Chemical segregation of complex organic O-bearing species in Orion KL

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Chemical segregation of complex organic molecules (COMs) in star-forming regions has been investigated concerning the spatial differentiation between the O- and N-bearing species (see e.g. **[1]** and references therein). However, information about the spatial distribution of chemically related COMs is lacking, mostly due to the low abundances of the most complex species which prevent the detection of these species in the majority of star-forming regions. We investigate the chemical segregation of complex O-bearing species (including the largest and most complex ones detected to date in space) towards Orion KL **[2]**, the closest high-mass star-forming region. The identification of several O-bearing COMs in Orion KL allows us to investigate the spatial distribution of similar species (in terms of complexity and variety of atoms) but harbouring different chemical functional groups to test the COM formation and evolution.

The molecular line images obtained using the ALMA science verification data reveal a clear segregation of chemically related species depending on their different functional groups. We map the emission of $^{13}CH_3OH$, $HCOOCH_3$, CH_3OCH_3, CH_2OCH_2, CH_3COOCH_3, $HCOOCH_2CH_3$, $CH_3CH_2OCH_3$, HCOOH, $OHCH_2CH_2OH$, CH_3COOH, CH_3CH_2OH, CH_3OCH_2OH, $OHCH_2CHO$, and CH_3COCH_3 with ∼1.5'' angular resolution and provide molecular abundances of these species towards different gas components of this region. We find that while species containing the C−O−C group, i.e. an ether group, exhibit their peak emission and higher abundance towards the compact ridge, the hot core south is the component where species containing a hydroxyl group (−OH) bound to a carbon atom (C−O−H) present their emission peak and higher abundance. This finding allows us to propose methoxy (CH_3O−) and hydroxymethyl (−CH_2OH) radicals as the major drivers of the chemistry in the compact ridge and the hot core south, respectively.

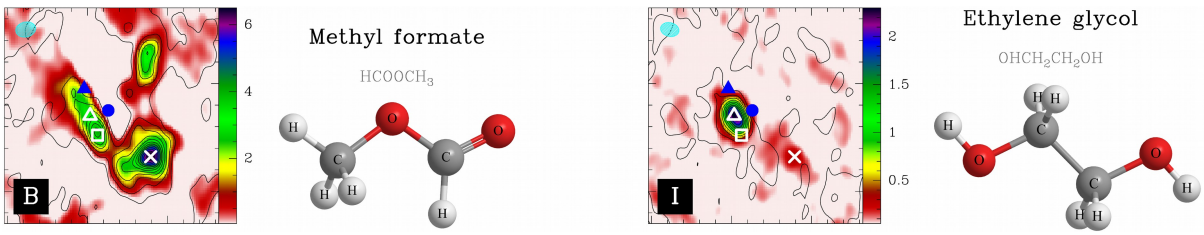

Fig. 1. Spatial distribution of O-bearing species in Orion KL

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References: [1] Suzuki et al. ApJS, 237, 3 (2018); [2] Tercero et al. (2018), A&A, 620, L6 (2018)