ALICE2 Case Study

Auger: World scientists seek to solve the enigma of the origin of ultra high energy cosmic rays

The Auger project is an international effort to study the arrival on Earth of particles of the highest energy through measurements that determine their load and direction of arrival. According to the experts, to learn about their origin would make it possible to understand what the Cosmos' most energetic astrophysical sources are and what the acceleration mechanisms of these particles are, something that could provide information on the Universe's evolution and origin.

With a 3,000 square kilometres covered area, the Pierre Auger observatory (Argentina) is the world's largest cosmic rays detector. Located in the Malargüe area, in the Mendoza Province, its facilities consist of a network of 1600 detectors integrated with a set of high sensitivity telescopes; with them the faint ultraviolet light produced by cosmic rays showers as they cross the atmosphere can be observed.

400 scientists from more than 70 institutions in 17 countries across the globe have come together in this project in order to elucidate the enigma of these rays' origin; to this end, measurements are taken and then sent, via mobile telephony, to a central station, from where data are sent through the Innova|Red (Argentinean network) connection to RedCLARA towards the Constituyentes Atomic Centre (in Buenos Aires), where they are stored and made available for international collaboration.

Thanks to the connectivity provided by RedCLARA for data transfer and storage, in 2007 the research done in the observatory determined that galaxies with active nuclei are the most probable source of the ultra-high energy cosmic rays that get to the Earth; the fact was catalogued as one of the major achievements of that year by the Science journal.

"*By applying statistic methods, we concluded that the directions of arrival of the 27 cosmic ultra high energy rays were not randomly distributed. The majority of these events come from directions near the positions of the active nuclei of near galaxies such as Centaurus A*", explains Diego Harari, researcher from the Bariloche Atomic Centre and Argentina's National Scientific and Technological Research Council, CONICET, in an article published by the Organisation of Hispanic-American States on 17th November 2008 (http://www.oei.es/noticias/spip.php?article3877).

Contributing to education, the observatory offers guided tours around its facilities for students and general public, and publishes 1% of the surface detector data through its website's Events Viewer.

"*Apart from the scientific results already published, there is a very important impact on the city and the province, resulting in a different image of science for the general public and mainly students from levels previous to university, clearly showing the possibility of participating in projects of world interest*", states Ruben Squartini, Technical and Computing Systems Administrator from the Pierre Auger Observatory.

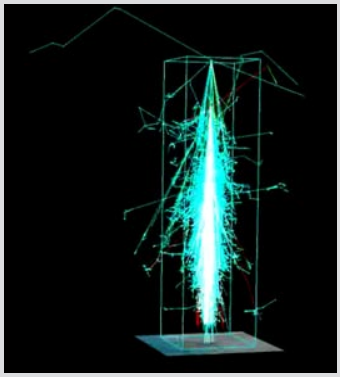
INNOVA|RED
Red Nacional de Investigación y Educación de Argentina

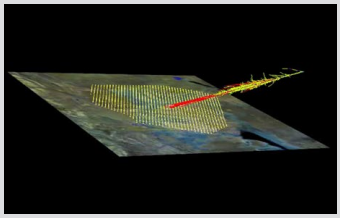
RedCLARA

The impact of cosmic rays

In a constant and almost imperceptible way, particles, atoms or electrons from all directions get to our planet. Some of them are more energetic than any other particle observed in nature; they travel at a speed near the speed of light and have hundreds on million times more energy than the energy produced by any accelerator in the world. This is what is known as ultra-high energy cosmic rays.

Through measurements carried out on the showers of particles which are produced every time a cosmic ray crashes against the higher atmosphere's molecules, their energy, nature and direction of arrival are determined. Scientists contend that learning about their origin could make it possible to understand what the most energetic astrophysical sources in the Universe are, and understand these particles' acceleration mechanisms, something that could yield information on the Cosmos' evolution and origin.



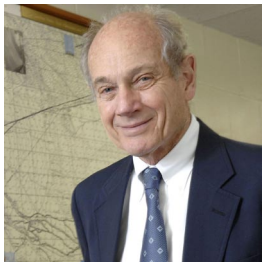


Pierre Victor Auger (1899 - 1993)

French physicist, with great interest in the dissemination of science, he conducted outstanding studies on atomic physics (fotoelectric effect), nuclear physics (slow neutrons) and cosmic ray physics. His most renowned contributions include the discovery of the "Auger Effect" or "Auger Electron" (1925) and its comprehensive study of the Extensive Atmospheric Shower – Air Showers (1938)-, also known as Auger Shower.

"In principle, the major importance is to lay the foundations for other collaboration projects, demonstrating that it is possible to build a measurement instrument as complex as this between many institutions in many countries. From the scientific point of view, it enables the interaction of multiple disciplines in the research of one single phenomenon, which helps study all aspects of it".

Ruben Squartini, Technical and Computing Systems Administrator, Pierre Auger Observatory



"We have taken a great step forward in the solution of the mystery of ultra-high energy cosmic rays' origin"

James Cronin, Nobel Prize for Physics (1980), University of Chicago, United States

Further information:

Innova| Red - www.innova-red.net

Pierre Auger Observatory - http://visitantes.auger.org.ar/

RedCLARA – www.redclara.net

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