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Claudio Codella - Astrochemistry of Galactic regions: living ALMA, preparing SKA (Review Invited)

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Astrochemistry of Galactic regions is living a golden age. More specifically, the study of theso-called interstellar Complex Organic Molecules (iCOMs, mainly O-bearing species with at least 6atoms), considered the simplest bricks needed to have pre-biotic environments, has benefited ofrecent improvements of observational tools. On the one hand, single-dish spectral surveys withtelescopes observing at cm-wavelengths (mainly GBT, and Yebes), once equipped with improvedbackends, increased the number of complex species detected in the interstellar medium (ISM). Onthe other hand, the advent of the ALMA (sub-)mm interferometer, with its unique combination ofhigh sensitivity, high angular resolution, and large spectral coverage, boosted both the detections ofiCOMs and the imaging of their spatial distributions. iCOMs are almost ubiquitous in the ISM,being observed in a wide variety of astronomical environments and physical conditions: in bothcold molecular clouds and hot regions, in the Galactic disk as well as in the Galactic Center. In this context, we will review the power of ALMA in shedding light on the chemistry atwork during the earliest phases of low-mass star formation. The role of the pre-solar chemistry inthe composition of the Solar System bodies is far to be understood. Key questions still to beaddressed are: how chemically organic complex are the volatiles delivered to the pristine planetaryatmospheres? What molecules are passed from the large-scale envelope to the disk in which planets,comets, and asteroids form? As a matter of fact, molecular complexity builds up at each step of theprocess leading to star formation, ending up in prebiotic molecules. Indeed, one of the breakthroughresults found by ALMA has been imaging iCOMs emission in protostellar and protoplanetary disks.Finally, we will also discuss the limits of ALMA observations, paradoxically due to the high spatialresolution reached: the iCOMs detection is hampered by the high-opacity continuum in the diskmidplane, i.e. the region where planets are expected to form. This is a limit of the ALMA datasetsthat further sub-mm observations will never overcome. Only high spatial resolution (< 10 au)observations at much lower frequencies, at cm-wavelengths, where the dust continuum is morelikely to be optically thin, will be able to provide the answer, paving the way to the arrival of SKA.

Session Classification: Milky Way