An **SMA** and **HERSCHEL** view of the HMSFR **G23.01-0.41**

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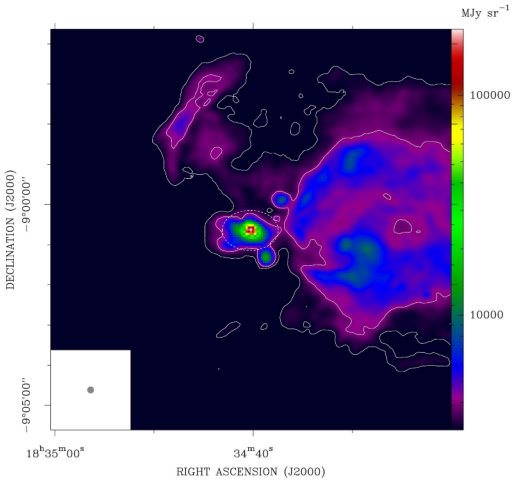
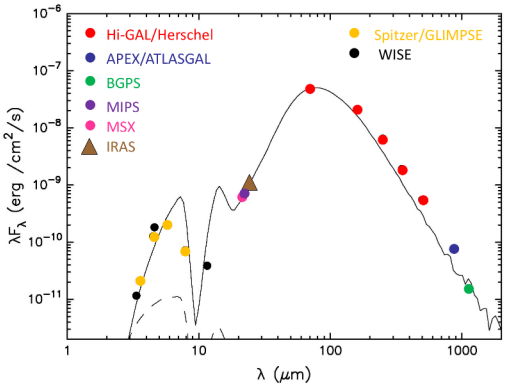
We present here the results of our recent SMA observations at 1.3 mm toward the high-mass star-forming region (HMSFR) G23.01-0.41, with both the most extended and compact array configurations, providing sub-arcsecond and high sensitivity maps for different molecular lines (e.g., ^{12}CO and isotopomers, SiO, CH_3CN, and CH_3OH). We also complement this dataset with the spectral energy distribution (SED) between 3.4 μm and 1.1 mm (**upper right panel**) and the continuum images from the Hi-GAL/Herschel survey (**upper left panel**). The aim of these observations is twofold: 1) to image at high angular and spectral resolution the flattened, hot molecular core (HMC) detected toward G23.01-0.41, which contains strong masers and a radio continuum source (**bottom panels**); 2) to compare the spatial distribution and velocity field of the gas close to the central YSO with those of the associated molecular outflow (**middle panels**). The dust and molecular line emission trace a flattened structure inside a radius of 8000 AU from the center of radio continuum and maser line emission in the region. The equatorial plane of this HMC is strictly perpendicular to the main elongation of the outflow emission onto the plane of the sky, which extends over a 10 times larger region (~0.5 pc). The inner velocity field mapped with the CH_3CN (12_K-11_K) lines outlines that ***molecular gas rotates about the outflow axis and is simultaneously dragged along the outflow direction*** indicating Hubble-law expansion. The IR SED from the HMC suggests the presence of a single **O9.5 ZAMS star** with a mass **~19 Mo,** consistent with the mass required for centrifugal equilibrium.

An Infrared view toward the HMC



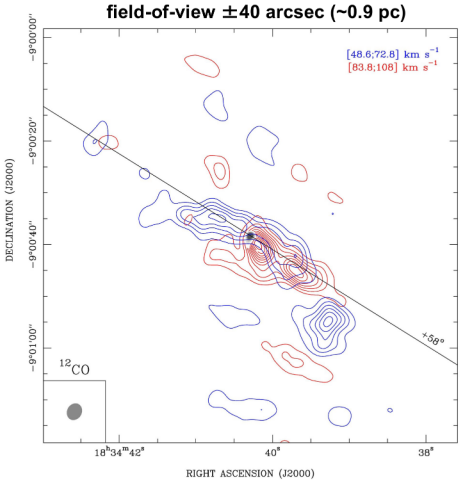
LEFT PANEL. Parsec-scale structure of the G23.01-0.41 star-forming region at the wavelength of 70 μm obtained with the PACS camera on board of the Herschel satellite. Beam and map units are given in the bottom left corner and the right-hand wedge, respectively.
The outflow (middle panels) and the HMC emission (bottom panels) arise from the brightest peak at the center of the plot (dashed box).

RIGHT PANEL. SED within the dashed box in the left panel, from 3.4 μm to 1.1 mm. Dots (triangles) indicate measurements (lower limits) from different IR facilities available to date. The SED was fitted with the radiative transfer model by Robitaille et al. (2007, ApJS 169, 328). The solid black line indicates the best-fitting model.
The best-fit values for the bolometric luminosity and envelope mass are 3.9×10^4 Lo and 1.4×10^3 Mo.



Outflowing gas from the HMC

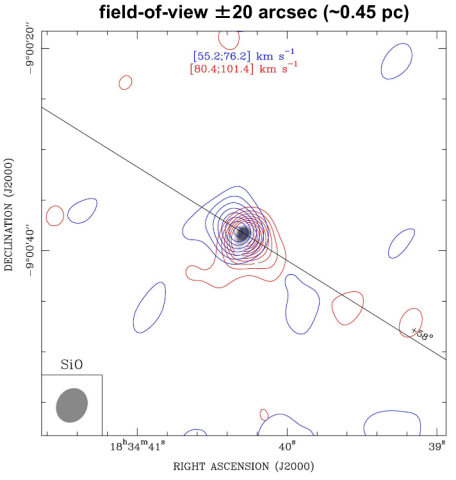
field-of-view ±40 arcsec (~0.9 pc)



LEFT PANEL. Integrated emission of the ^{12}CO(2-1) line observed with the compact configuration of the SMA. The velocity ranges of integration (top right) are symmetric w.r.t. the systemic velocity of the HMC. Contours start at 3σ by 2σ steps for the red- and blue-shifted wings.
At the center of the field is the 1.3 mm continuum (grey scale). The NE-SW line draws the direction of the outflow as inferred from the inner HMC tracers.

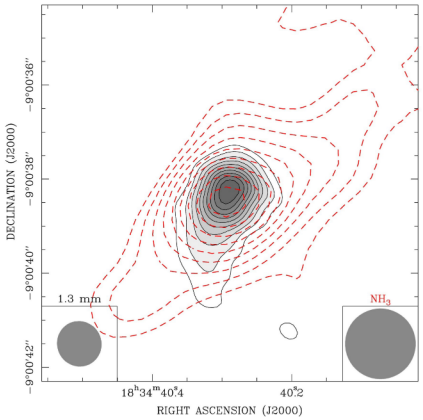
RIGHT PANEL. Similar to the left panel but for the SiO (5-4) line emission and with a zoom of 2 times the field of view. Contours start at 3σ by 2σ steps for both the red- and blue-shifted wings.
The SiO maps trace a bipolar, Hubble-law, expansion aligned with the NE-SW direction of the CO outflow, within 0.15 pc **from the dust continuum peak.**

field-of-view ±20 arcsec (~0.45 pc)



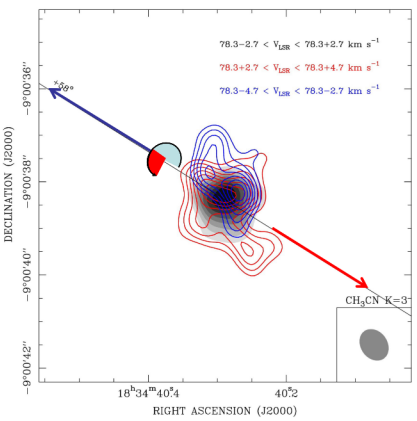
Inside the Hot Molecular Core

field-of-view ±4 arcsec (~0.09 pc)



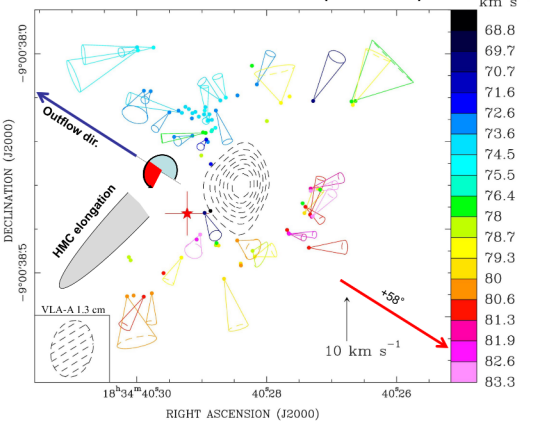
SMA map of the **1.3 mm continuum** emission from the combined Compact and VEX configurations (grey scale), superposed to the VLA-C **NH_3 (3,3)** map (red dashed) obtained by Codella et al. (1997, A&A 325, 282). Contour levels start from 5σ by 3σ for the 1.3 mm map and from 3σ by 1σ steps for ammonia.

field-of-view ±4 arcsec (~0.09 pc)



Moment-0 map of the **CH_3CN (12_3-11_3)** line integrated over its FWHM in three velocity ranges, to underline the spatial distribution of the bulk emission (grey) and the red- and blue-shifted wings from the core. Contours start at 3σ by 1σ steps. **The NE-SW line shows the outflow direction and rotation pattern.**

field-of-view ±0.4 arcsec (~ 2000 AU)



3D gas kinematics (cones) from the **6.7 GHz CH_3OH masers** within ~ 2000AU from the dust continuum peak (red star & 1σ). The right wedge gives the scale of the line-of-sight velocity and the bottom arrow that on the sky plane. Dashed contours draw the **1.3 cm continuum** emission (**Sanna et al. 2010, A&A 517, A78**).