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Water Masers Outburst in the Massive Stellar Cluster W49A

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Abstract. We report a multi-wavelength study of a recent major flare ($\sim$ 80,000 Jy at V_{LSR} $\sim$ -98.1 km s^{-1}) of the 22-GHz water maser in W49A. In February 2014, we started monthly monitoring with the Effelsberg 100-m radio telescope. In May 2014, we carried out the nearly simultaneous observations of the 22-GHz transition with selected submillimeter water transitions using the IRAM 30-m telescope (at 183 GHz) and the Atacama Pathfinder Experiment (APEX) 12-m telescope (from 321 to 475 GHz). We have also performed interferometric observations using the NRAO Very Long Baseline Array (VLBA) at 22 GHz and the Submillimeter Array (SMA) at 321 and 325 GHz. One remarkable result is the detection of very high velocity emission features in several transitions. Our data also represent its first detection of the 475-GHz water transition in a star-forming region. Studying these multiple masing transitions in conjunction with theoretical modeling of their excitation not only places strong constraints on the physical conditions of the masing gas but also allows us to study their association with the embedded massive stellar cluster in W49A.

Keywords. masers, stars: formation, ISM: molecules, radio lines: ISM

1. Results and Summary

Results from single dish observations are shown in Figure 1. Several high velocity features were present in several transitions. The 475 GHz water maser transition was detected for the first time in a star-forming region. Several features including the high velocity outburst features are coincide.

The global distribution of the masers spots from VLBA observations agrees well with the previous observations over 30 years ago. The north-south arc-like structure observed with VERA (Honma *et al.* 2004) during the major outburst in 2003 is also present. The 2014 outburst feature (V_{LSR} $\sim$ -98.1 kms^{-1}) is located near to the 2003 outburst feature within the north-south arc-like feature. The SMA map of the 321-GHz transition also shows that the peak of high velocity features (-98 to -95 km s^{-1}) is located in the south-east offset to the central low velocity features (0 to 22 km s^{-1}). Further results will be presented elsewhere (Hutawarakorn Kramer *et al.* in prep.)

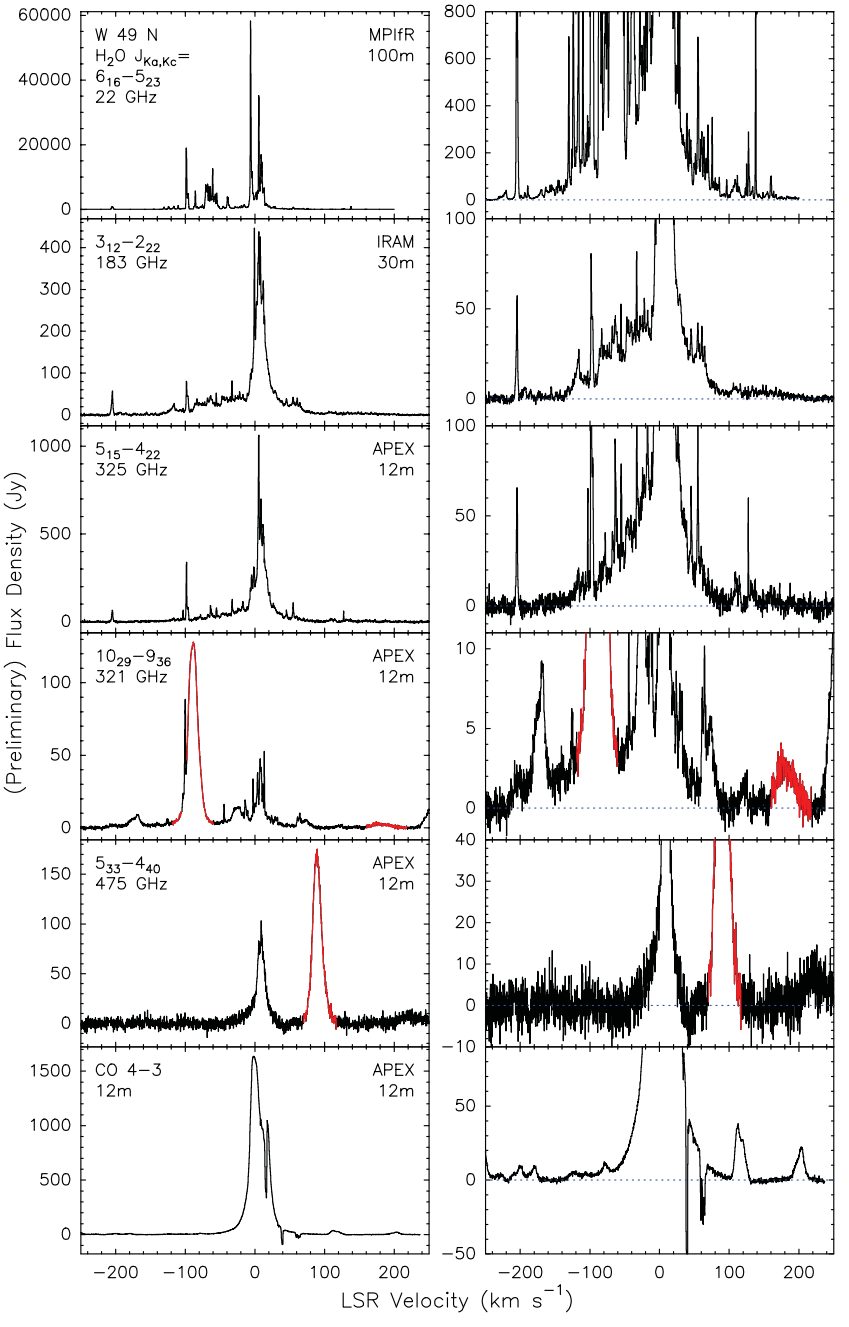

Figure 1. Water and CO *J=4-3* spectra observed toward in W49A during May 2014. Other known molecular lines are indicated in red color.

References

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