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Fifty AU Study of the chemistry in the disk/envelope system of Solar-like protostars (FAUST) Large program first results: the hot corino in L1551 IRS5

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Detection of hot corinos in Solar-like protostars has been so far mostly limited to Class 0 objects, hampering our understanding of their origin and evolution. Recent evidence suggests that planet formation probably starts already in Class I protostars, representing a key step in our understanding of their chemical composition at the planet formation scale. Therefore, understanding the fate of hot corinos in Class I protostars has become of paramount importance. In this context, we report the discovery of a hot corino at the heart of the prototypical Class I source L1551 IRS5, obtained via ALMA observations as part of the Large Program FAUST (Fifty AU Study of the chemistry in the disk/envelope system of Solar-like protostars). More specifically, FAUST is the first ALMA Large Program based on astrochemistry and is designed to survey the chemical composition of a sample of 13 Class 0 and I protostars at the planet-formation scale.

We detected in L1551 IRS 5 several emission lines from interstellar complex organic molecules (iCOMs) such as methanol and its most abundant isotopologues, as well as methyl formate and ethanol. The line emission is bright toward the north component (N), although a hot corino in the south component, cannot be excluded. The non-LTE analysis of the methanol lines towards N provides constraints on the gas temperature (~ 100 K), density (≥ 1.5 x 10^8 cm^{-3}) and emitting size (~0.15", i.e. ~ 10 au in radius). The lines are predicted to be optically thick, the $^{13}CH_3OH$ line having an opacity ≥ 2. The methyl formate and ethanol column densities relative to methanol are ≤ 0.03 and ≤ 0.015, respectively, compatible with those measured in Class 0 sources. Thus, the present observations towards L1551 IRS5 agree with little chemical evolution in hot corinos from Class 0 to I.

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