On the detectability of undetected methanol forms in star forming regions

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The growing body of observed complex organic molecules (COMs), in particular deuterated isotopes, motivated us to revise the chemical networks used in modeling their chemistry. Methanol and its deuterated forms (all probable forms) are well-known parent molecules of more complex species. In this study, we are looking into the detectability of undetectable methanol forms and the impact of their inclusion in chemical models.

Our results showed that the undetectable forms of methanol such as CH_2DOD and CHD_2OD can be detected with abundances ~ few x $10^{-11}n_H$ in cores around low-mass and massive star forming regions and their effect if added to chemical models without detection is minor. Therefore, we conclude that their inclusion in theoretical chemical models is safe.

Computational approach for detecting undetected interstellar molecules: CH_2DOD and CHD_2OD

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Observations revealed that complex molecules (COMs) are very abundant in star forming regions (SFRs) either low-mass or massive. Methanol is believed to be the main driver of molecular complexity in the interstellar medium. Some deuterated forms of methanol; namely CH_2DOD and CHD_2OD, could play a role in the formation of deuterated COMs. We found that these undetected forms are detectable in SFRs (with abundances $>10^{-12}n_H$). We ran theoretical models and computed the peak positions of the IR spectral lines of these species and compared them with experimentally predicted IR positions.

Our results are in agreement with experimental data. Given the calculated abundances of these undetected species and their spectral line positions, we recommend searches for these molecules in SFRs.