



Two H₂O MegaMasers at high resolution

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The RadioAstron Space-VLBI mission has successfully detected extragalactic H₂O MegaMaser (MM) emission regions at space-Earth baselines ranging between 1.4 and 26.5 Earth Diameters (ED). The results for two galaxies, NGC 3079 and NGC 4258, present unexpected and distinctly different masering environments and excitation conditions in these galaxies.

The high-brightness maser components in the H₂O MM NGC 3079 form an arc that is offset from the triple components of the radio Compact Symmetric Object (CSO) at the nuclear center. The maser components in the offset arc-structure appear to result from a shocked region in the nuclear ISM that is also seen in blueshifted OH and HI absorption components. The cross-correlation spectra of NGC 3079 on space-Earth baselines of 2.3 ED and 13.5 ED shows features with a line strength that is significantly lower than obtained on the terrestrial baselines. The decrease in strength of the detected features would indicate that the maser emission is mostly extended and appears completely resolved at longer baselines.

The H₂O MM emission regions in NGC 4258 are confined to a nearly edge-on disk of 0.5 pc surrounding the nuclear AGN with a CSO radio structure. The orbiting molecular regions within the disk drift in front of the southern part of the CSO radio continuum and amplify this continuum. The H₂O MM emission of NGC 4258 has been detected with space-Earth baselines up to 26.5 ED, which constitutes a record resolution of 8 micro-arcseconds or a spatial resolution at the galaxy of 60 AU inside the 0.5 pc disk. At shorter space-Earth baselines the spectra show a multi-component profile that resemble those obtained with terrestrial baselines. At longer baselines these components appear regularly spaced and isolated as the compact and high brightness components remain unresolved. The mere detection of such compact maser components in NGC 4258 and their regular spacing indicate special conditions within the structure of the accretion disk. Furthermore, these more compact masering regions are a good place to detect organised magnetic fields by means of their polarisation properties.