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Astrochemistry with SKA: a laboratory perspective on solid-phase pathways and gas-phase detections

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The low temperature (<20 K) and high density ($n > 10^4$ cm $^{-3}$) of dense molecular clouds cause simple gas-phase species to freeze onto dust grains. The so-formed ices are then subjected to a variety of processes that may increase their chemical complexity. Among them, UV photons and low-energy cosmic rays trigger the formation of both simple and more complex species [1, 2], including interstellar-complex organic molecules (iCOMs), [3]. In the further stages of star-formation, both thermal and non-thermal desorption processes cause the injection of solid-phase compounds into the gas-phase, allowing their detection by means of radio-telescopes [4, 5].

SKA will allow to search for iCOMs in star-forming regions and protoplanetary disks, allowing us to shed light on the chemical complexity and the distribution of molecules in these regions [6, 7].

The Laboratory for Experimental Astrophysics at the INAF-Osservatorio Astrofisico di Catania is currently working on a new experimental setup to simulate the exposure to energetic ions and UV-photons of ices in molecular clouds and to investigate the formation of iCOMs. Ices will be then injected in the gas-phase and analyzed by means of mass spectrometry.

We will show the ongoing activities and some scientific cases that show the importance of solid-phase chemistry in the formation of molecules in star-forming regions.

[1] Rothard, H. et al. 2017, J. of Phys. B, Atom. Molec. Optic. Phys. 50, 6, 062001

[2] Urso, R. G., et al. 2022, A&A, 668, A169

[3] Caselli, P., & Ceccarelli, C. 2012, A&ARv, 20, 56

[4] Palumbo, M.E. et al. 2008, ApJ, 685, 2, 1033

[5] Urso, R.G. et al. 2019, A&A, 628, A72

[6] Codella, C. et al. 2015, AASKA14, 9-13 June 2014, id. 123

[7] Testi, L. et al. 2015, AASKA14, 9-13 June 2014, id. 117

Research area

Cradle of Life

Primary authors: SCIRE' SCAPPUZZO, Carlotta (Istituto Nazionale di Astrofisica (INAF)); FULVIO, Daniele (Istituto Nazionale di Astrofisica (INAF)); BARATTA, Giuseppe (Istituto Nazionale di Astrofisica (INAF)); PALUMBO, Maria Elisabetta (Istituto Nazionale di Astrofisica (INAF)); GERMANÀ, Massimo (Università di Catania, Dipartimento di Fisica e Astronomia); URSO, Riccardo Giovanni (Istituto Nazionale di Astrofisica (INAF))

Presenter: PALUMBO, Maria Elisabetta (Istituto Nazionale di Astrofisica (INAF))

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