targets for OHM searching;

3) For the Arecibo OHM sample, the MIR luminosity at 22 μm is found to be correlated with the MIR color [W1]-[W4] (Fig. 1). To choose (U)LIRG(s) samples located within the limited region may increase the OHM detection rate.

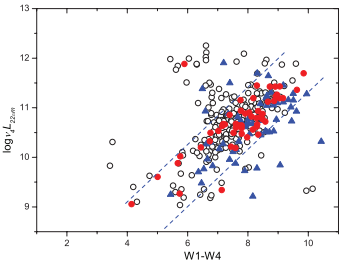

Figure 1. WISE 22 μm luminosity versus color ([3.4 μm-22 μm]). The Arecibo OHMs mostly locate within the region limited by two dashed lines (from linear fit line with error.

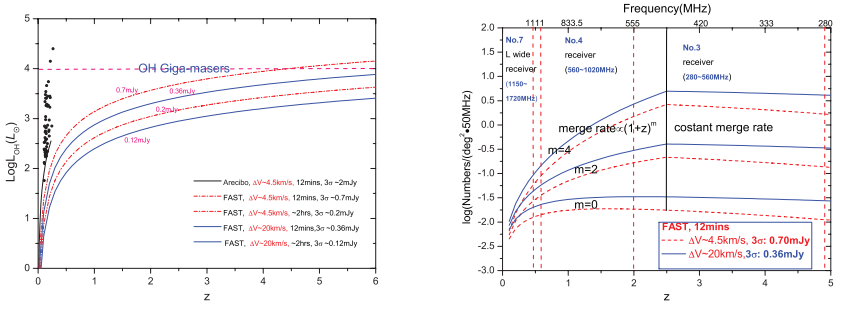

Figure 2. Left: the minimum detectable OH maser luminosity (3σ) as a function of redshift. Black dots and short line: detected OH megamasers and the Arecibo survey sensitivity. Right: OHM detection rate with FAST 12 minutes integration. m is merging rate index: z $(1+z)^m$.

3. FAST maser studies

Figure 2 shows the minimum detectable OH maser luminosity (left panel) and the detection rate (right) through the coming FAST (See details in Zhang *et al.*2015). Within a reasonable integration time, FAST can detect the majority of OH megamasers with $L_{OH} > 10^2\, L_\odot$ out to redshift z$\sim$1 and all OH megamasers with $L_{OH} > 10^3\, L_\odot$ out to z$\sim$2, even some out to z$\sim$3. With an integration time of 12 minutes, a few OHMs at z$\sim$2 and dozens of OH megamasers within the redshift range $0.6 < z < 2$ per square degree per 50 MHz bandwidth would be likely detected by the coming FAST. The number of OHMs with redshift $z < 0.5$ could be expected to increase 20 times or more, within FAST sky coverage ($\sim$24000 square degrees).

Acknowledgements

Supported by China 973 project (2012CB821800) and the Natural Science Foundation of China (No. 11178009, 11473007).

References

Baan W.A. 1995, *ASPC*, 16, 45
Darling, J., & Giovanelli, R. 2002, *AJ*, 124, 100
Lo, K. Y. 2005, *ARA&A*, 43, 625
Whiteoak, J.B., & Gardner, F. F. 1974, *ApJ*, L15, 211
Willett, K. W. 2002, *IAUS*, 287, 345
Zhang, J.S., Wang, J.Z., Di, G.X. *et al.* 2014, *A&A*, 570, A110
Zhang, J.S., Li, D., Wang, J.Z. *et al.* 2015, *RAA*, accepted for the FAST issue

https://doi.org/10.1017/S1743921316008486 Published online by Cambridge University Press