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OH and H_2O Maser Distribution in Orion KL

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Abstract. In order to study the powering source behind KL nebula, we made a map of OH and H_2O masers from VLA observations of this region, and compared their spatial distribution and velocity structure with that of the SiO masers. The distribution of the OH masers consists of a multi-stream structure and seems to be related to the Hot Core molecular emission. The low velocity H_2O masers may be classified as two groups: i) an inner clump of maser spots surrounding the SiO maser disc and continuum source "I", and ii) component associated with the Hot Core represented by HDO emission peaks.

1. Low Velocity Masers in Orion KL

Masers from Orion KL region are roughly classified with two velocity components: the high velocity components $\pm$ 30 km/s around the systemic velocity $\sim$ 9 km/s and the low velocity components of about $\pm$ 15 km/s. The high velocity components are mainly observed in H_2O masers which are associated with outflow (e. g., Genzel et al. 1981). The SiO, OH and some of H_2O masers are observed in the low velocity range, which seem to be associated with a molecular torus around central forming star. However the detail structure of the low velocity maser complex is still unclear because of its complexity. On the other hand, the observations of SiO masers in Orion KL seem to delineate a high density region believed to be a rotating and expanding molecular ring (torus) (Plambeck et al. 1990). Menten & Reid (1995) argued that the center of the SiO maser ring does coincide with a continuum source "I" standing near the strong infrared source IRc2, which has been identified as the possible exciting proto-star and now appears to be an I.R. reflector. The source "I" is, hence, thought to be the central star whose radiation "pumps" the masers in the surrounding region. One would hypothesize that the low velocity H_2O masers around such SiO maser ring well represent star-forming activity in lower density cloud. To elucidate this we will focus on the low velocity components of masers in this paper.

2. Observations

The VLA observations were done in December 1988 both for H_2O masers at 22GHz and OH masers at 1665 MHz. H_2O masers were observed for left hand circular polarization. The OH masers were observed both for right hand and left hand circular polarization simultaneously. In Figure 1 we present the distribution of both species. From 25k m/s to -12 km/s, we identified 22 maser spots for H_2O. While twelve of them are distributed from north-east to south-west with about ten arcsec elongation, ten of them are surrounding around near IRc2 region with few arcsec extension. The detail structure suggests that the later cluster components extend around SiO maser ring with $\sim$ 300 AU scale in radius. The OH masers show a multi-stream structure with a red-shift stream toward north-east from IRc2 region and a pair of both red and blue-shift streams elongated to north-west. The north-west one corresponds to the foot of the large scale outflow. From the observation of both left and right hand circular polarization for OH masers, we could identify four Zeeman pairs. The velocity shifts of such pairs are 0.2, 0.3, 0.5 and 0.6 km/s which correspond to the strength of magnetic fields 0.8, 1.4, 2.1 and 2.8 mG, respectively.

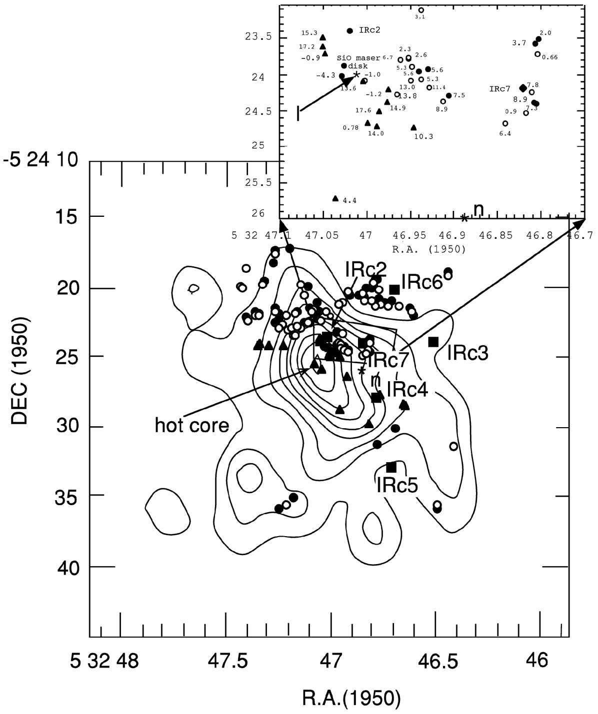

Figure 1. Distribution of H_2O masers (triangle) and OH masers (circle) superimposed on the HDO emission map of Plambeck & Wright (1987).

3. Masers and Hot Core

In Figure 1, we superimposed all the masers on the HDO distribution map (Plambeck & Wright 1987) to see how it relates to the Hot Core. While the OH masers are well located on the edge of the Hot Core, H_2O masers are located on the peak of the emission lines. This suggests that this class of H_2O maser molecules are released with the evaporation of the dust with molecule like HDO and ammonium which dominate the Hot Core.

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References

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