Mapping Studies of High Velocity Gas near IRAS02310+6133

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Abstract Mapping observations in CO J=1-0 lines were made towards IRAS 02310+6133 with the 13.7m telescope at Qinghai Station of Purple Mountain Observatory. There exists the line-centre velocity shift, probably caused by rotation. Taking the shift into account, we made the wing emission intensity contours and the core contours. In the wing emission intensity contours, there is a bipolar structure, and we calculate the outflow parameters. From the core contours, IRAS 02310+6133 is deviated from the core emission peak. Maybe it is a new star formation region.

There are three major reasons why we observed IRAS 02310+6133. First, this region is a massive star formation region (Wu et al. 1998). Second, it is associated with two H_2O masers (Comoretto et al. 1990); In addition, there is no coincidence with HII region. All these three characteristics show that the evolution stage of this region is earlier than the ultra compact(UC) HII, which is a good target to probe the early status of massive stellar objects. High-velocity gas detected in this region has not been identified to be an outflow (Wu et al. 1998). Mapping CO J=1-0 is necessary and useful to further study this region.

Our observation for IRAS 02310+6133 was made with 13.7 m telescope at Qinghai Station of Purple Mountain Observatory, NAOC, in April 2002. At the observing frequency of 115.271 GHz, the width of the half-power beam is $54''$. The pointing and tracking accuracy is better than $10''$. An AOS spectrometer was used, which has 1024 channels and with a total bandwidth of 170 MHz. The equivalent velocity resolution is 0.43 km/s. The spectral line intensity T_A^* was calibrated with ambient temperature. The antenna efficiency $\eta_{\rm fss}$ is 0.50. All spectra were taken in the absolute position-switching mode. The 7×7 points maps were made almost centered on IRAS 02310+6133, whose equatorial coordinates is $\alpha(1950) = 02^h30^m56.4^s$, $\delta(1950) = 61^o33'15''$. The grid spacing was 1'. Data were reduced with Drawspec software package. Winsurf was used for the analysis of the contours and spectra.

From the spectra detected, we can see line wings, and also find line-centre velocity shift. There are two possible reasons for this shift (Jiang et al. 2001): one is the rock effect and the other is the rotation. Compared the distribution of line-centre velocity grids with the contours of the outflow, the shift is possibly caused by rotation. If we ignore this, the outflow analysis and the core emission intensity will be affected.

Taking the shift into account, we get the wing emission intensity contours. The result shows that, the red lobe is compact. The blue lobe is not as compact as the red one. Nevertheless, a bipolar structure is apparent. Though there are two IRAS sources in this region, the real source that dominates this region is IRAS02310+6133. The outflow parameters are listed in Table1. Column 1 is the distance from us. Column 2 is mean size of the outflows.

Column 3 is its mass. Column 4 is the mass lost rate. Momentum, energy and time scale are listed in column 5, 6 and 7, respectively. Column 8 represents the mean velocity of the outflow. Column 9 is the mechanical luminosity and the force is listed in the last column. Their unit are listed in the second row.

In the core emission contours, two H_2O masers are close to the dominant IRAS source (Zinchenko et al. 1998; Palagi et al. 1993). We can also find that IRAS 02310+6133 is deviated from the core emission peak. Maybe the core is a new star formation region.

The observations show that there are wings in CO $J = 1 - 0$ spectra. Also, there are line-centre velocity shift, which may be caused by rotation. Taken the shift into account, emissions of wings and the core were analyzed. From the wing emission intensity contours, a bipolar structure is apparent and its parameters are calculated. IRAS 02310+6133 is deviated from the core emission peak. Maybe the core is a new star formation region.

Table 1 Parameters of the molecular outflow

D	$R_{\rm mean}$	Mass	$M_{\rm lost}$	P	E	t	v	$L_{\rm mech}$	F
kpc	pc	$M_\odot$	$M_\odot \cdot yr^{-1}$	$M_\odot \cdot km \cdot s^{-1}$	erg	yr	km/s	$L_\odot$	$M_\odot \cdot km \cdot s^{-1} \cdot yr^{-1}$
3.8	2.06	508.1	2.45×10^{-5}	2.52×10^{3}	1.0×10^{47}	5.15×10^{5}	4.98	1.59	3.1×10^{-3}

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References

Comoretto G., Palagi F., Cesaroni R., et al., A&A, 1990, 84,179C
Jiang L., Wu Y., Miller M., CSB, 2001, 46, 1514
Palagi F., Cesaroni R., Comoretto G., et al., A&AS, 1993, 101, 153P
Wu Y., Li Y., Lü J., et al., ACTA Astrophysica Sinica, 1998, 18, 415
Zinchenko I., Pirogov L., Torisevo M., A&AS, 1998, 133, 137