GLYCOLALDEHYDE IN PERSEUS YOUNG SOLAR ANALOGS

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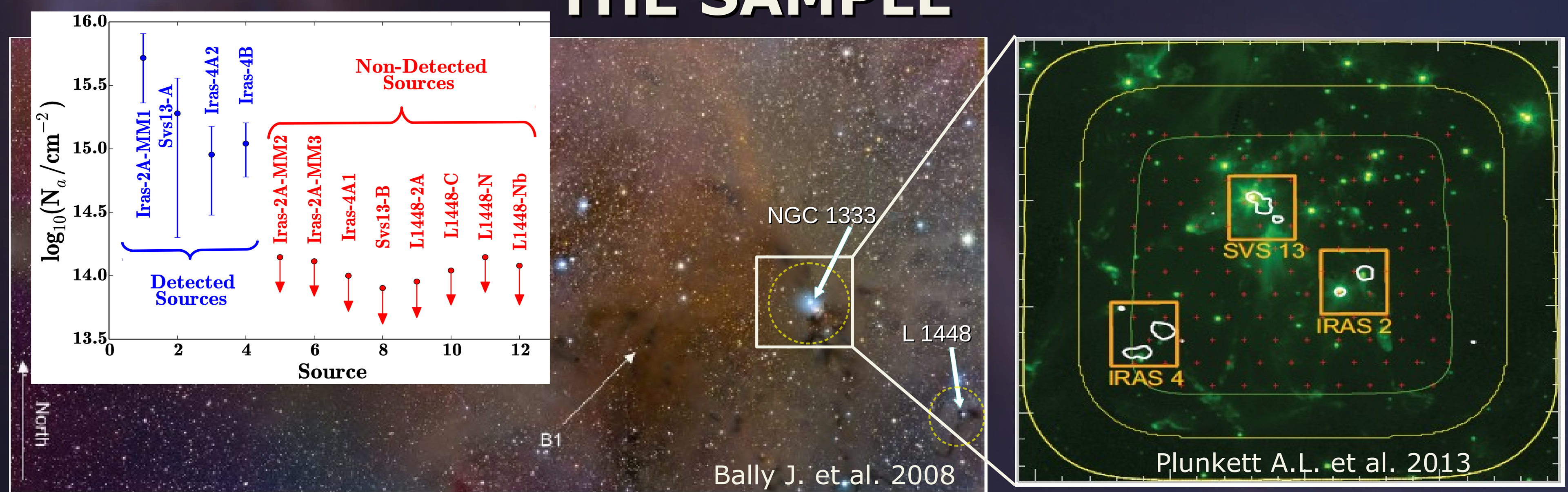
ABSTRACT

Glycolaldehyde ($HCOCH_2OH$) is the simplest sugar and it is expected to be a precursor of ribose, an RNA component; it is playing a major role in the prebiotic chemistry in low-mass star forming regions from the astro-biological perspective. As part of the CALYPSO (http://irfu.cea.fr/Projects/Calypso) survey with the PdBI (NOEMA) interferometer, we have obtained high angular resolution (≤ 1”) spectral maps at 1.3 mm and 1.4 mm of 12 Solar-mass Class 0 protostellar systems in L1448 and NGC-1333 regions in Perseus. This deep survey led to the detection of a large number of lines emitted by complex organic molecules in several sources: our analysis was based on the searching of Glycolaldehyde emission. Preliminary results: (i) 4 (33%) of 12 individual sources show $HCOCH_2OH$ emission; (ii) we detect several lines covering a large spread in excitation (30 to 370 K); (iii) The bulk of the emission seems to be consistent with a single temperature LTE emission (~100-200 K). Our results suggest that the Glycolaldehyde emission is confined to a limited region of the inner envelope where the gas temperature is sufficiently high to evaporate the ice mantles. Our preliminary analysis shows also that the $HCOCH_2OH$ gas phase abundance relative to molecular hydrogen has a spread of a factor of ~10 among the detected sources.

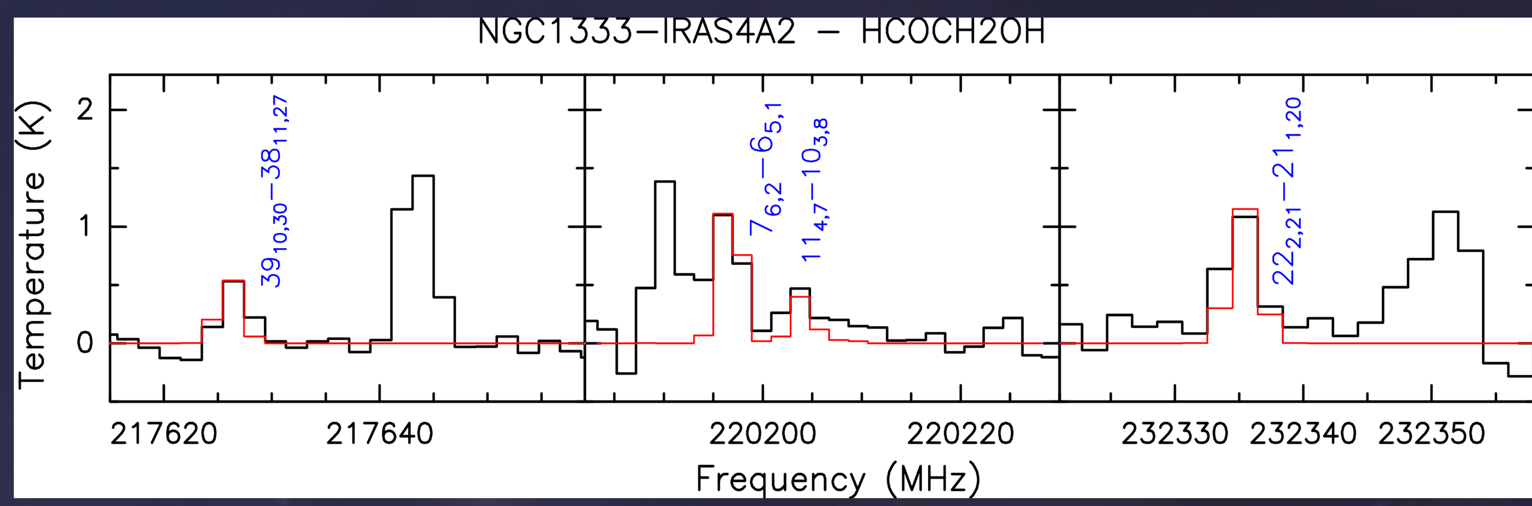
THE SAMPLE



We searched for Glycolaldehyde ($HCOCH_2OH$) emission in 12 Class 0 protostars located in L1448 and NGC1333 regions, within the Perseus molecular cloud at 235 pc from the Sun. We detected Glycolaldehyde emission in 4 of the sources, which represent 33% of the total sample: it is the first systematic study in a complete star formation region.

Glycolaldehyde detected in 1/3 of the sample

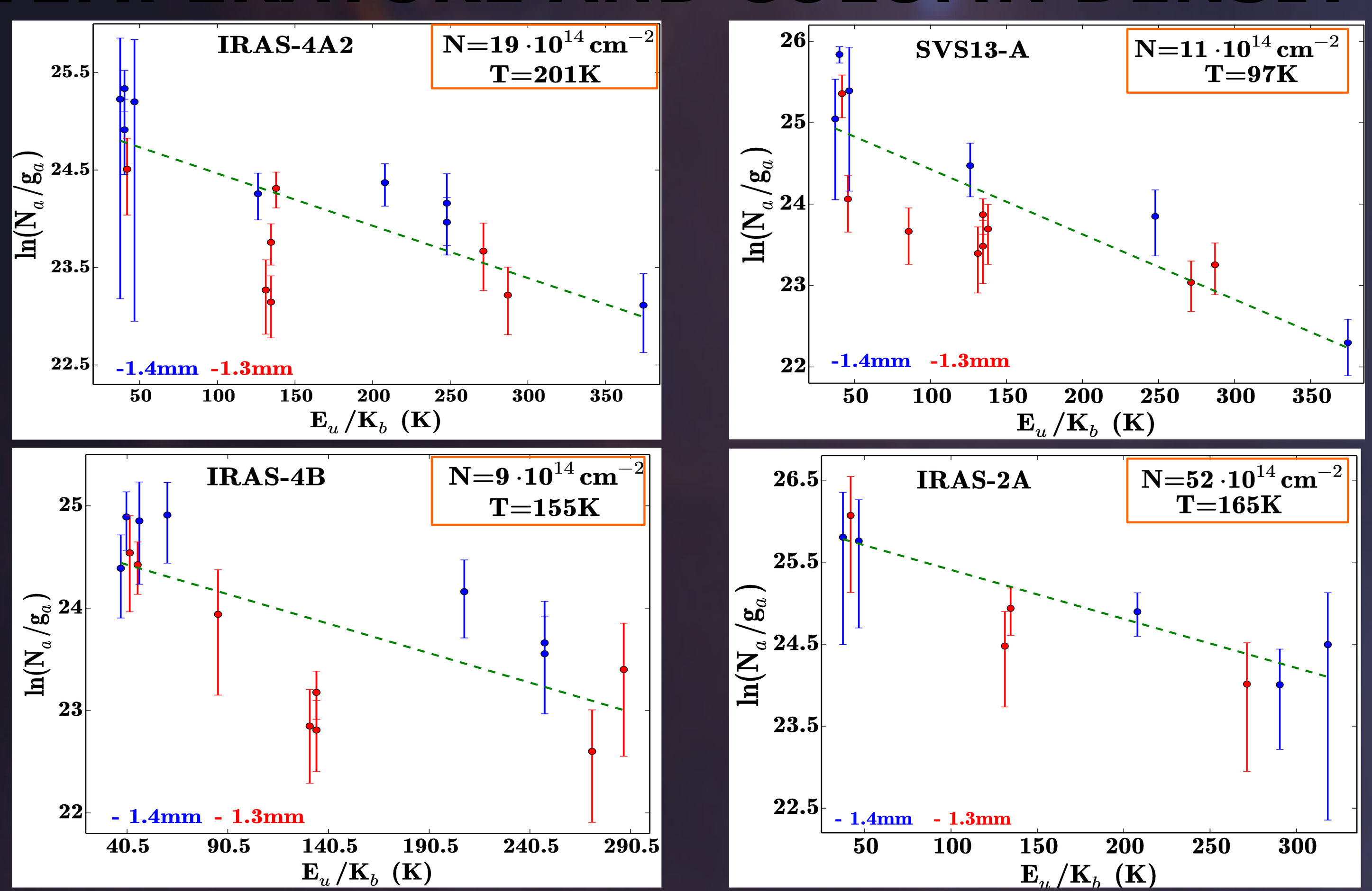
TYPICAL SPECTRA



Examples of Glycolaldehyde lines toward the protostar IRAS-4A2 (in black). The red lines show the model spectra simulated by WEEDS within the CLASS/GILDAS package (see [7]). The blue labels mark the identified $HCOCH_2OH$ transitions.

Glycolaldehyde confirmed by the detection of several lines in each source

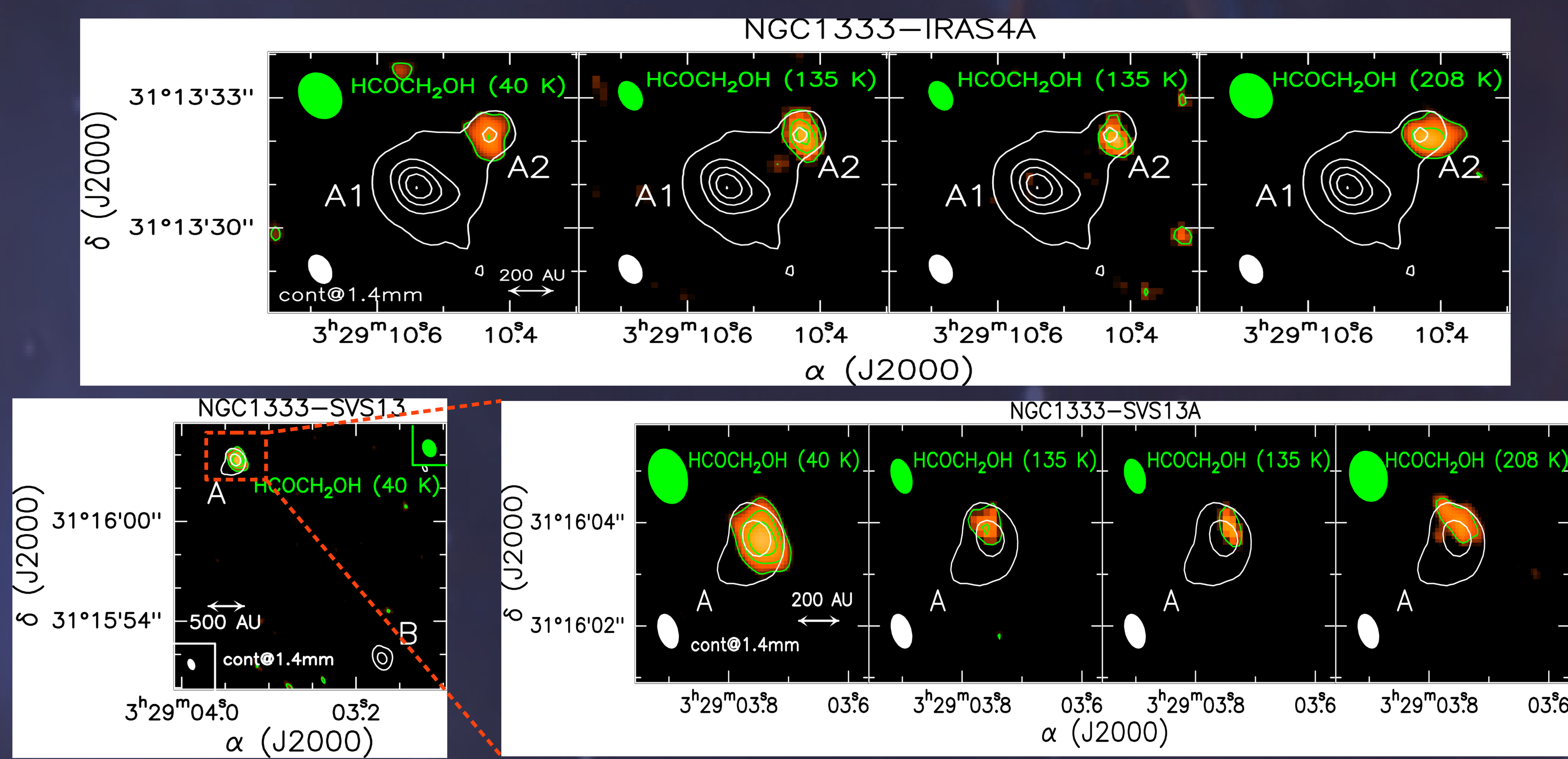
TEMPERATURE AND COLUMN DENSITY



Only the simultaneous fit of all the COMs emission will allow us to properly derive the N and T of Glycolaldehyde. However, our rotational diagrams show that a single temperature and optically thin emission seem to fit the data. This findings suggest that Glycolaldehyde emission is spatially confined in the inner envelope, where we can have the sublimation of grain ice mantles.

Glycolaldehyde emission is well fit by a single rotation temperature

SPATIAL DISTRIBUTION



Spatial distribution of Glycolaldehyde emission toward IRAS-4A and SVS13 at several frequencies related to a range of excitation energies. **Top:** IRAS-4A. We can see the presence of $HCOCH_2OH$ (green lines) only in one of the two sources. The white contours show the continuum emission. **Bottom**: SVS-13. In the left panel we show the two sources located in this region; only in one we detect the emission, shown in the right bottom panel.

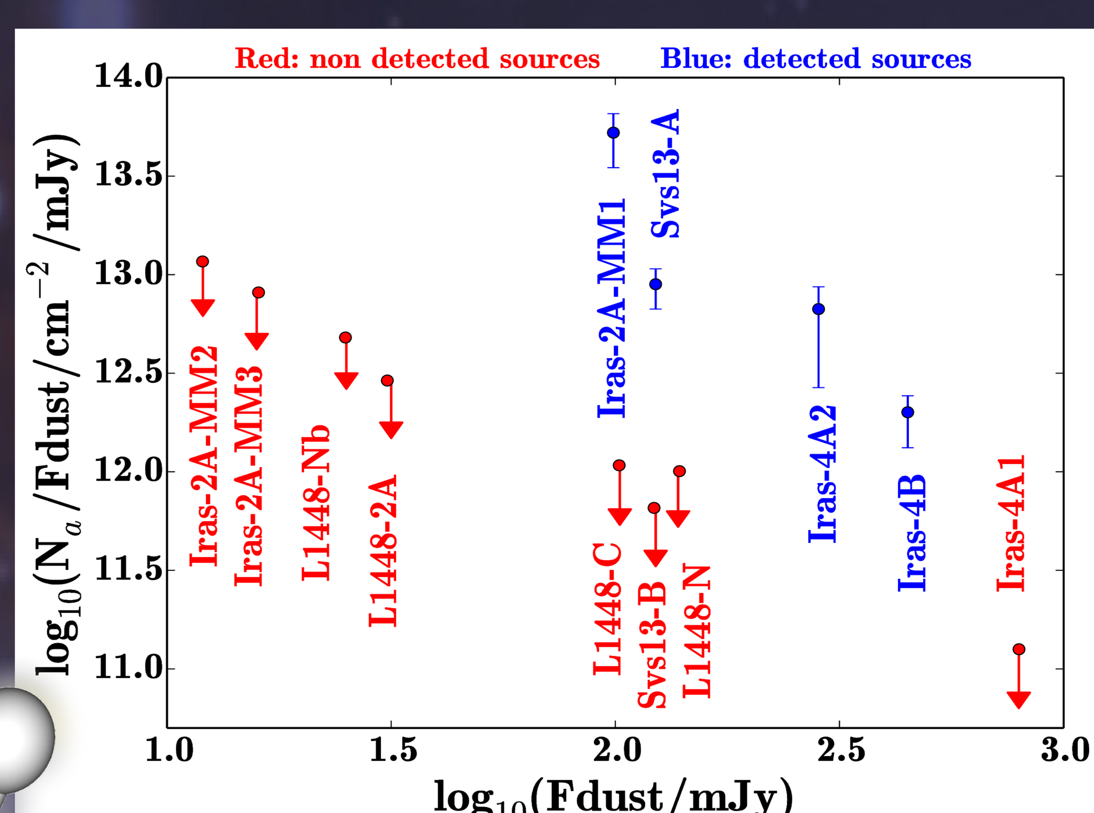
Glycolaldehyde emission is compact: (less than 100 AU)

RESULTS

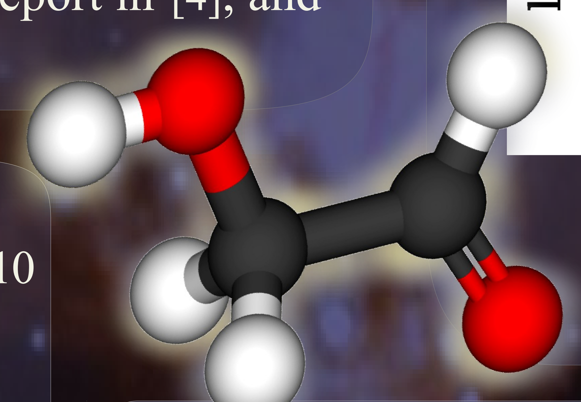
Source	N $[10^{14}cm^{-2}]$	Trot [K]	Eu [K]	N lines -	Range Frequency [GHz]
IRAS-2A-MM1	52(29)	165(33)	37-290	12	217-221 229-233
IRAS-4A2	19(17)	201(56)	37-375	18	217-221 229-233
IRAS-4B	9(6)	155(43)	37-323	17	217-221 229-233
SVS13-A	11(5)	97(14)	37-375	17	217-221 229-233

From the rotational diagrams we obtained the column density (**N**) and the rotational temperature (**Trot**) of each detected-source. We sample a larger excitation range (**Eu**) for a large number of identified lines (**Nlines**) in the **range frequency** shown, obtaining results well in agreement with those report in [4], and with those expected in a hot corino region, (see [3] and [5]).

COMPARISON WITH CONTINUUM



The ratio between the $HCOCH_2OH$ column density (Ng) and the continuum peak flux at 1.3mm (Fdust) can be used to verify possible trends involving the Glycolaldehyde abundance. The plot shows that the Glycolaldehyde gas phase abundance relative to the molecular hydrogen (directly related to dust flux) has a spread of a factor of ~10 among the detected sources. A proper comparison using the continuum emission provided by the CALYPSO database is in progress.



References

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