Astrophysical Masers:
Unlocking the Mysteries of the Universe
Proceedings IAU Symposium No. 336, 2017
A. Tarchi, M.J. Reid & P. Castangia, eds.

doi:10.1017/S1743921317011425

LBA high resolution observations of ground- and excited-state OH masers towards G351.417+0.645

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Abstract. We present the results from the Australian Long Baseline Array (LBA) observations of the ground- and excited-state OH masers at high resolutions towards the massive star-forming region G351.417+0.645 in 2012. We obtain the most accurate spatial gradient of magnetic fields at ground state transitions and verify the reliability of magnetic field strengths measured from previous lower resolution observations. In comparison with previous LBA observations in 2001 at 6.0 GHz, we identified several matched Zeeman pairs. We found that the OH maser features have no significant change of magnetic field strengths and directions with small internal proper motions, implying quite stable physical conditions. Additionally, we found that 1665- and 6035-MHz OH maser features reveal the same trend of reversal of magnetic fields. Moreover, we also analyzed the physical conditions at different locations from the coincidence of different OH maser transitions based on current OH maser models.

Keywords. masers, stars: formation, ISM: kinematics and dynamics, ISM: magnetic fields, ISM: molecules

1. Summary of the results

Our detected 142 OH maser features from both left- and right-handed circular polarization (LHCP and RHCP) from five transitions (1665, 1667, 1720, 6030 and 6035 MHz) distribute along the Northwest boundary of UC HII region NGC6334F (Fig. 1). We obtained, for the first time, the spatial gradient of magnetic fields and radial velocities from all five transitions with the most accurate values at 1.6 − 1.7 GHz. The dominant magnetic fields are negative (directed towards us) while the reversals of magnetic fields are found at 1665 and 6035 MHz above Galactic longitude 351.417 deg. In comparison at 6.0 GHz between epochs 2001 (Caswell *et al.* 2011) and 2012 (our observation), an

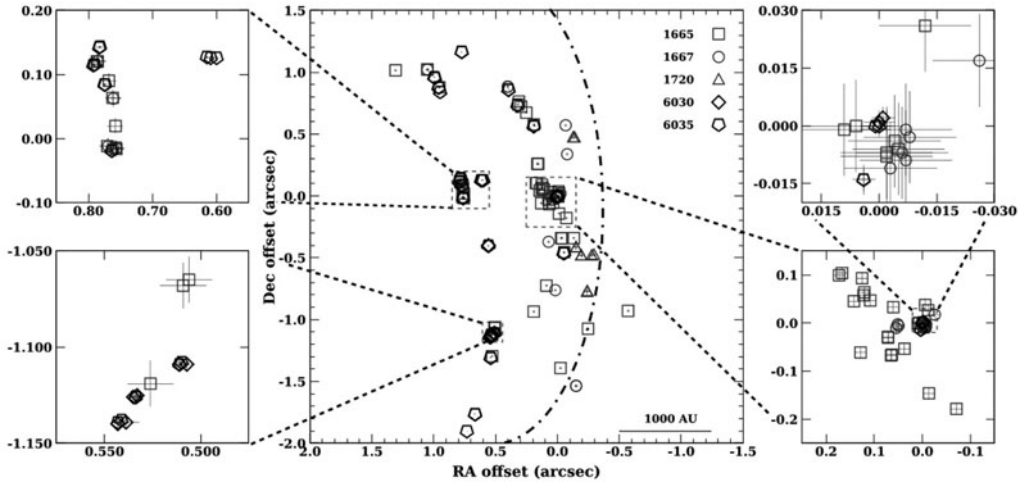

Figure 1. The OH maser distribution from all five transitions along the northwest boundary of the UC HII region NGC6334F shown as dash-dot line adapted from Hunter *et al.* (2006). Square, circle, up-triangle, diamond and pentagonal symbols represent OH maser features from 1665, 1667, 1720, 6030 and 6035 MHz respectively (grey and black colors are used to distinguish between ground− and excited−state transitions). The position offsets are relative to the brightest feature of 6035−MHz transition at R.A.(J2000) = 17h 20m 53.3716s and Dec.(J2000) = -35° 47′ 1.″608.

11-year time span, there was no any significant change, within the uncertainties, in the magnetic fields and radial velocities. Moreover, we have estimated the internal proper motions over the 11-year interval and found the tendency to move downward relative to the brightest feature at the reference center with the maximum velocity of ∼11 km s^{-1}. Moreover, we also infer the physical conditions in this region by comparing with Cragg *et al.* (2002)'s OH models based on the coincidences of OH maser features from different transitions.

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https://doi.org/10.1017/S1743921317011425 Published online by Cambridge University Press