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CREDO and cosmic radiation – main facts

The Cosmic-Ray Extremely Distributed Observatory (CREDO) collaboration is a project whose character is both global and unique. Its heart is a virtual observatory of cosmic radiation, formed by a combination of the detection capabilities of as many already functioning detectors as possible.

The CREDO main idea is to skilfully combine data collected by already existing detectors, registered by different methods and concerning different types of radiation, over different ranges of energy.

All smartphone owners can participate in attempts to test hypotheses about the quantum structure of spacetime, the potential relationships between cosmic radiation and earthquakes, and even the role played by high energy cosmic rays in cancer.

The CREDO infrastructure consists of sophisticated detectors, sending data registered within the framework of current scientific experiments of various types and scales, and a large number (potentially reaching even millions) of smaller and less subtle, but still useful detectors. Of the latter, the most numerous are the CMOS matrices in smartphones of the individual enthusiasts participating in the project.

Anyone can join CREDO's research infrastructure at any time. To transform an ordinary smartphone into a cosmic ray particle detector and join the current CREDO experiment, just download the free CREDO Detector application.

“Your smartphone can become a portal to the world of real research for you, allowing you to interact with other science enthusiasts as well as with the scientists involved in the project,” emphasizes Dr. Piotr Homola, the international coordinator of CREDO.

The CREDO application monitors photos taken with a covered lens by the camera in the smartphone. The bright traces correspond to sites where particles of secondary cosmic radiation (or local radiation) have passed through the CMOS matrix. After pre-processing, images with detected particle traces are sent to a common database.

All participants of the CREDO project become co-authors of the scientific publications based on collected data.

Particles of cosmic radiation, hitting the vicinity of the Earth from outside the Solar System, are primary cosmic radiation. It consists mainly of protons and atomic nuclei from helium (i.e. alpha particles) to iron, and even as massive as lead and uranium. In primary cosmic radiation electrons, positrons, and even antiprotons are also registered, as well as photons and neutrinos with high energies.

The most energetic single particles of cosmic radiation carry energy that is roughly equivalent to the energy of a strongly hit tennis ball (for comparison: protons in the LHC accelerator reach energies a billion times smaller). The origin of particles with the highest energies is not known.

Particles of the primary cosmic radiation usually ‘die’ in collisions with atmospheric particles. Secondary particles are then formed, with smaller energies, moving in a direction similar to the

direction of movement of the primary particle. These cascades are called extensive air showers and form secondary cosmic radiation.

Smartphones do not allow easily for the collection of valuable data on extensive air showers. Fortunately, they allow to track another phenomenon: time correlations between particles recorded by the matrices of individual smartphones. For the first time, there is an opportunity to monitor global changes in the cosmic radiation flux reaching our planet.

The muons of secondary cosmic radiation are so penetrating that they reach a depth of several hundred metres below the surface of our planet. It is assumed that an average of five such muons pass through the head of an adult human being every second.

Cosmic radiation influences our planet's climate. As the cause of at least some genetic mutations, it is also one of the driving forces of evolution.

The idea of CREDO was first presented on 30th August, 2016 at a symposium at the Institute of Nuclear Physics of the Polish Academy of Sciences (IFJ PAN) in Cracow. The CREDO Detector application, initially prepared by the IFJ PAN, is currently being developed by scientists from the Cracow University of Technology. The responsibility for the collection and processing of incoming data is borne by the Academic Computer Centre Cyfronet of the AGH University of Science and Technology in Cracow.

At present (i.e. September 2019) the CREDO Observatory is composed of 25 institutional entities from 12 countries on 5 continents: nine from Poland, three from the United States, two from Australia, the Czech Republic and Ukraine, and one each from Georgia, Mexico, Nepal, Russia, Slovakia, Uruguay and Hungary.