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LBA observations of OH masers in the star-forming region OH 330.953–0.182

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Abstract. OH masers are sensitive probes of the kinematics, physical conditions, and magnetic fields in star-forming regions. The maser site OH 330.953−0.182 has been studied using the Long Baseline Array of the Australia Telescope National Facility. Simultaneous observations of the 1665- and 1667-MHz hydroxyl ground-state transitions yield a series of maps at velocity spacing 0.09 km s^{-1}, in both right- and left-hand circular polarization, with tenth-arcsec spatial resolution. Several clusters of maser spots have been detected within a five-arcsec region. Eight Zeeman pairs were found, and in one case, at 1665 MHz, there is a nearby 1667-MHz pair indicating a similar value of magnetic field and velocity. Over the whole site, all magnetic field estimates are toward us (negative), and range from −3.7 to −5.8 mG. We also compared the morphology and kinematics of the 1665- and 1667-MHz maser spots with those from the excited state of OH at 6035 MHz and from methanol at 6668 MHz.

Keywords. OH masers, star-forming region, OH 330.953-0.182, magnetic field

1. Observations and data reduction

The present observations were made using the Australian Long Baseline Array (LBA) telescopes at Parkes, Mopra, and Narrabri on 16–17 August 2000. The signals from the telescopes forming the Compact Array at Narrabri were combined together to form a single telescope with an equivalent size of diameter 46 m. The three stations yield baselines of approximately 119 km, 203 km and 321 km in a predominantly north-south direction. The S2 tape system was used to record both right- and left-hand circular polarizations simultaneously with a band pass centred at 1667 MHz and limited to 4-MHz bandwidth by digital filters with an excellent flat response in both amplitude and phase. The target source, OH 330.953−0.182, was observed for 25-min periods, interleaved with another target source, and with 8-min periods on a phase and secondary amplitude calibrator. The data reduction, mapping and image analysis were done by using AIPS – see Caswell & Reynolds (2001) and Hutawarakorn & Cohen (1999).

2. Results and discussion

The positions of the 1665- and 1667-MHz OH masers are shown in Figure 1, revealing three clusters of maser spots. The north-west and north-east clusters correspond respectively to 330.953–0.182 and 330.954–0,182 (Caswell 1998). The 1665-MHz southern cluster, newly discovered in these observations, is at the same position as the 6035-MHz

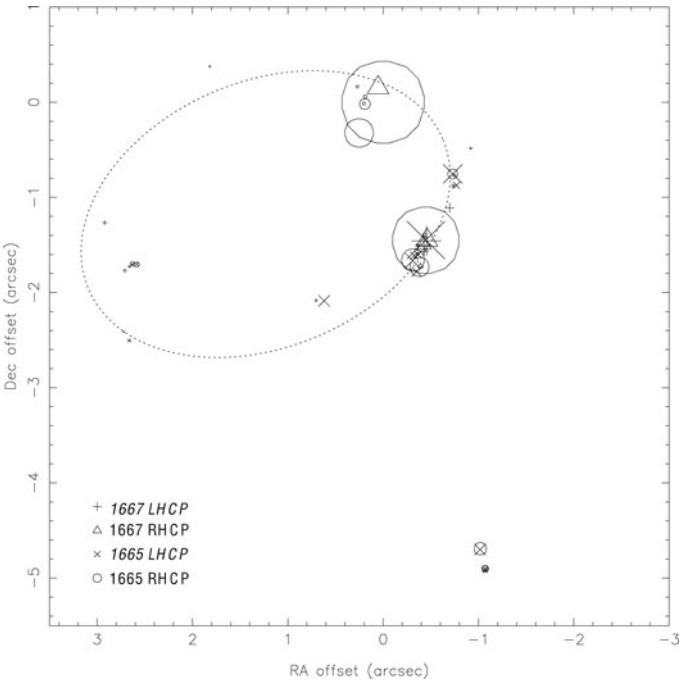

Figure 1. Intensities and relative positions of 1665- and 1667-MHz masers. The size of each symbol is proportional to the peak flux density.

OH maser (Caswell 2001), which in turn coincides with the 6668-MHz methanol maser (Caswell 2001).

The brightest 1665- and 1667-MHz features, in both LHCP and RHCP, are clustered in the north-west region (330.953-0.182). If we focus on the northern clusters, the position distribution can be fitted by a ring shape. At an assumed distance of $\sim$ 8.5 kpc, the diameter of the ring is $\sim$ 1700 au. The velocity distribution of the masers shows a gradient along the RA axis. This might be interpreted as a rotating disk, with central radial velocity $\sim -90\,\mathrm{km\,s^{-1}}$. Similar results have been found in recent studies of OH masers in massive star-forming regions associated with disks and outflows (Nammahachak, Asanok, Hutawarakorn Kramer *et al.* 2006 and references therein).

Eight Zeeman pairs were found, and in one case at 1665 MHz, there is a nearby 1667-MHz pair indicating a similar value of magnetic field and velocity. Over the whole site, all magnetic field estimates are toward us (negative), and range from -3.7 to -5.8 mG. A magnetic field of this strength is sufficient for the field to be dynamically important in the star-forming regions.

References

Caswell, J. L. 1998, *MNRAS* 297, 215
Caswell, J. L. 2001, *MNRAS* 326, 805
Caswell, J. L. & Reynolds, J. E. 2001, *MNRAS* 325, 1346
Hutawarakorn, B. & Cohen, R. J. 1999 *MNRAS* 303, 845
Nammahachak, S., Asanok, K., Hutawarakorn Kramer, B., Cohen, R. J., Muanwong, O., Gasiprong, N. 2006, *MNRAS* 371, 619

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