

Invitation to the Cosmic Ray Extremely Distributed Observatory

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The executive summary

Cosmic Ray Ensembles (CRE) are very large, yet not observed particle cascades initiated above the Earth atmosphere. Such cascades could be formed both within classical models (e.g. products of photon-photon interactions) and exotic scenarios (e.g. result of decay of Super Heavy Dark Matter particles and subsequent interactions). Some of CRE might have a significant spatial extent which could serve as a unique signature detectable with the existing cosmic ray infrastructure taken as a network of detectors. This signature would be composed of a number of air showers with parallel axes. An obvious, although yet not probed, CRE „detection horizon” can be located somewhere between an air shower induced by an CRE composed of tightly collimated particles (preshower effect), and undetectable CRE composed of particles spread so widely that only one of them have a chance to reach Earth. Probing the CRE horizon with a global approach to the cosmic ray data, as proposed by the newly formed Cosmic Ray Extremely Distributed Observatory (CREDO), defines an extensive scientific program oriented on the search for physics manifestations at largest energies known, with potential impact on ultra-high energy astrophysics, the physics of fundamental particle interactions and cosmology. In this talk the current status and perspectives of CREDO will be summarized, with an open invitation for the colleagues interested in a global approach to cosmic ray studies, and in particular in observing and investigating multi-primary cosmic ray events such as CRE. Once CRE are observed, a new observation channel of the Universe will be open, and the information from this channel can point us back to the interactions at energies close to the GUT scale, leading possibly to a breakthrough in physics. On the other hand, if CRE are not observed, we will set the new upper limits constraining selected theories. Moreover, since the CREDO concept and strategy offers inter- and transdisciplinary opportunities, the advances of the studies proposed here will automatically contribute to many external studies and scientific achievements as well. Within this report we give an overview of the CREDO status and perspectives, as presented in the other ICRC 2021 articles and in the first several peer-reviewed articles that have been published within the last year.

¹ Speaker