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TITLE: Protostellar Interferometric Line Survey (PILS): Constraining the formation of complex organic molecules with ALMA

ABSTRACT BODY:

Abstract Body: Understanding how, when and where complex organic and potentially prebiotic molecules are formed is a fundamental goal of astrochemistry and an integral part of origins of life studies. Already now ALMA is showing its capabilities for studies of the chemistry of solar-type stars with its high sensitivity for faint lines, high spectral resolution which limits line confusion, and high angular resolution making it possible to study the structure of young protostars on solar-system scales. We here present the first results from a large unbiased survey “Protostellar Interferometric Line Survey (PILS)” targeting one of the astrochemical template sources, the low-mass protostellar binary IRAS 16293-2422. The survey is more than an order of magnitude more sensitive than previous surveys of the source and provide imaging down to 25 AU scales (radius) around each of the two components of the binary. An example of one of the early highlights from the survey is unambiguous detections of the (related) prebiotic species glycolaldehyde, ethylene glycol (two lowest energy conformers), methyl formate and acetic acid. The glycolaldehyde-ethylene glycol abundance ratio is high in comparison to comets and other protostars - but agrees with previous measurements, e.g., in the Galactic Centre clouds possibly reflecting different environments and/or evolutionary histories. Complete mapping of this and other chemical networks in comparison with detailed chemical models and laboratory experiments will reveal the origin of complex organic molecules in a young protostellar system and investigate the link between these protostellar stages and the early Solar System.

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