

Discovery of H₂O Megamasers in Obscured Active Galactic Nuclei

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We carried out a survey of H₂O maser emission toward 10 obscured active galactic nuclei (AGNs). The target galaxies were selected from obscured AGNs found by Terashima et al. (2015) [1]. They developed a new method to discover obscured AGNs by utilizing X-ray and infrared data.

We made observations of H₂O maser emission from February to June and December in 2016 using the 45-m telescope of the Nobeyama Radio Observatory.

We newly detected maser features from two AGNs, NGC 1402 and NGC 7738, with a signal-to-noise-ratio (SNR) of above 4, and tentatively detected in NGC 5037 (SNR>3). The isotropic maser luminosities of NGC 1402 and NGC 7738 are $47 L_{\odot}$ and $468 L_{\odot}$, respectively; they are megamasers (i.e., $\geq 10 L_{\odot}$). On the other hand, the isotropic maser luminosity of NGC 5037 is $5 L_{\odot}$, which is one order of magnitude smaller than typical luminosities of megamasers.

NGC 7738 shows maser features redshifted and blueshifted from the systemic velocity of the galaxy (Figure 1). Weak features at $V_{\text{LSR}} \approx 6573 \text{ km s}^{-1}$ may be systemic velocity features, although SNR is not high enough. Redshifted and blueshifted features are symmetrical with respect to the possible systemic features in velocity. Such symmetrical components are typically seen as water-vapor masers in AGNs, indicating a rotating edge-on disk (its inclination angle is $\approx 90^{\circ}$). Thus the spectrum in NGC 7738 strongly suggests an edge-on maser disk rotating with velocity of $\sim 350 \text{ km s}^{-1}$ (separation between the systemic and the other two features).

NGC 1402 and NGC 7738 have an X-ray spectrum that has a flat continuum and a strong Fe-K emission line, indicating the presence of Compton-thick AGNs in these objects. In the case of NGC 6926, classified as an AGN of the same type by Terashima et al. (2015) [1], H₂O maser emission has already been detected. This type of AGNs may tend to have H₂O maser emission.

Our detection rate of 20% (2/10) is higher than those of previous surveys (usually several percent). This high detection rate indicates that the selection method is effective.

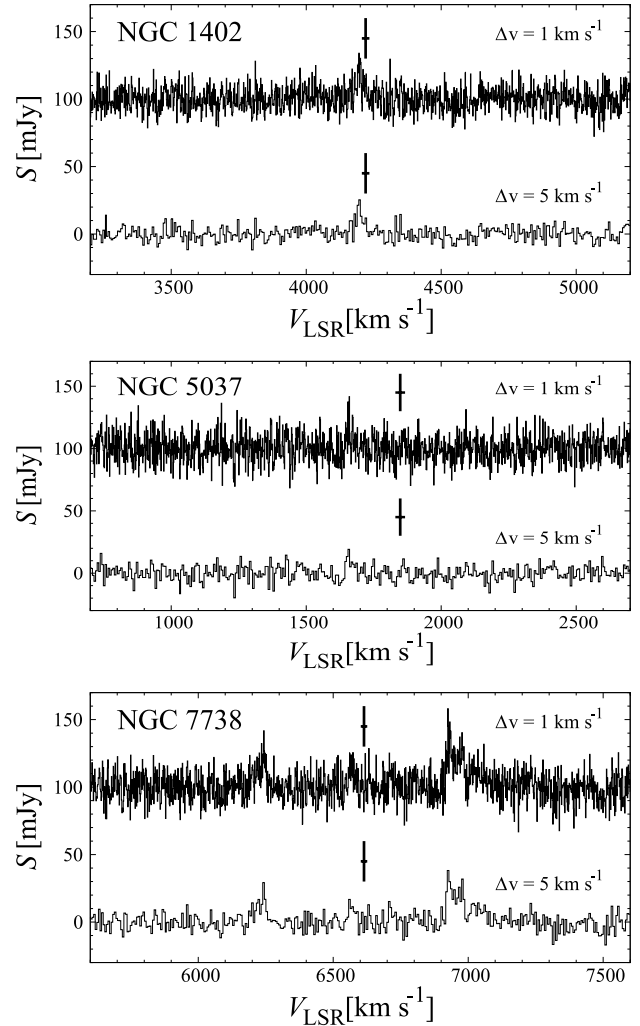


Figure 1: Yamauchi et al. (2017) [2]. The H₂O maser spectra of AGNs (marginally) detected with the 45-m telescope. To make the graph easier to view, the spectra with velocity resolution of 1 km s^{-1} are plotted 100 mJy above. Vertical and horizontal lines in the spectra indicate the systemic velocities of the galaxies and those errors, respectively.

References

- [1] Terashima, Y., et al.: 2015, *ApJ*, **814**, 11.
- [2] Yamauchi, A., et al.: 2017, *PASJ*, **69**, L6.