

Molecular complexity in strongly UV-irradiated gas

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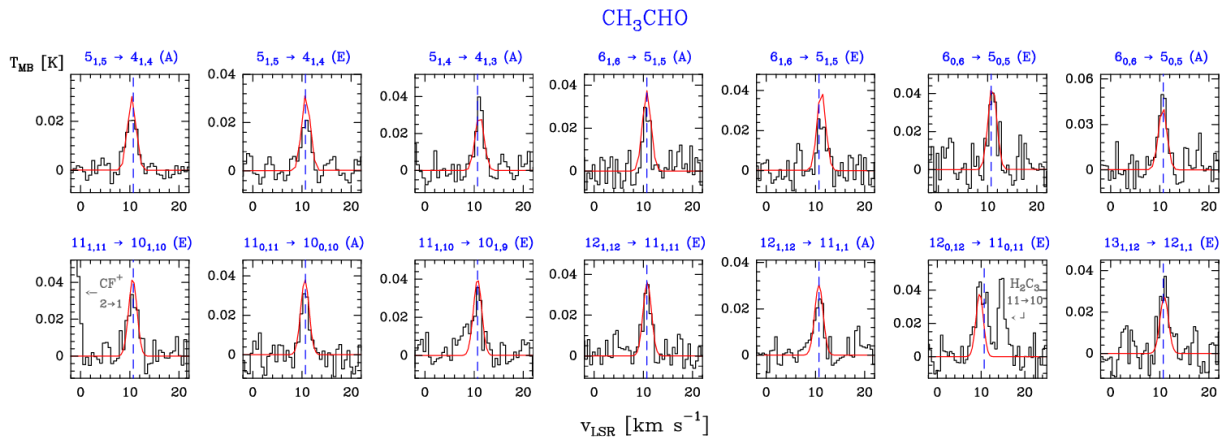
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In the context of investigating the chemistry prevailing in dense molecular gas directly exposed to strong far-UV fields, we carried out a millimetre line survey towards the edge of the Orion Bar photodissociation region (PDR) using the IRAM-30m telescope.

The Orion Bar is the prototypical dense PDR with a far-UV radiation field of a few 10^4 times the mean interstellar field. Because of its proximity (~ 414 pc) and nearly edge-on orientation, the Orion Bar provides a very good template to determine the chemical content, spatial stratification, and molecular formation-destruction routes in strongly UV-illuminated gas [1-3], and also to study the structure and dynamics of strongly FUV-irradiated molecular gas [4]. These kinds of environments have been traditionally considered too harsh to maintain a complex chemistry and thus significant abundances of polyatomic organic species (excluding PAHs). However, our millimetre line survey showed a relatively rich and distinctive chemistry. In addition to reactive ions typically seen in strongly UV-irradiated PDRs (e.g. SH^+ , HOC^+ ; [5-6]) and hydrocarbons (C_2H , C_4H , $c\text{-I-C}_3\text{H}_2$, $c\text{-I-C}_3\text{H}$, $\text{I-C}_3\text{H}^+$, C^{13}CH , ^{13}CCH ; [3]), we detect more than 250 lines from complex organic molecules (COMs) and related precursors (e.g. H_2CO , HCOOH , CH_3OH , CH_3CN , CH_3CHO ; [7-8]).

The presence of COMs in the interstellar medium is thus more widespread than initially expected. COM formation reflects the complicate interplay between gas and grain surface chemistry. However, the specific formation pathways are not fully clear yet. More laboratory experiments, providing reaction rates at different temperatures, as well as photo-desorption yields, are clearly needed.



A- and E- CH_3CHO detected lines (black histogram spectra).
Single excitation temperature models are shown overlaid in red.

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