Il Colle di Galileo

Cosmic Rays: the salt of the star formation recipe 3

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Abstract. The third edition of a three-day workshop entitled "Cosmic Rays: the salt of the star formation recipe 3" was held at the Department of Physics and Astronomy of the University of Florence. The goal of the workshop proposed was to bring together experts in theory and simulations of cosmic-ray propagation, astrochemists and observers to share ideas, discuss recent and current results, and identify the key challenges regarding the chemistry and physics of cosmic rays in the near future.

Keywords: cosmic rays, star formation, astrochemistry, magnetic fields, acceleration mechanisms, astrobiology.

Cosmic rays are one of the most important ingredients across many domains of astrophysics, especially star formation, yet we have a fairly incomplete understanding of all their implications. Thanks to the data provided by the new generation of radio and (sub)millimetre telescopes, we can start providing a thorough picture of the role of cosmic rays in interstellar medium physics and chemistry, and consequently in the processes of star and planet formation. Observations are needed to constrain the multiple aspects of the theoretical models proposed and models are required to interpret the observations properly. Due to the multidisciplinary nature of cosmic-ray research, we organised the third edition of a workshop to facilitate interaction among the observational and theoretical communities working on cosmic rays in star-forming environments. We initiated active discussions, establishing a strong basis to identify key problems in cosmic-ray related physics and chemistry in the years to come.

The science topics included the role of cosmic rays in star and planet formation, cosmic-ray signatures in different environments, their importance in the formation of interstellar molecules (observations, models, and laboratory experiments), local cosmic-ray acceleration in protostellar shocks and their link with the origin of life.

The meeting was attended not only by researchers already working on cosmic rays but also by experts in other facets of star formation, with the hope of raising awareness of the relevance of cosmic rays to their work. The debate that ensued

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Figure 1. Group photograph in the courtyard of the Department of Physics and Astronomy (Garbasso building).

following this workshop laid the foundations for a more effective use of existing radiotelescopes, such as NOEMA, IRAM 30m, APEX, Effelsberg, LOFAR, VLBI, ALMA, and VLA, and to prepare ambitious future projects that will make use of the powerful facilities that will become available in the years to come: SKA, ALMA (bands 1-2), and next generation VLA.

The total number of participants was 62 (1 master student, 16 PhD students, 19 postdocs, and 26 staff). The geographical distribution was the following: Italy (14 participants), USA (12), France (11), Germany (7), Spain (3), Japan (2), Poland (2), and one participant each from Austria, Canada, Chile, Greece, Hungary, India, Iran, Ireland, Israel, the Netherlands and China. We had ten invited experts. The collaborative environment was especially advantageous for students and early-career postdocs, as they discovered new research paths by connecting the various fields present in the workshop.

The website of the meeting, including the presentations, is available at the following link: https://www.arcetri.inaf.it/cosmicrays3/.

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