Cosmic Magnetic Fields:
From Planets, to Stars and Galaxies
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Scattered OH Maser sources in the direction of W49N

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Abstract. OH masers spots are observed with the VLBA at 1612, 1665 and 1667 MHz. The orientation of the ellipses resulting from scattering are all nearly aligned perpendicular to the galactic plane. These ordered orientation could be due to the galactic magnetic field.

Keywords. OH masers – W49N – interstellar scattering

1. Observations and results

Using VLBA observations of 2005 October 6 towards W49N at the 1612 MHz, 1665 MHz and 1667 MHz OH frequencies, 215 maser spots were detected (Fig.1). LCP and RCP are observed simultaneously in 240 spectral channels with a resolution of 0.1 km/sec in a range of about 22 km/sec. The beam size is about 20 mas by 15 mas at a position angle of 84 degrees. The galactic plane is at a position angle of 30 degrees. The magnetic field at the maser emitting region obtained based on Zeeman pairs gives values from -4 to 6 mGauss. All for a region of about one arcsecond square near the center of the field. The deconvolved major axis (mjax) of the spots are between 30 to 70 mas and the ratio of mjax to minor axis (mnax) range from about 1.5:1 to 3:1.

The center of expansion (CE) of Gwinn *et al.* (1992) for H_2O maser spots at W49N is denoted by + in Fig. 1. The velocities of the nearest spots are slightly higher or smaller than 9 km/s, a value near the middle of the entire velocity range that we use as reference in Fig. 1a). Red shifted spots predominantly appear at the right (as also observed by Kent & Mutel (1982)) and blue shifted spots are located at the left, slightly to the north respect the red shifted spots, as occurs for H_2O spots (Gwinn *et al.* 1992). However, the left hand side H_2O spots are red shifted while the OH of the same side are blue shifted and vice versa.

The principal axis (PA) takes values from about 80 to 130 degrees, i.e., even though the spots are spread more than 7×10^4 AU, their PAs are all nearly aligned. Most of the ellipses of the right group are oriented as if they would be traced from the CE but the ellipses of the left hand side group do not follow any given orientation respect the CE.

The larger PA values take place at the larger mnax (Fig. 2) and a similar correlation is observed between PA and mjax. However, there is no correlation between PA and the majax/minax ratio. This suggests that it is the size of the spots and not the ratio of their axes that correlates with PA.

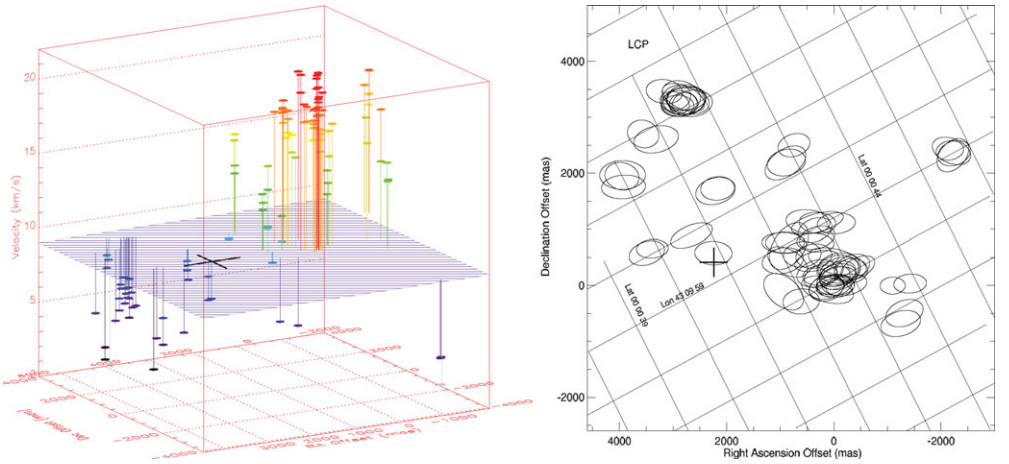

Figure 1. a) Scatter 3D plot for the spots at 1667 MHz, a plane around the central velocity is plotted as reference. b) Distribution of LCP 1667 MHz spots. The locations are denoted by ellipses multiplied by a factor of 15. A grid of lines of constant Galactic Longitude and constant Galactic Latitude are shown. The CE of Gwinn *et al.* (1992) is denoted by +.

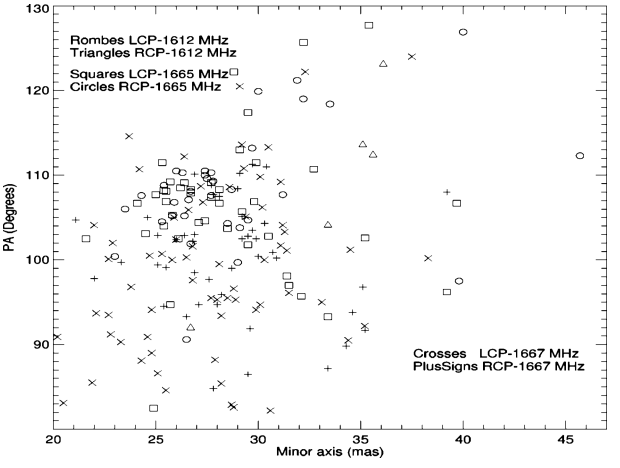

Figure 2. The scatter plot of the PA and the minor axis of all the spots.

2. Discussion

The observed size and orientation of the spots are not related to CE. Density inhomogeneities produced by turbulence are expected to be elongated along the galactic magnetic field (Desai *et al.* 1994) and produce ellipses whose apparent sizes are larger in the direction of the short axes (Narayan *et al.* 1988). The magnetic field could order the density inhomogeneities of the interstellar medium at such scales. In this scheme, the scattering of the inhomogeneities could determine the largest observed sizes.

References

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