The Dynamic of Molecular Gas of NGC 7538 IRS 1 in 345 GHz Using SMA

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Abstract:

The NGC7538 IRS1 is a hyper-compact HII region located in Perseis at 2.65kpc. The luminosity of IRS1 is around $10^5\ L_\odot$, suggesting it embeds the O6 star. Previous the outflow, magnetic structure, and abundant molecular line have been studied. The P-Cygni and inverse P-Cygni profiles have shown in different lines, associated with distinct dynamics structures. We present 345GHz. SMA observation with high spatial (≈ 1000 AU)and frequency($0.72\mathrm{km/s}$) resolution. The seven sources have been detected as larger than 4σ. One of the brightest source is called MM1, identifying the strength of molecular lines like CH_3CN ,CH_3OH.

Introduction:

NGC 7538 IRS 1, embedding the O6/7 star, is a hyper-compact HII region located in Perseis at 2.65kpc. (Moscadelli et al 2009) .It's system velocity is $-59.5\mathrm{km/s}$. (Lei Zhu et al 2013) Previous studies have explored outflow, magnetic fields of spiral-arm-like structures, and gas dynamics in 230GHz. (Keping Qiu et al 2011; Lei Zhu et al, 2013; P.Frau et al 2014) This region is identified as a hot molecular core, indicating the abundance of molecular lines, making it an excellent trace for investigating high-mass star formation mechanisms. An inverse P-Cygni profile has been identified in MM1 using SMA and PdBI, suggesting an infall structure.(Lei Zhu et al, 2013; S.Feng et al, 2016) The high spatial resolution and high-frequency observations help trace the inner density structure to help our further understanding of the high mass star forming process.

Observations and data reduction :

The SMA observed NGC 7538 IRS 1 on 2011 Oct 24 and Sep 05 in compact and very-extended configurations (PI: Vivien Huei-Ru Chen). The phase center was J2000 = 23:13:45.36, 61:28:10.2. The local oscillator was set to 343.1 GHz with a spectral resolution of 0.81 MHz. Data were reduced with IDL MIR, and gain calibration and imaging were performed in MIRIAD. A combined-configuration continuum was used for self-calibration, with gains applied to molecular line data. UVLIN was used to separate line emission in u,v space.

Result :

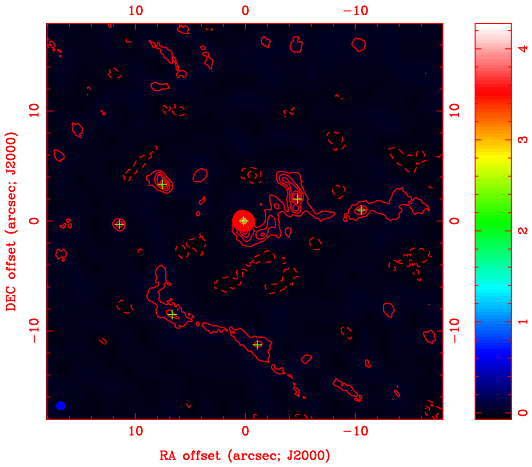

Figure 1: The 345 GH continuum map with $0.72'' \times 0.67''$.contour=[-6,-4,-2, 2,4,...,18,30,40,...,100,125,150,200,300,400,500]*
$\sigma_{rms} = 14.1$ mJy/beam

Source	R.A. (h:m:s)	Decl. (d:m:s)	I_ν^{Peak} (Jy beam^{-1})	S_{int} (Jy)	FWHM ($''\times''$)	M ($M_\odot$)	N_{H2} ($10^{23}cm^{-2}$)	n_{H2} (10^6cm^{-3})
MM1	23:13:45.38	61:28:10.21	4.57	4.98	0.83 × 0.30	0.43	5.9	9.2
MM2	23:13:44.70	61:28:12.2	0.333	0.99	0.27 × 0.18	10.3	36.9	1.39
MM3	23:13:46.416	61:28:13.54	0.352	0.48	0.48 × 0.15	6.5	18.8	5.53
MM4	23:13:43.89	61:28:11.19	0.143	0.52	0.15 × 0.09	0.03	7.0	47.9
MM7	23:13:45.21	61:27:58.95	0.105	0.29	0.26 × 0.15	0.10	9.2	36.2
MM12	23:13:46.29	61:28:01.70	0.124	0.495	0.26 × 0.15	0.10	9.2	36.2

Table: continuum emission parameters

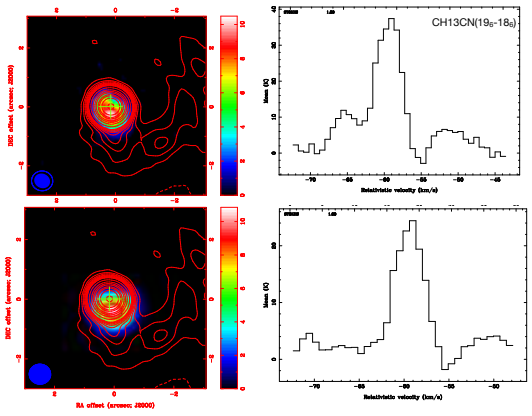

Figure 2: The Integrated intensity map and line profile of CH3CN and CH3OH

Future:

The physical properties of the molecular gas and analyze its dynamical structure.

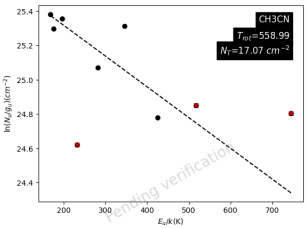

Figure 3: The rotation diagram of CH3CN

References:

P.Frau et al, 2014, A&A, 567, A116
Keping Qiu et al, 2011, ApJ, 728, 6
Lei Zhu et al, 2013, ApJ, 779, 51
S.Feng et al, 2016, A&A, 593, A46
Moscadelli et al, 2009, ApJ, 693, 406