

20 marzo 2013

ore 15.00

Sala Azzurra

Palazzo della Carovana

Piazza dei Cavalieri

Colloqui della Classe di Scienze

Anno Accademico 2012/2013



SCUOLA
NORMALE
SUPERIORE

PASQUALE BLASI

Osservatorio Astrofisico di Arcetri

COSMIC RAYS ONE CENTURY FROM DISCOVERY

ABSTRACT

The penetrating radiation discovered by Viktor Hess one century ago plays a crucial role for many phenomena of both astrophysical and terrestrial origin. This radiation ionizes the central parts of molecular clouds thereby allowing the formation of stars in those clouds. The death of massive stars in turn leads to the injection of new cosmic rays in the Galaxy. Cosmic rays are also the main source of DNA mutations and are believed to have played a very important role in the evolution of Life on Earth. A few decades after the discovery of the cosmic origin of the penetrating radiation, cosmic rays literally bootstrapped the field of particle physics: the positron, the muon, the pion, several hyperons were first discovered in cosmic rays. Given this overwhelming role and given the extreme energies that cosmic ray particles carry (up to a few 10^{11} GeV), the search for their sources, the understanding of the acceleration mechanisms that energize them and the investigation of their propagation throughout the universe appear to be of the utmost importance.

Here I will summarize the most important steps in the history of cosmic ray research and the most recent developments in the field. I will discuss the physics underlying the acceleration of charged particles in supernova remnants and new avenues to test these ideas, using the crucial fact that cosmic rays modify the environment in which they get accelerated. This interaction leads to amplification of magnetic fields in the acceleration region, which is observed in X-rays, and is crucial if to aim at understanding acceleration to very high energies. A similar phenomenon is also likely to occur during propagation of cosmic rays throughout the Galaxy and might provide an explanation of some puzzling recent data concerning the spectra of the most abundant chemical species in cosmic rays.

Finally I will try to outline what the next hundred years of cosmic ray research might look like.