

2nd CREDO Visegrad Workshop 2024

Monday, 3 June 2024 - Wednesday, 5 June 2024

Humenne, Slovakia

Book of Abstracts

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The CREDO Science and Popularization / 1**Invitation to the Cosmic Ray Extremely Distributed Observatory**

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The Cosmic Ray Extremely Distributed Observatory (CREDO) is an international scientific programme dedicated to global studies of yet not observed extremely extended cosmic-ray phenomena, the cosmic-ray ensembles (CRE), possibly beyond the reach of existing detectors and observatories. Up to date cosmic-ray research has been focused on detecting single air showers, while the search for ensembles of cosmic-rays, which may spread over a significant fraction of the Earth, is a scientific terra incognita. The key idea of CREDO is to combine existing cosmic-ray detectors (large professional arrays, educational instruments, individual detectors, such as smartphones, etc.) into a worldwide network, thus enabling a global analysis. Our global approach to cosmic ray research is also envisaged to universally serve for other, even yet not defined interdisciplinary studies and missions where large scale cosmic ray effects might play a role. A recent example of such efforts is the observation of the precursor-like correlations between low energy cosmic radiation and earthquakes considered on globally. An interpretation of this unexpected phenomenon is presently the first and the most promising scientific priority of the CREDO Collaboration. An important characteristic of the whole CREDO programme is its openness and inclusiveness dictated by the purely scientific requirement of the widest possible area of research, both in terms of sensors and manpower, on different levels. In other words the CREDO Collaboration aims at engaging a large number of participants (not only professionals but also, or even mainly, citizen scientists), assuring the geographical spread of the detectors and hands necessary to deal with vast amount of data to search for evidence for cosmic-ray ensembles and, possibly, other exciting, large scale, multi-channel phenomena.

The CREDO Science and Popularization / 2**An update on the cosmo-seismic correlations: an interplay of the geomagnetic field and the solar wind or an exotic "third factor"?**

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I'll report on the progress with understanding the physics of the cosmo-seismic correlations. The main observations associated with the effect point to the role of both solar magnetism and lunar gravitational forces, although the latter does not appear to have a tidal character. In addition we observe a clear appearance of the sidereal day periodicity in both cosmic ray and earthquake data. The observed peculiar characteristics of the phenomenon might be at least partly consistent with the impact of magnetic forces released while the geomagnetic field encounters different sectors of the geomagnetosphere with very specific, near-24h regularities observed also in both the cosmic ray and earthquake data. However, the whole range of properties of the cosmo-seismic effect, and in particular an impact of the Moon and the sidereal day frequencies present in both cosmic and seismic data, seem to require some additional explanation, possibly including some "third factor" capable of affecting both cosmic ray detection frequencies and of inducing earthquakes, such as a dark matter stream. If any of these scenarios is confirmed the scientific consequences will be immense. For instance, we should be able to predict some earthquakes by monitoring spaceweather and the cosmic radiation, and we would have to revisit all the climate change models by considering the newly discovered external factor. A large scale impact of spaceweather conditions or of a nearby dark matter stream could possibly be hardly noticed by individual, narrowly-focused observatories, but

the observational chances should grow with adopting an unbiased, interdisciplinary approach where a combination of weak indications from distinct research areas could give a strong, unquestionable signature. We attempt to implement such an approach in CREDO, and everybody is invited to be a part of this quest.

Citizen Science I / 3

Blebricks: Building the Future of IoT Innovation

The CREDO Science and Popularization / 4

Black holes, neutron stars, gravitational waves and cosmic radiation in the CREDO program

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A presentation often given in schools will be presented. It will be at the popular science level. The conference participants' task will be to provide comments - tips for possible modification of the presentation.

Observations of the Cosmos / 5

Observation of cosmic rays on the Lomnický štít

In our contribution we will explore the achievements of our extensive research using the neutron monitor at the Lomnický štít Observatory in Slovakia. We'll delve into the principles of neutron monitors, which detect secondary cosmic rays produced by interactions between high-energy particles from space and Earth's atmosphere.

By continuously monitoring these secondary neutrons, we gain valuable insights into space weather events. Solar flares and coronal mass ejections (CMEs) emit energetic particles that can disrupt Earth's magnetosphere and atmosphere. These disruptions, in turn, affect satellite operations, power grids, and communication systems.

Our long-term data from the Lomnický štít neutron monitor allows us to:

Track solar activity and identify potential space weather threats.

Improve our understanding of cosmic ray flux variations.

Develop and validate models for forecasting space weather events.

Our presentation will showcase the valuable contributions of the Lomnický štít neutron monitor to space weather research and its role in safeguarding our technological infrastructure from the impacts of solar storms.

Observations of the Cosmos / 6

Detection possibilities of astrophotography at the Astronomical Observatory on Kolonica Saddle

Astrophotography has become quite popular and widespread in recent years by making use of a diverse range of detectors and optics. More and more amateurs or professionals in the field of astrophotography are capturing well-known or less-known objects of the universe and trying to push the limits in the capabilities of their instruments. Astrophotographers' detectors can capture a variety of objects and events taking place in the sky and are becoming an important educational tool for the popularization of astronomy and can contribute to unexpected discoveries. Particularly dark locations with minimal light pollution allow to capture more phenomena than is the case in and around cities. In my paper I want to present activities and results related to astrophotography at the Astronomical Observatory on Kolonica Saddle located in the Poloniny Dark Sky Park.

Research Opportunities and Cooperation / 7

Research on variable stars at the Astronomical Observatory on Kolonicé saddle

The paper presents the history of observations of variable stars at the Astronomical Observatory on Kolonický Sedlo. The observational program focused on the research of variable stars is constantly under development. We started with the visual observation of eclipsing binaries. Physical variables were added later. Observations were usually made only during expeditions and astropractices. CCD photometry was started after the arrival of a permanent observer in March 2006. The first test measurements on a two-channel photoelectric photometer were performed in September 2006. The number of observed types of objects grows with the development of observation technology. A long-term concept of observations was created, which is gradually being fulfilled. The main targets are: intermediate polars, close binaries, cataclysmic variables with superhumps and semi-regular variables. Recently, active galactic nuclei have also been added.

We also present milestones in the development of observational techniques, the most important results and publications.

Research Opportunities and Cooperation / 8

A brief history of research at the Vihorlatská hvezdárna in Humenno

The paper summarizes the scientific and professional research carried out at the Vihorlatská hvezdárna in Humenno during the entire period of its existence. For a long time, expert astronomical observations were mainly focused on variable stars, the solar photosphere and meteor showers. Initially, visual observations were made. In all three areas, they are carried out to this day, which is important for the preservation of homogeneous observation series. Above all, in the case of variable stars, observations based on electronic detection - photoelectric photometry, CCD photometry, spectroscopy - are already developed. Practical observations form the main part of professional research. However, the workers of the Vihorlatská hvezdárna also devote themselves to theory, especially subtle effects on the light curves of eclipsing binaries. In addition, they participated in the development of unique software for online processing of photometric observations from several telescopes. The main result of scientific work is publications. Vihorlatská hvezdárna workers are the authors or co-authors of 130 works that can be found through ADS. In most cases, it is a co-authorship based on the provision of photometric data.

In recent years, the research carried out mainly at the Astronomical Observatory on the Colony Saddle has diversified considerably. Several scientific institutions installed their experiments here using the infrastructural facilities of the observatory.

The CREDO Science and Popularization / 9**Invitation to cooperation - distributing small detector arrays for CREDO**

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A short invitation to cooperation in a project which will include distribution of small detector arrays to collect data for CREDO. Each array, consisting of several small scintillator detectors in a coincidence circuit, will be able to register Extensive Air Showers and measure secondary cosmic ray flux. They will send data directly to the CREDO database creating network of devices different than smartphones. If funding will be granted equipment could be deployed along with workshop for students during which they will learn how to construct and operate such device.

The CREDO Science and Popularization / 10**CREDO Master Class Contribution to the Czech Particle Physics Project**

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Discussion about the CREDO Master Class Contribution to the Czech Particle Physics Project: <https://cphp.web.cern.ch>

Observations of the Cosmos / 11**Earthquakes, UFOs, and airplane accidents**