



Il Colle di
Galileo

Cosmic Rays: the salt of the star formation recipe

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Abstract. A three-day workshop entitled “Cosmic Rays: the salt of the star formation recipe” was held at the Department of Physics and Astronomy of the University of Florence. The proposed workshop had the goal of bringing together experts in theory and simulations of cosmic-ray propagation, astrochemists, and observers to share ideas, discuss recent and present 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 a key ingredient in many fields of Astrophysics and particularly in Star Formation but, despite their great relevance, our understanding is still relatively incomplete. Thanks to the data delivered by the new generation of radio and (sub)millimeter telescopes, we now have the opportunity to attain a comprehensive knowledge of the role of cosmic rays in the physics and chemistry of the interstellar medium, and consequently of the processes leading to star and planet formation. Observations are needed to constrain the multiple aspects of the theoretical models proposed and models are required to properly interpret observations. Given the multidisciplinary character of cosmic-ray research, we organised a workshop to bring the observational and theoretical communities working on cosmic rays in star-forming environments together for the first time so that they could present their recent results and trigger active discussions, which established a solid basis for the key challenges in cosmic-ray related physics and chemistry for the next decade.

The science topics debated upon were the role of cosmic rays in star and planet formation, cosmic-ray fingerprints in different environments, the impact of cosmic rays on the formation of the interstellar molecules (observations, models, and laboratory experiments), the local acceleration of cosmic rays in protostellar shocks, and the relationship of cosmic rays with the origin of Life (interstellar medium, comets, planets, and the Earth).



Figure 1. Group photograph in the hall of the Department of Physics and Astronomy (courtesy of Luca Carbonaro).

Not only researchers who already work on cosmic rays but also experts on different aspects of star formation joined the meeting with the aim of make everyone aware of the relevance of cosmic rays to their respective research. The discussion that arose from this workshop settled the ground for a more efficient exploitation of current radiotelescopes such as NOEMA, IRAM 30m, APEX, Effelsberg, LOFAR, VLBI, ALMA, and VLA and to prepare ambitious future projects making use of powerful facilities available in the years to come: SKA, ALMA (bands 1-2), and the next generation VLA.

The total number participants was 63 (8 students, 19 postdocs, and 36 staff), from Europe, the United States and Asia. The geographical distribution was the following: Italy (13 participants), UK (10), France (9), USA (7), Germany (5), Japan (4), Spain (3), Poland (3), Russia (3), and one participant each from Taiwan, Czech Republic, Switzerland, Latvia, Netherlands, and South Korea. We had 15 invited experts. The interdisciplinary environment was particularly beneficial for students and young postdocs, who found new directions in their research by linking the different fields coexisting in the workshop.

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