The environment of G345.0061+01.794B HC HII region

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How high-mass stars keep accreting?

Theoretical works have shown that under steady spherical accretion, radiation pressure inhibits the growth of the protostars. An effective way to circumvent the radiation and ionized gas pressure is accretion from a disk, allowing the accreting material to reach the young high-mass stars much more easily by flowing inward, mainly through the plane perpendicular to the angular momentum vector of the system [1]. Accretion through a disk may only choke the ionized region near the disk plane, allowing for H II region development in the polar regions [2]. In this scenario, an HC H II region should consist of an ionized biconical cavity confined by a rotating and contracting hot molecular core.

Molecular gas

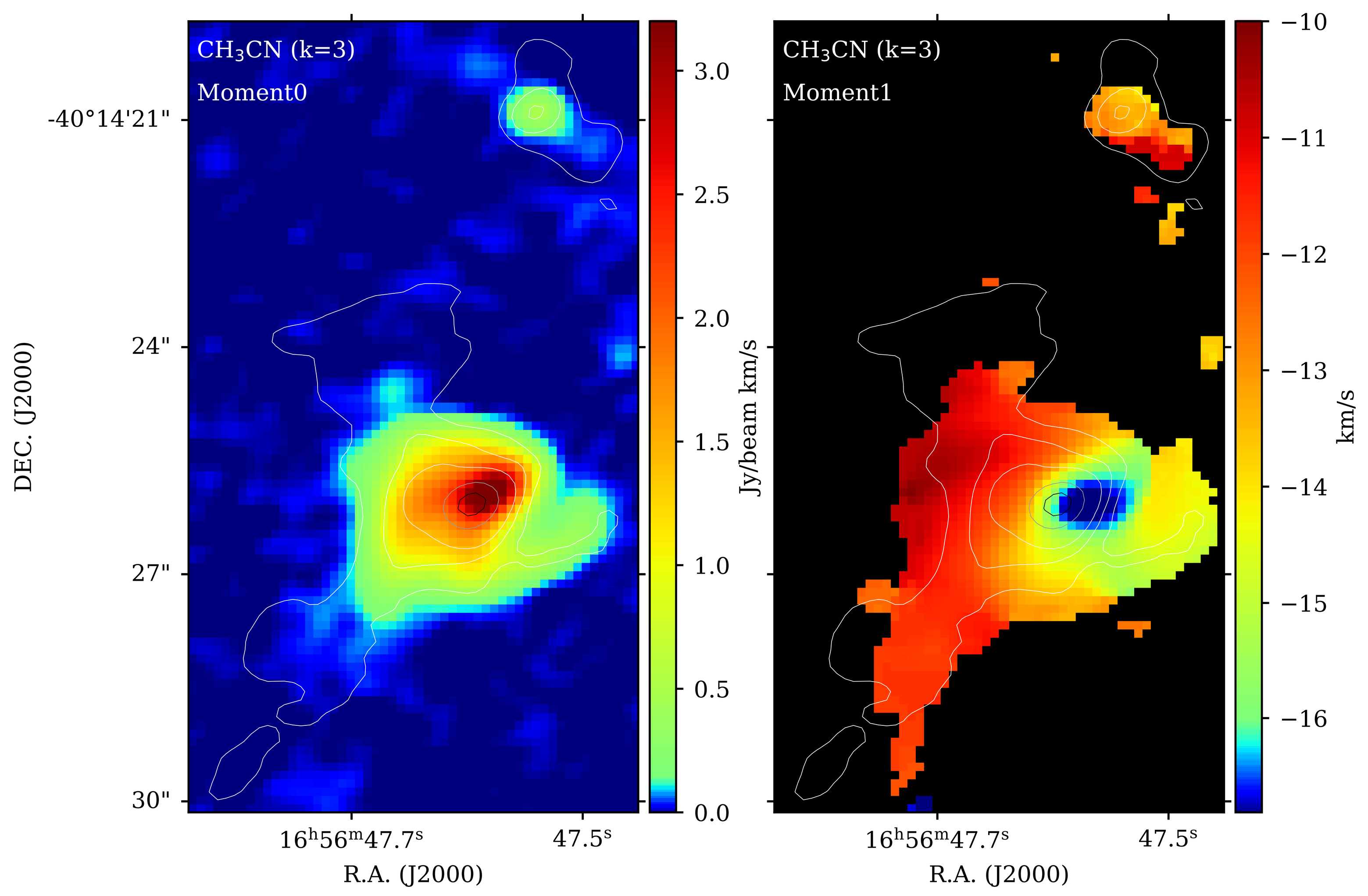

Figure 1:Images of the velocity integrated line emissions (left panel) and moment one images (right panel) of the K=3 transition of $\mathbf{CH_3CN}$ along with the dust continuum contours. The first-order moment image show a velocity gradient from NE to SW with average velocities preferentially blueshifted in the SW side and redshifted in the NE side of the source, and a spot of blueshifted emission towards the peak of the zero-order moment. The blue spot signature is presented in all K components of $\mathbf{CH_3CN}$ and $\mathbf{SO_2}$ (30-30 and 32-32) emissions as well.

Ionized gas H29α line emission

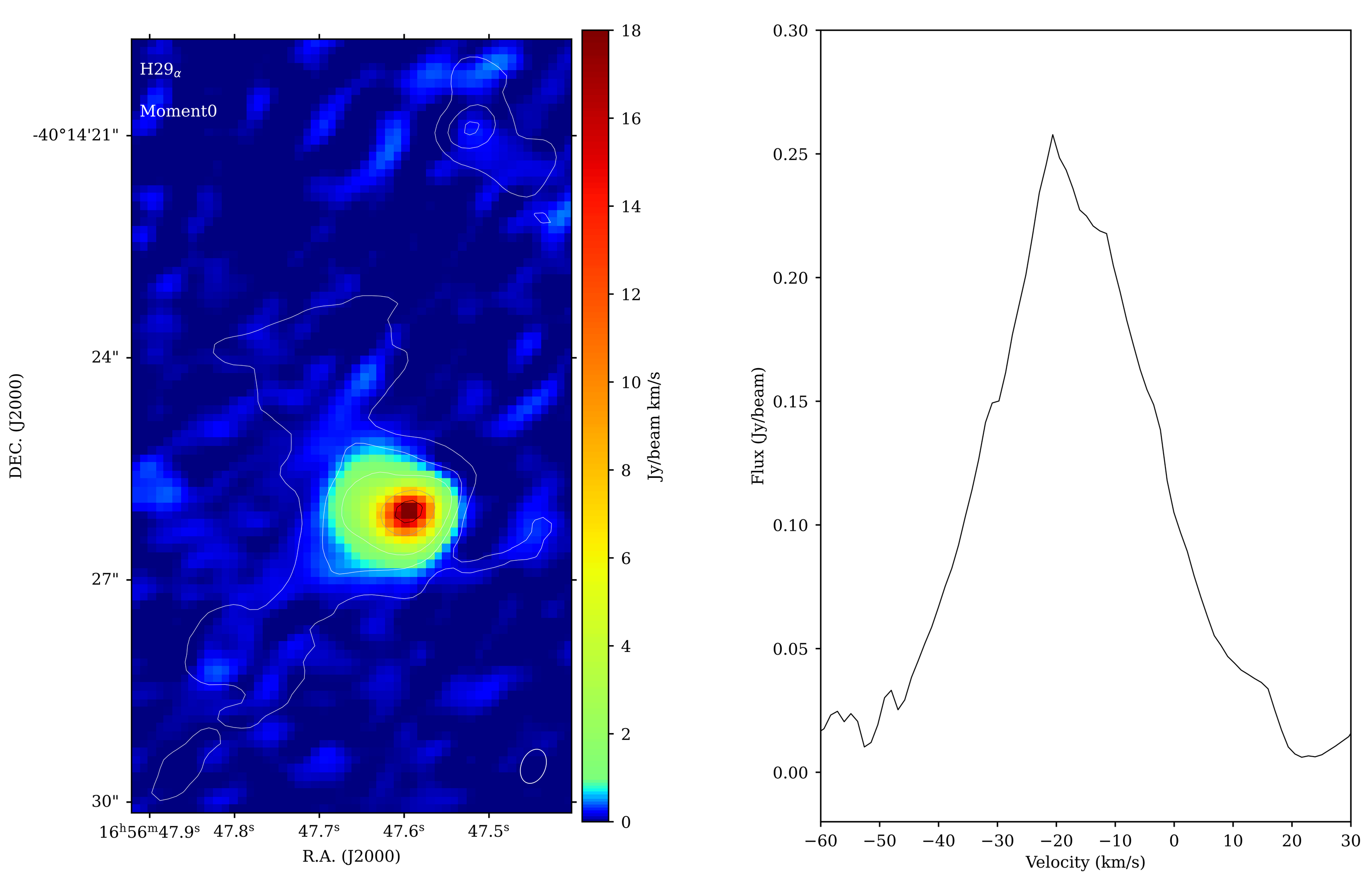

Figure 2:Left panel: image of the velocity integrated H29α emission along with the dust continuum contours. The velocity range of integration is from -44 to 8 km s^{-1}. The velocity integrated line emission is reaching up to 18.7 Jy/beam km s^{-1} at the peak positions which is coincident with dust continuum. Right panel: spectrum of the RRL emission integrated over the source.

ALMA Observations

Table 1:Observational parameters. The phase center of the array was (RA, Dec) (J2000) = ($16^h56^m47^s$, -40°14′25).

SPW	Center Freq. (GHz)	Bandwidth (GHz)	Vel. res. (km s^{-1})
H29α	256.302035	1.875	1.320
$\mathbf{SO_2}$ v=0 30(4,26)-30(3,27)	259.599448	0.23438	0.564
$\mathbf{SO_2}$ v=0 32(4,28)-32(3,29)	258.388716	0.23438	0.566
$\mathbf{CH_3CN}$ v=0 14-13 ladder	257.325000	0.46875	0.569

Rotational Temperature

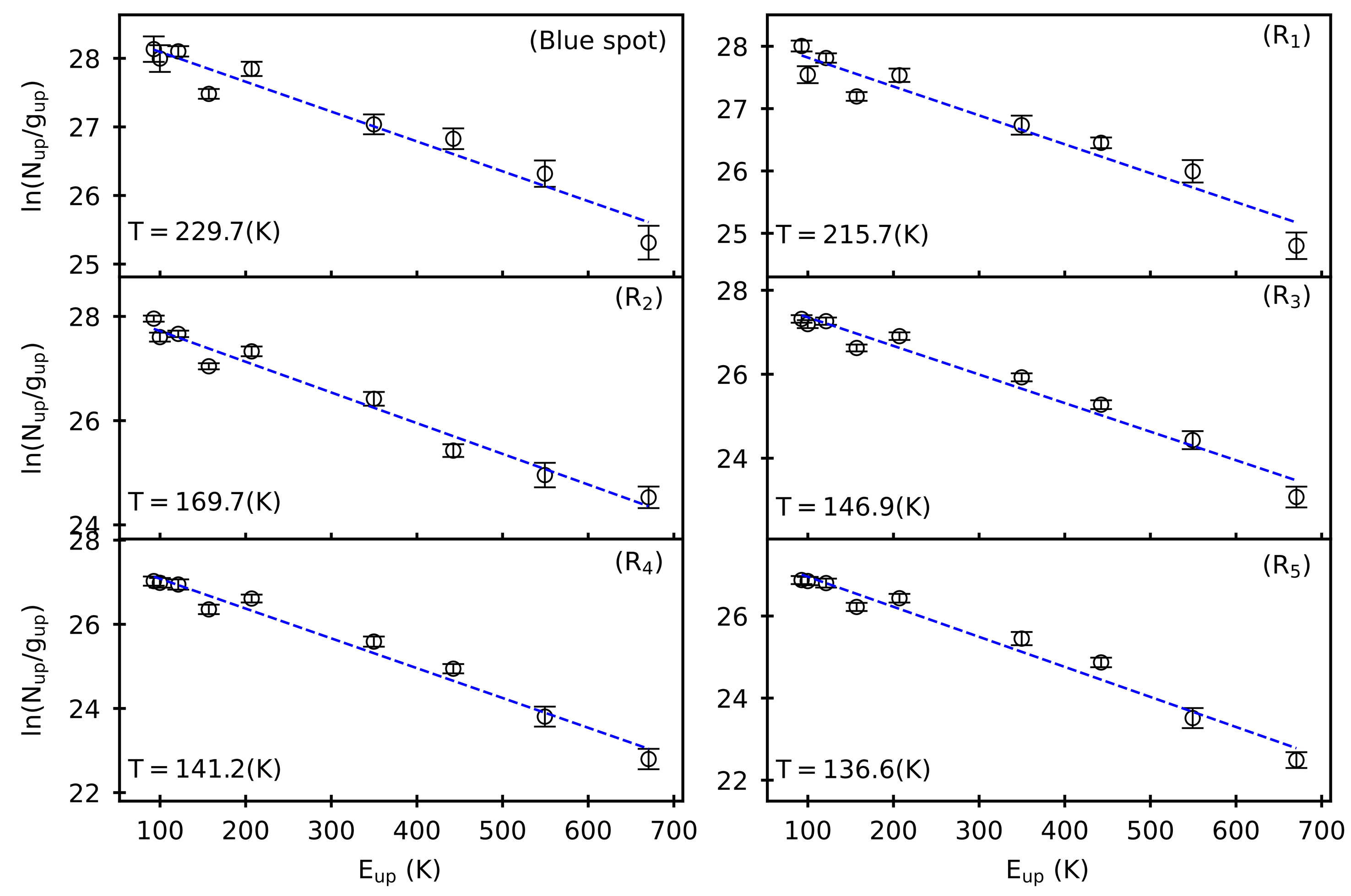

Figure 3:Rotational diagrams derived from the peak position (blue spot), and in halp-rings going from the peak position towards the South-East (diameters at angles of -45 degrees) with different radial radius (R_1, R_2, R_3, R_4 and R_5) from the peak position.

Infall motions

The blue spot feature can be taken as a signature of infall [3]. The central region of the first-order map appears blueshifted because of the higher weight of the strong blueshifted emission. Additionally, the integrated intensity, (zeroth-order moment) peaks toward the central position. At larger distances from the center, the integrated intensity decreases, the blue and redshifted intensities become similar, and the intensity-weighted mean velocity approaches the systemic velocity of the cloud. Therefore, the first-order moment of an infalling envelope is characterized by a compact spot of blueshifted emission toward the position of the zeroth-order moment peak.
The clear detection of the 'central blue spot' signature in G301.01 HC H II region indicates that infall motions play a fundamental role in the gas kinematics of this source.

References

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