The properties and polarization of the H2O and CH3OH maser environment of NGC7538-IRS1

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NGC7538 is a complex massive star-forming region. The region is composed of several radio continuum sources, one of which is IRS1, a high-mass protostar, from which a 0.3 pc molecular bipolar outflow was detected. Several maser species have been detected around IRS1. The CH3OH masers have been suggested to trace a Keplerian-disk, while the H2O masers are almost aligned to the outflow. More recent results suggested that the region hosts a torus and potentially a disk, but with a different inclination than the Keplerian-disk that is supposed to be traced by the CH3OH masers. Tracing the magnetic field close to protostars is fundamental for determining the orientation of the disk/torus. Recent studies showed that during the protostellar phase of high-mass star formation the magnetic field is oriented along the outflows and around or on the surfaces of the disk/torus. The observations of polarized maser emissions at milliarcsecond resolution can make a crucial contribution to understanding the orientation of the magnetic field and, consequently, the orientation of the disk/torus in NGC7538-IRS1. The NRAO Very Long Baseline Array was used to measure the linear polarization and the Zeeman-splitting of the 22GHz H2O masers toward NGC7538-IRS1. The European VLBI Network and the MERLIN telescopes were used to measure the linear polarization and the Zeeman-splitting of the 6.7GHz CH3OH masers toward the same region. We detected 17 H2O masers and 49 CH3OH masers at high angular resolution. We detected linear polarization emission toward two H2O masers and toward twenty CH3OH masers. The CH3OH masers, most of which only show a core structure, seem to trace rotating and potentially infalling gas in the inner part of a torus. Significant Zeeman-splitting was measured in three CH3OH masers. [...] We also propose a new description of the structure of the NGC7538-IRS1 maser region.

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