A Mapping Study of High-velocity Gas near Young Stellar Object

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Abstract It is generally believed that during the earliest stages of evolution, stars undergo a phase of very energetic mass ejection, frequently characterized by the occurrence of massive bipolar outflows of molecular gas. The broad molecular emission line is an evidence of high-velocity molecular gas, but it also the evidence of turbulence and rotation. So mapping the region of high-velocity is an effective method to identify the outflows. The Outflows Catalog (Wu et al. 1996) still have some objects that did not mapped. We identified the high high-velocity gas of three outflow candidates with the observation by 13.7m telescope at Qinhai Station. In this paper we present the result and discussion.

1 Introduction

Star formation have many kinetic phases. Molecule outflows are an important phenomenon in the formation process. Observations of the ambient molecular gas accelerated by stellar winds are a powerful means to study the energetic phenomenon in the star formation process (Snell et al. 1990). Particularly, mapping is useful to investigate the property of high velocity gas. In 1985 the first Outflows Catalog is made by Lada, that includes 67 sources, some unmapped. The second catalog is made by Fukui in 1989, that includes 144 sources, all mapped. The third catalog is made by Wu et al.in 1996, that includes 264 sources, 28 unmapped. In 2002, our group try to renew the old Outflow Catalog and the select criterion is all sources must be mapped. We selected three sources from the Outflows Catalog (Wu et al. 1996) which are not mapped and listed in Table 1.

Table 1 Selected sources

NAME	α (1950)	δ (1950)
05379-0757	05:37:56.0	-07:57:390)
LKH α 325	03:25:48.0	30:34:00
RNO131	21:02:24.0	67:55:00

2 Observations

The observation of the J=1-0 transition of CO were obtained with the 13.7 m telescope of Qinghai station of Purple Mountain Observatory from March to May in 2002. The center frequency is 115.271 GHz, and the beam size is $54''$ in corresponding frequency. Point and track precision is better than $10''$. An AOS spectrum meter was used, which has 1024 channels and a total bandwidth of 170 MHz. The data calibration was made with software of Drawspec and protract by Surfer7.0.

3 Results and Discussion

The three sources were detected in CO J=1-0 emission as point sources(Morgan & Bally 1991; Ball & Lada 1983; Cohen 1980). We got the 7X7 point maps, spaced by 54", centered on each of the reference position listed in Table 1. The strategy reduced the chance of missing outflows, since outflow emission is often extended and separated from the driving stellar source (Snell et al. 1990).

Based on our mapping data, we analysed two respects for identifying outflow activity: 1. emission over a large velocity extent must be present. A typical outflow appears as spatially confined wings beyond the emission from the cloud core; 2. the high-velocity emission must be spatially confined to the region near the far-infrared source. The blueshifted and redshifted gas emission intensities are calculated.

1) LKHα 325

This source lies adjacent to IRAS 03257+3034. And it is at a distance of 0.5 kpc. CO spectra have a velocity extent of 13 km/s. We didn't get an obvious outflow structure either.

2) 05379-0757

This is an IR source that lies adjacent to another IRAS 05379-0758. And it is at a distance of 0.5 kpc. From the CO spectra we can see a velocity extent about 9.1 km/s. We made contours of integrate CO emission to both core and in blue and red line wings. Although we can see the obvious line wings in spectra, we did not get a visible outflow component in these maps.

3) RNO131

This source lies adjacent to IRAS 21023+6754. The CO spectra velocity extent are about 14 km/s. We may get an outflow component in the northeast. Because the center of the component seem to out of our grid map, we can not confirm that it is really an outflow.

We check the environment of the three sources by Simbad and find that there are a few IR sources around the 05379-0757. We think that there would be a star cluster and the environment is complicated that we can not detect a visible outflow structure. And the environment of LKHα325 is clean, maybe this region is in an early phase that do not have outflows. Toward RNO131 we need to map a larger region to identify the outflow component in the northeast in the future.

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