TRACING OUR CHEMICAL ORIGIN: COMPLEX ORGANIC MOLECULES IN SUN-LIKE PROTOSTARS

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Molecular complexity builds up at each step of the Sun–like star formation process, starting from simple molecules and ending up in large polyatomic species. Understanding how our own solar system, Earth and life, have come to be is one of the most important and exciting topics in science. Complex organic molecules (COMs; > 6 atoms; such as methyl formate, $HCOOCH_3$, dymethyl ether, CH_3OCH_3 , or glycolaldehyde, $HCOCH_2OH$) have been found in several components of the star formation recipe (prestellar cores, hot–corinos, shocks induced by fast jets).

These species are thought to be either formed in solid state chemistry of grain mantles and then released in the gas phase due to ice grain mantle sublimation or sputtering, or produced in the gas phase using simpler species released by mantles (such as H_2CO or CH_3OH). This question is hotly debated. The level of chemical processing and complexity in low–mass star forming regions and protoplanetary disks and their relationship with the material delivered on planetary surfaces is still very uncertain, in spite of the astrobiological implications.

In this framework, the PhD project aims to analyse several observational data to test the laboratory results and the theoretical models predictions on COMs formation and evolution. Our group is involved in a strong international observational effort to detect and study complex and rare molecular species in the interstellar space through emission due to their roto-vibrational transitions. In particular, with ALMA and the IRAM telescopes, using both single dish and high resolution interferometric data.