

CREDO Visegrad Workshop 2019

Report of Contributions

Contribution ID: 1

Type: **not specified**

Workshop Opening & Motivation Highlights

Thursday, November 21, 2019 2:00 PM (30 minutes)

Workshop Opening & Motivation Highlights

Presenter: ARMAN TURSUNOV & PIOTR HOMOLA

Contribution ID: 2

Type: **not specified**

Tadeusz Wibig / The First CREDO Registration of Extensive Air Shower

Friday, November 22, 2019 2:20 PM (30 minutes)

We have described the CREDO-Maze mini array with four CosmicWatch detectors. We show that this simple and affordable apparatus is able to register the Extensive Air Showers and it can be used to study cosmic rays much more effectively than the simple two-detector CosmicWatch muon telescope station. The further development direction is indicated.

Contribution ID: 3

Type: **not specified**

Alexander Ayriyan / Heterogeneous computing platform HybriLIT

Thursday, November 21, 2019 3:00 PM (30 minutes)

Heterogeneous computing platform HybriLIT is a part of the Multifunctional information and computing complex (MICC) of the Laboratory of Information Technologies of JINR. The platform consists of “Govorun” supercomputer and HybriLIT cluster as an education, scientific and testing polygon. It is based on heterogeneous structure of computation nodes and allows developing parallel applications for carrying out data analysis and computation using various computing architectures such as multicore CPUs, Intel Xeon Phi co-processors, and NVIDIA (Tesla K40, K80, V100) GPUs. Therefore, the platform provides the unified software and information environment and ecosystems for parallel computations and for ML/DL. It also provides a possibility to hold tutorials in parallel programming technologies that help students and scientists to learn new computing architectures.

Contribution ID: 4

Type: **not specified**

CREDO Collaboration highlights & discussion starter: Piotr Homola

Thursday, November 21, 2019 4:00 PM (30 minutes)

Collaboration Meeting: only for CREDO contributors.

Contribution ID: 5

Type: **not specified**

Visegrad project implementation highlights & discussion starter: Arman Tursunov

Thursday, November 21, 2019 4:30 PM (30 minutes)

Visegrad Project Meeting: for V4 project members and CREDO contributors.

Contribution ID: 6

Type: **not specified**

Visegrad project implementation highlights & discussion starter: Arman Tursunov

Visegrad Project Meeting: for V4 project members and CREDO contributors.

Contribution ID: 7

Type: **not specified**

David Alvarez Castillo / Ultra High Energy Cosmic Rays produced by compact star mergers and pulsars

Friday, November 22, 2019 10:00 AM (30 minutes)

In this talk I shall review a few mechanisms of ultra high energy cosmic rays produced by the merger of compact objects, supernovae infall into magnetars, formation of hybrid compact stars and emissions from pulsars. Moreover, I will discuss the physical implications of these processes within the framework of CREDO detections.

Contribution ID: 8

Type: **not specified**

Arman Tursunov / Acceleration of ultra-high-energy cosmic rays by supermassive black holes

Friday, November 22, 2019 11:00 AM (30 minutes)

Production and acceleration mechanisms of ultra-high-energy cosmic rays (UHECRs) with energy exceeding EeV remain unclear. Energy range of UHECRs beyond the GZK-cutoff limit points to exotic nature of the phenomena. I will show that extraction of rotational energy of a black hole by the novel, ultra-efficient regime of the magnetic Penrose process could indeed foot the bill. Ionization of particles, such as beta-decay of neutron, skirting close to the black hole horizon energizes protons to over 10^{20} eV. It is remarkable that the process requires neither extended acceleration zone, nor fine-tuning of accreting matter parameters. Further, this leads to a certain verifiable constraints on the black hole mass and magnetic field strength as UHECRs sources. Applied to the Galactic center supermassive black hole we have proton energy of orders coinciding with the knee of the cosmic ray spectra. I will also discuss the results of numerical studies related to the acceleration of primary cosmic rays and energy losses along the propagation distance.

Contribution ID: 9

Type: **not specified**

Oleksandr Sushchov / Simulation of formation and propagation of cosmic-ray ensembles : status and perspectives

Friday, November 22, 2019 11:30 AM (30 minutes)

Contribution ID: 10

Type: **not specified**

Kevin Almeida Cheminant / Search for ultra-high energy photons through the preshower effect with CTA telescopes

Friday, November 22, 2019 12:00 PM (20 minutes)

As ultra-high energy photons (EeV and beyond) propagate from their sources of production to Earth, radiation-matter interactions can occur, leading to an effective screening of the incident flux. In the ultra-high energy domain, photons can undergo e^+ / e^- pair production when interacting with surrounding geomagnetic field, which in turn can produce cascade of electromagnetic particles called preshower. Such cascade can initiate air showers in the Earth's atmosphere that gamma-ray telescopes, such as the next-generation gamma-ray observatory Cherenkov Telescope Array, can detect through Cherenkov emission. We study the feasibility of detecting such phenomena using Monte-Carlo simulations of nearly horizontal air showers for the example of the La Palma site of the Cherenkov Telescope Array. We investigate the efficiency of multivariate analysis in correctly identifying preshower events and cosmic ray dominated background. The effective area for such kind of events are also investigated and event rate predictions related to different ultra-high energy photons production models are presented.

Contribution ID: 11

Type: **not specified**

Paweł Jagoda / Numerical simulations of Extensive Photon Cascades and study of their signatures in the Cosmic-Ray

Friday, November 22, 2019 2:50 PM (20 minutes)

The cosmic ray research has been so far focused on investigating single air showers. In contrast, the CREDO project is dedicated to studying extremely distributed cosmic ray phenomena, so-called Super-PreShowers. If photons constitute a fraction of ultra-high energy primary particles, on their way through space they may initiate cascades comprising thousands of secondary elements. The simulation package developed attempts to model possible signatures of those events which we expect to observe in the extremely distributed observatory. The model of cascade development employed is governed by a simple probabilistic scenario, which gives similar results in terms of the number of particles and spatial dispersion as anticipated in real experiment. The presented visualisation tool provides signature maps of events that occur in remote locations. The signature maps are designed to be comprehensible to citizen scientists. The resulting map images are made available through the Dark Universe Welcome project. Undoubtedly, both detection as well as non-detection of such an event will extend our knowledge of Universe.

Contribution ID: 12

Type: **not specified**

Robert Kamiński / CREDO project (online talk)

Friday, November 22, 2019 9:30 AM (30 minutes)

The Cosmic-Ray Extremely Distributed Observatory (CREDO) is a project created a few years ago in the Institute of Nuclear Physics PAS in Krakow and dedicated is to global studies of extremely extended cosmic-ray phenomena. The main reason for creating such a project was that the cosmic-ray ensembles are beyond the capabilities of existing detectors and observatories. Until now, cosmic ray studies, even in major observatories, have been limited to the recording and analysis of individual air showers therefore ensembles of cosmic-rays, which may spread over a significant fraction of the Earth were neither recorded nor analyzed.

Contribution ID: 13

Type: **not specified**

Michal Niedzwiecki / Machine Learning methods for classification cosmic-ray events

Thursday, November 21, 2019 2:30 PM (30 minutes)

State of art, our plans and conception of usage the machine learning and reinforcement learning for classification of cosmic-ray events from CREDO database.

Contribution ID: 14

Type: **not specified**

Szabolcs Jakab / LOBA / CREDO expertise intro: science communication (online talk)

Friday, November 22, 2019 3:30 PM (20 minutes)

Online talk

Contribution ID: 15

Type: **not specified**

Silvia Lorenzo Perez / CREDO expertise intro: ethics (online talk)

Friday, November 22, 2019 3:50 PM (20 minutes)

Online talk

Contribution ID: 16

Type: **not specified**

Jacek Gębala & Kacper Lawera / Astronomy Club Almukantarat

Friday, November 22, 2019 4:20 PM (20 minutes)

Contribution ID: 17

Type: **not specified**

Discussion: CREDO & H2020 SwafS applications

Friday, November 22, 2019 5:00 PM (20 minutes)

Chair: Piotr Homola

Contribution ID: **18**

Type: **not specified**

Discussion: Visegrad implementation plan

Friday, November 22, 2019 5:20 PM (30 minutes)

Chair: Arman Tursunov

Contribution ID: 19

Type: **not specified**

Krystian Batyjewski / Playing with the Universe

Saturday, November 23, 2019 10:00 AM (15 minutes)

Audiovisual, interactive art performance powered by CREDO - one of the main drivers for the CREDO mission.

Contribution ID: 20

Type: **not specified**

Krystian Batyjewski & Piotr Homola / CREDO citizens discussion highlight: a global performance

Saturday, November 23, 2019 10:15 AM (15 minutes)

Contribution ID: 21

Type: **not specified**

Sławomir Stuglik / "Particle Hunters" competition and status of work on the user interface of the CREDO project

Saturday, November 23, 2019 10:30 AM (15 minutes)

I would like to present information about the "particle hunters" competition in Poland, and show the status of work on the user interface being developed by me.

Contribution ID: 22

Type: **not specified**

**Anna Kowalewska / Short description of
simultaneous detection of two \sim TeV photons - new
channel for DM search**

Contribution ID: 23

Type: **not specified**

Szymon Ryszkowski / CREDO citizens & gamification: board games

Saturday, November 23, 2019 10:45 AM (15 minutes)

Contribution ID: 24

Type: **not specified**

Discussion: CREDO Collaboration - vision, strategy & next steps

Saturday, November 23, 2019 11:30 AM (30 minutes)

Chair: Piotr Homola

Contribution ID: 25

Type: **not specified**

Discussion: Visegrad implementation - practical conclusions / to do list

Saturday, November 23, 2019 12:00 PM (30 minutes)

Chair: Arman Tursunov

Contribution ID: 26

Type: **not specified**

**Anna Kowalewska / Short description of
simultaneous detection of two \sim TeV photons - new
channel for DM search (online talk)**

Friday, November 22, 2019 2:00 PM (20 minutes)

online talk

Contribution ID: 27

Type: **not specified**

Probability of detecting cosmic-ray cascades by simple CREDO detectors - How to work efficiently with students? (online talk)

Friday, November 22, 2019 4:10 PM (10 minutes)

Presenter: WOZNIAK, Krzysztof (Institute of Nuclear Physics PAS, Krakow, Poland)