



CREDO: On the past, towards the future

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. This observatory has a dynamic structure. It 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.

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. To make it easier for smartphone owners to connect to the cloud of CREDO detectors, just one year later the premiere of the CREDO Detector application prepared by the IFJ PAN and currently being developed by scientists from the Cracow University of Technology took place. Installed on smartphones with the Android operating system, the application monitors photos taken with a covered lens by the camera in the smartphone. Among the many dark frames, there are those with more or less clear traces, most often resembling smaller or larger dots or lines, although there are also very varied shapes, giving even the best experts food for thought. These traces correspond to sites where particles of secondary cosmic radiation (or local radiation) have passed through the CMOS matrix.

Initially developed in an informal manner, the idea of CREDO was finally constituted in 2019. Under the signed agreements, more than 20 scientific and educational institutions from several countries of the world became full members of the cosmic ray observatory CREDO. The unanimous choice for coordinator of the project was Dr. Piotr Homola, professor at the IFJ PAN.

At present (i.e. September 2019) the CREDO Observatory is composed of participants from Australia (Swinburne University of Technology in Hawthorn, University of Adelaide), the Czech Republic (Czech Technical University in Prague, Silesian University in Opava), Georgia (Tbilisi State University), Mexico (Benemerita Universidad Autonoma de Puebla w Pueblo), Nepal (Tribhuvan University in Pokhar), Poland (Institute of Nuclear Physics of the Polish Academy of Sciences in Cracow, Cracow University of Technology, Academic Computer Centre Cyfronet of the AGH University of Science and Technology in Cracow, National Centre for Nuclear Research in Świerk, University of Łódź, Astronomical Observatory of the University of Warsaw), Russia (Irkutsk State University), Slovenia (Comenius University in Bratislava), the United States (Laboratory for Nuclear Science at Massachusetts Institute of Technology in Cambridge, University of Kansas in Lawrence, Quantitative Engineering Design in Sheridan), Ukraine (Taras Shevchenko National University in Kiev), Uruguay (Liceo No. 65 of Montevideo), Hungary (Wigner Research Centre for Physics in Budapest). The first formal members of CREDO of a strictly educational nature were the Copernicus Science Centre in Warsaw and the state Primary School in Rzezawa (Poland).

The creators of the project are making every effort to expand the number of detectors making up the CREDO Observatory in the following years by adding networks of pocket detectors constructed by students or enthusiast-amateurs, such as Cosmic Watch (detectors of this type are built according to a design originally developed by MIT for the famous IceCube Neutrino Observatory in Antarctica).

From the very beginning, the CREDO infrastructure has been designed to process data from other scientific projects, such as professional observatories of cosmic radiation, experiments related to the detection of neutrinos or particles of dark matter, or numerous accelerator centres, equipped with specialized detectors of elementary particles. Classical astronomical observatories equipped with telescopes with CMOS matrices may also constitute an important group of participants. Here, dark frames, regularly registered by astronomers in order to search for dead pixels in sensor matrices, would be a valuable research material.

The variety of data collected, combined with the ever-changing number of detectors, places high demands on the collection and processing of incoming information on cosmic radiation. The responsibility for this part of the CREDO project is borne by the Academic Computer Centre Cyfronet of the AGH University of Science and Technology in Cracow.