Resolving the Chemical Substructure of Orion-KL

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Summary

Combing observational data from the Submillimiter Array (SMA) and IRAM 30m telescope (Fig.2) , we obtain the chemical structures of Orion-KL with a spatial resolution of 4″. The spectra (Fig.4) allow us to derive the column densities, the abundances (Fig.6), and the spatial distribution for different species. These chemical properties vary significantly in the area of Orion-KL(Fig.3). Moreover, the unbiased spectral scans in our combined dataset offer us the opportunity to detect weak Complex Organic Molecules (COMs) (Fig.5).

Data

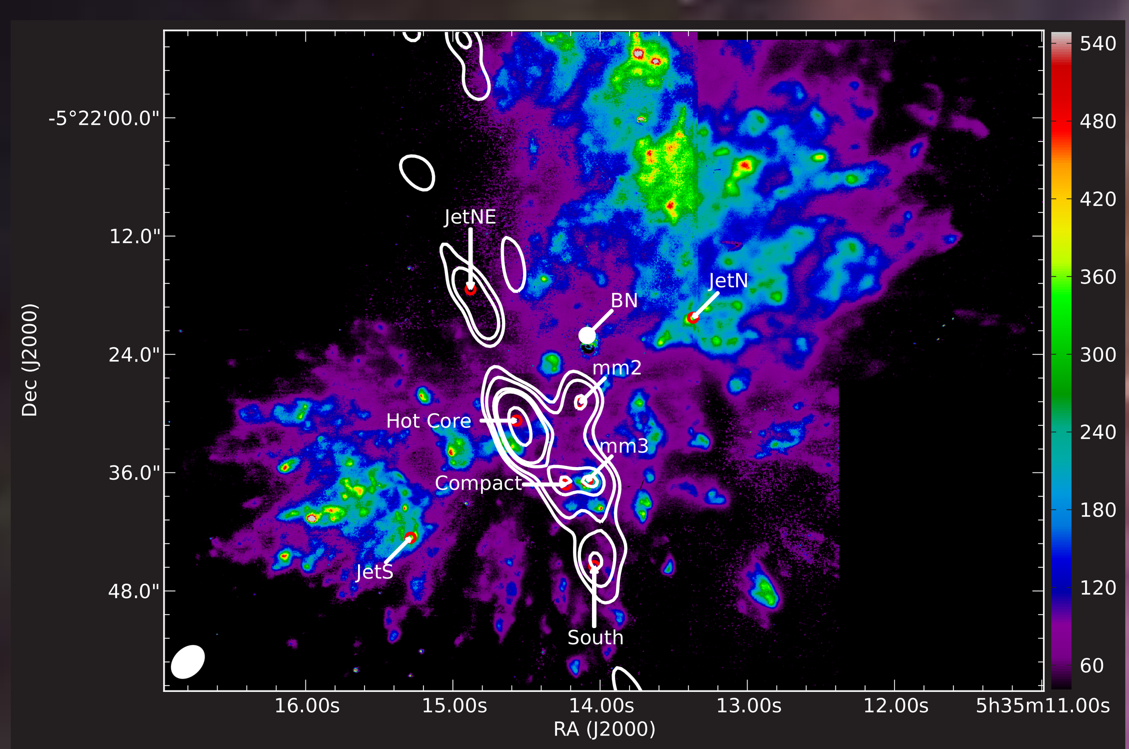

Fig.1 .The color scale presents the shocked H_2 emission[2], the contours show the SMA 230GHz continuum emission at 6σ, 10σ, 20σ, 30σ and 60σ levels. Red circles mark the peaks of hot core, compact ridge, mm2, mm3, the southern ridge, northern and southern parts of the high−velocity jet, as well as the northeastern part of the low−velocity jet.

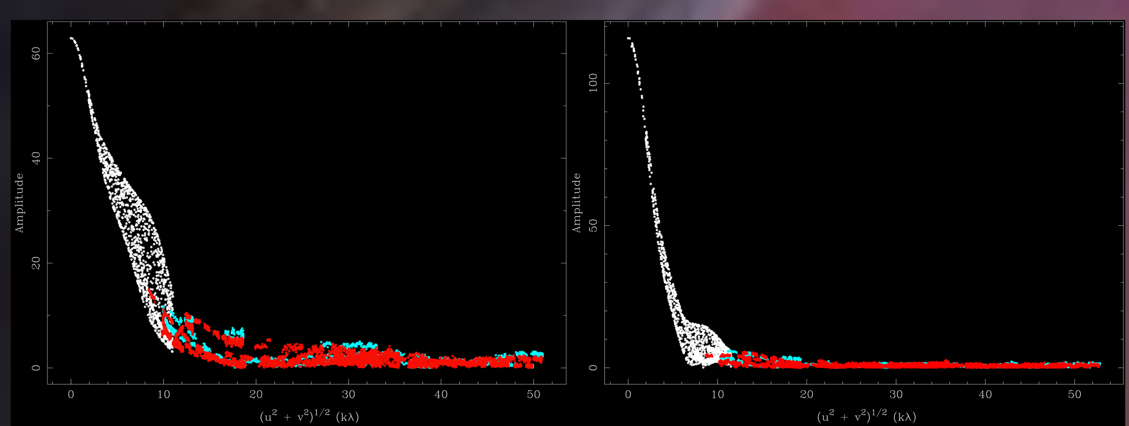

Fig.2 . The amplitude vs. projected baseline from uvcoverage plots show the successful combination of the interferometer and single dish data from the upper side-band (left) and the lower side-band (right).

- The interferometer data can disentangle chemical components at high spatial resolution;
- With the single dish, we can compensate the "missing short data" problem from the interferometer, thus obtain the total flux density.

References

[1] S.Y., Feng, H.Beuther, et.al, Resolving the chemical substructure of Orion-KL (*in prep.*)

[2] Nissen, H.D, Gustasson, M., Lemaire, J.L., et.al, 2007, A&A, 466,949

Acknowledge

We acknowledge the financial support by LASSIE FP7 Marie Curie Initial Training Network (ITN).

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Results

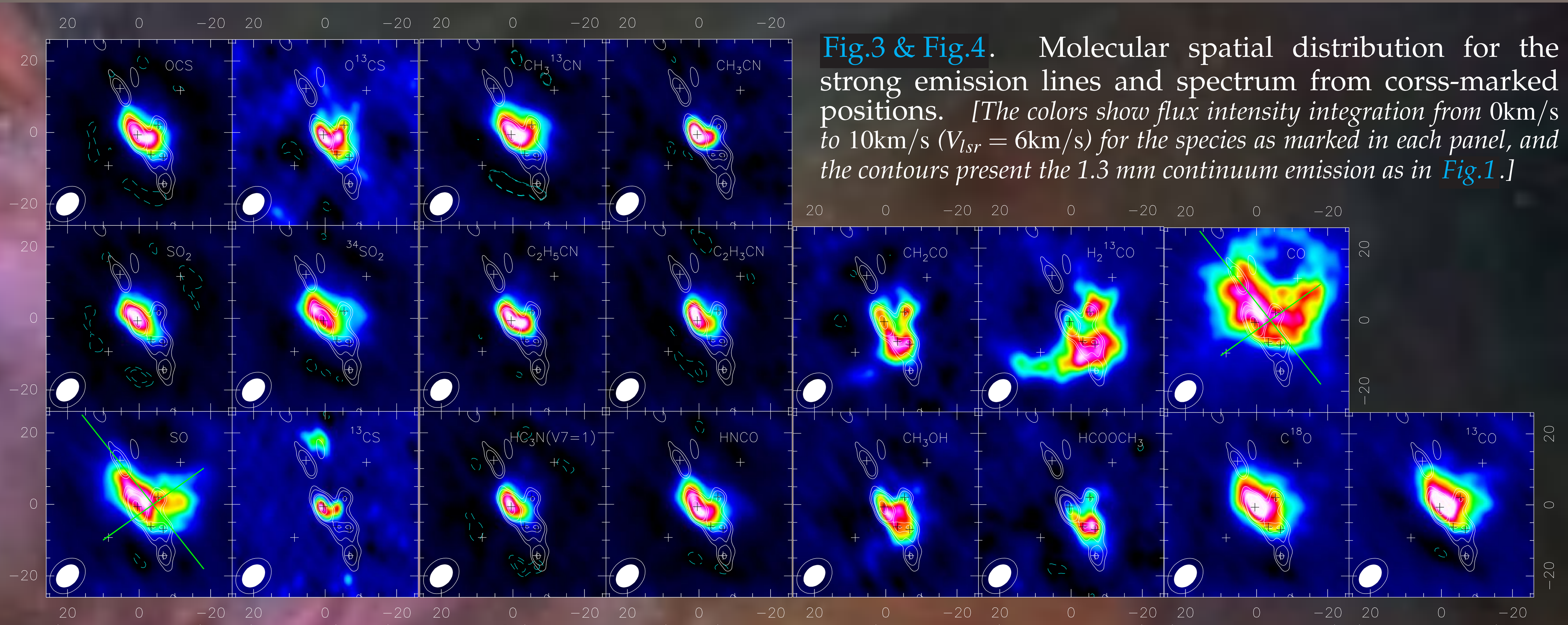

Fig.3 & Fig.4. Molecular spatial distribution for the strong emission lines and spectrum from corss-marked positions. *[The colors show flux intensity integration from 0km/s to 10km/s (V_{lsr} = 6km/s) for the species as marked in each panel, and the contours present the 1.3 mm continuum emission as in Fig.1.]*

N-bearing molecules peak at hot core, S-bearing and carbon monoxide species have extended emission, while saturated COMs have peaks either at hot core or compact ridge.

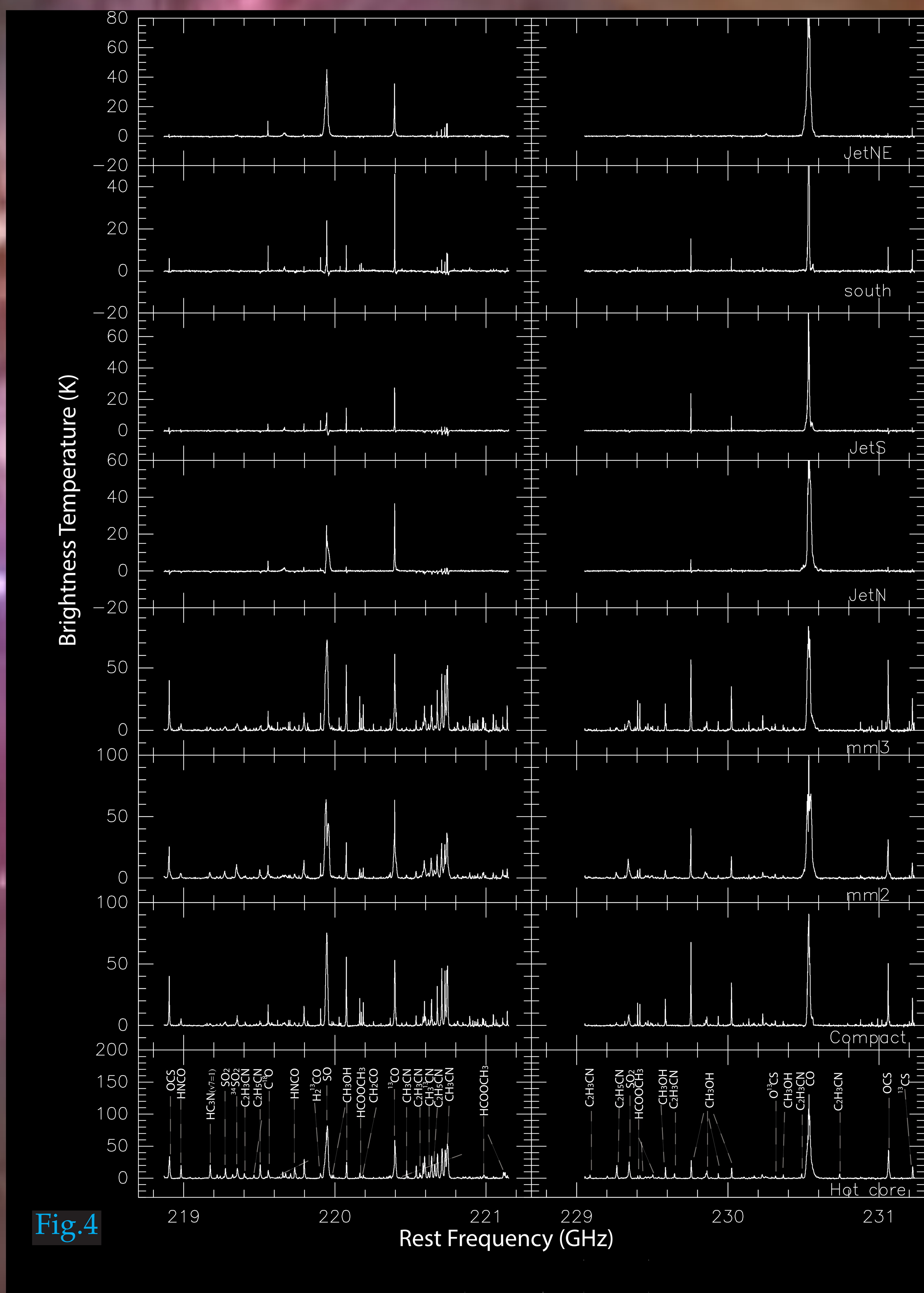

Fig.4

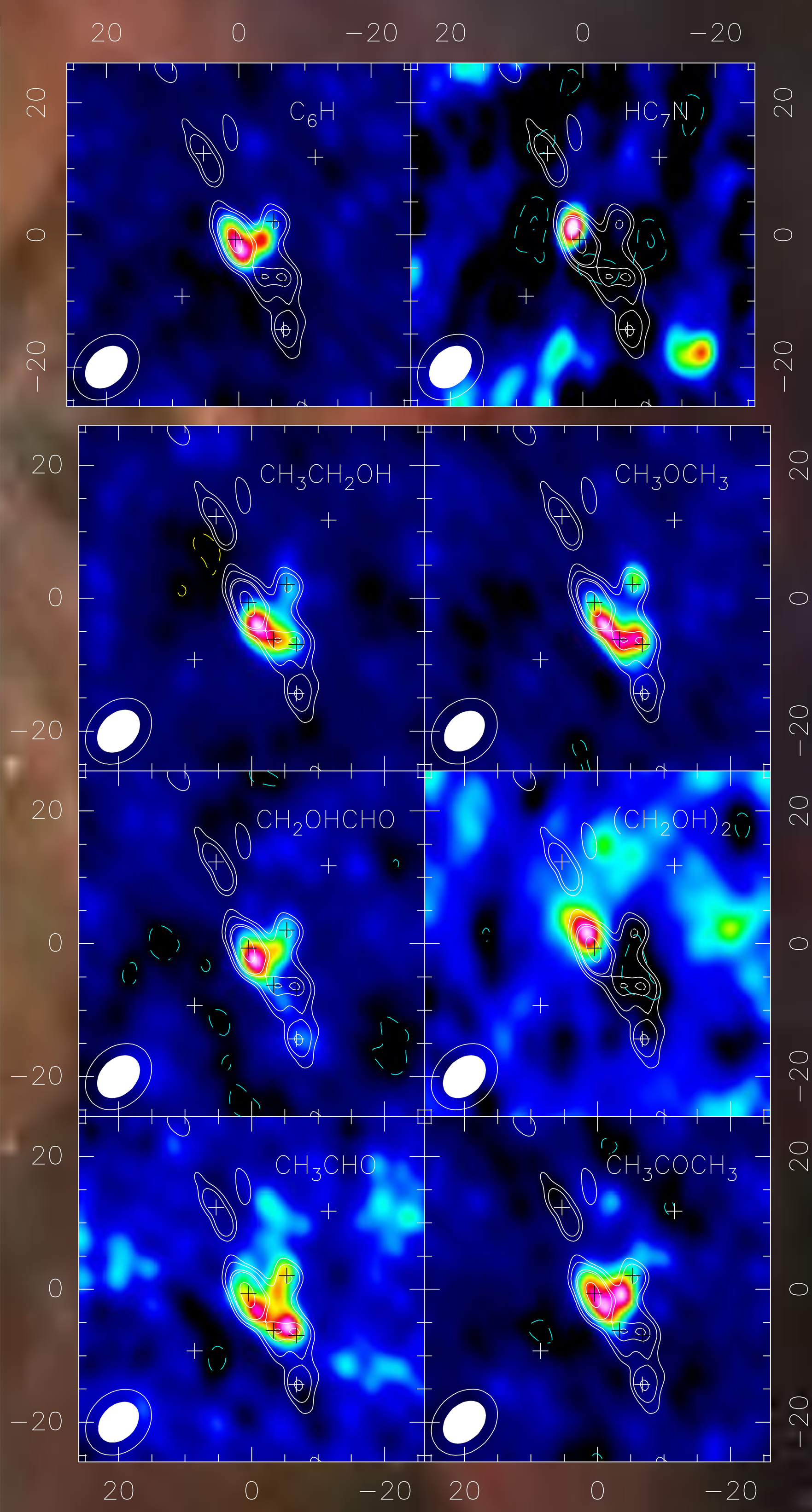

Fig.5 . Spatial distribution for the identified (CH_3COCH_3, CH_3CH_2OH, CH_3OCH_3) and tentative [HC_7N, C_6H, CH_2OHCHO, CH_3CHO, $(CH_2OH)_2$] COMs.

The colors show flux intensity integration from 0km/s to 10km/s (V_{lsr} = 6km/s) for the species as marked in each panel, and the contours present the 1.3 mm continuum emission as in Fig.1.

Calculation

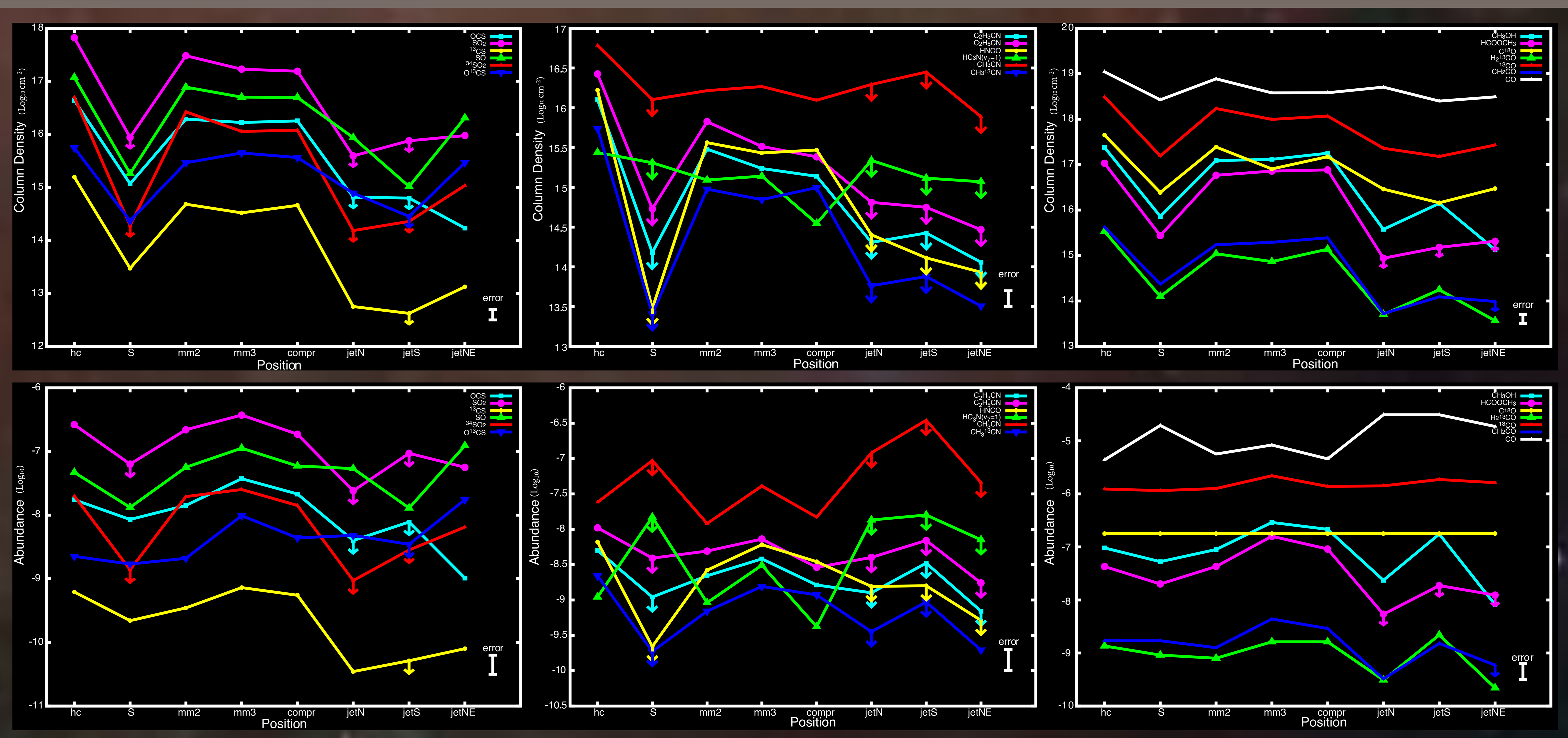

Fig.6 . Column density and abundance with respect to H_2 for different species, from cross-marked regions in Fig.3 .