

# Cosmic rays and radiobiology in a Sino-Italian network strategy: first bilateral workshop COSMIC-RAD

## Foreword

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The investment in space activities may be estimated in hundreds of billion of Euro and involves all G20 and BRIC countries. Why there is such a large interest, and why so many investments are allotted to space programs?

Space is definitely an essential driver of economic growth. Aside from the obvious impact onto high-technology industry, many disciplines benefit from the development of space technologies. Climatology, environmental science, various medical sciences as well as telecommunication and—off course—military applications are just few areas that need space technologies and justify the launch of satellites. Nearly a thousand satellites are currently in orbit with the aim of observing the Earth and are used for telecommunications, navigation and positioning in

addition to specific scientific research and to space exploration, with missions funded by many space agencies.

Man is exploring the solar system by means of satellites in orbit around Mars and Venus, and exploration is now active on the surface of Mars. China, India, Japan, Europe and United States launched spacecrafts in orbit around the Moon and the International Space Station is inhabited ever since 2003. More than 50 nations are participating in this “colonization” of space; they all benefit from space technologies and information gathered by satellites. Italy is participating since 1963 with a significant contribution to the activities of the International Space Station (ISS). The Chinese space program accounts for tens of launches with many satellites placed into orbit already. The successful mission of Shenzhou-X has confirmed China advances in space technologies and its ambitions for the future. In the next few years, China will launch its own Space Station, where many challenging scientific experiments in the fields of astronomy, microgravity, medicine and radiobiology will be performed.

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The COSMIC-RAD workshop held on the 4th and 5th September 2012 at the Institute of Modern Physics of the Chinese Academy of Science at Lanzhou, the capital of the Gansu province, organized by the Scientific Office of Italian Embassy with the patronage of Italian Accademia Nazionale dei Lincei, was the first bilateral meeting involving Italian and Chinese scientists interested to perform research on cosmic radiation and radiobiology, which are both fundamental issues for space applications. COSMIC-RAD had the goal of triggering innovative researches in the areas of radiobiology and biophysics applied to the cosmic radiation, with particular emphasis to applications of biomedical interest and to industrial spin off.

Actually, in the present and future projects, both China and Italy consider cosmic exploration a high priority. This workshop was the first initiative conceived to establish a strict cooperation between Chinese and Italian research institutes with the aim of identifying strategic scientific objectives common to both science communities.

Ever since the Apollo missions, crewed spaceflights have been limited to the Low Earth Orbit (LEO) i.e., they remained inside the protective magnetic field of the Earth that protects people from the damaging effects of space radiation. However, humans selected for the long duration space exploration missions to the Moon and to Mars will be exposed to significant ionizing radiation doses from galactic cosmic radiation as well as from solar particle events and from secondary particles generated by the interaction with spacecraft materials. When assessing the risks related to radiation in exploration scenarios, high uncertainty remains, which is mainly due to uncertainties about the biological effects of this type of space radiation. Many open questions need to be investigated; in particular, those regarding biological effects, so as to allow accurate risk assessments and a more accurate planning of countermeasures.

The space exploration represents indeed a great scientific opportunity for both Italy and China and a bilateral cooperation may synergistically reinforce and improve the

knowledge of both countries in many fields. To address many of the above issues requires experiments to be performed at high-energy particle accelerator facilities and, at the same time, information about the influence of the almost complete absence of natural ionizing radiation with experiments performed inside deep underground laboratories, such as those existing in both China and in Italy.

The Lanzhou joint Italian and Chinese meeting was attended by recognized experts involved in the study of radiation biology, biophysics and space physics from Ente Nazionale Energie Alternative (ENEA) and Istituto Nazionale di Fisica Nucleare (INFN), the two major institution operating in this field in Italy, as well as by researchers from the Universities of Rome, Florence and Perugia. A number of Italian small enterprises involved in space research participated too.

Beside this foreword, the present Special issue of the *Rendiconti Lincei* contains 16 peer-reviewed original mini-reviews of which seven have been submitted by Chinese teams, accepted after a careful evaluation. An introduction written by the Director of the Institute of Modern Physics of Lanzhou, Prof. Xiao, and an independent introduction written by Prof. G. Woloschak, a recognized scientist in the field complete the volume. The editorial effort has been managed by Academician Prof. A. Mottana with the generous assistance and supervision of Academician Prof. F. Sassi.

The effort brought forward to organize the meeting has also been witnessed by the signature of an official agreement that involves ENEA and Florence University on the Italian side and the Institute of Modern Physics of the Chinese Academy of Science from the other side to support the exchange of young researchers, a key issue for triggering new challenging researches.

We can now start thinking to the next step of China–Italy collaboration in space. It may be a dream, but what about an Italian and a Chinese astronaut performing together scientific experiments within the Chinese Space Station?