Contribution ID: **6** Type: **not specified**

Modified Characteristics of Hadronic Interactions in Ultra-high-energy Cosmic-ray Showers

Wednesday 2 October 2024 14:30 (30 minutes)

Data from multiple experiments suggest that the current interaction models used in Monte Carlo simulations do not correctly reproduce the hadronic interactions in air showers produced by ultra-high-energy cosmic rays (UHECR), in particular –but not limited to –the production of muons during the showers. We have created a large library of UHECR simulations where the interactions at the highest energies are slightly modified in various ways –but always within the constraints of the accelerator data, without any abrupt changes with energy and without assuming any specific mechanism or dramatically new physics at the ultra-high energies. We find that even when very different properties –cross-section, elasticity and multiplicity –of the interactions are modified, the resulting changes in some air-shower observables are still mutually correlated. Thus not all possible combinations of changes of observables are easily reproduced by some combination of the modifications. Most prominently, the recent results of the Pierre Auger Observatory, which call for a change in the prediction of both the muon content at ground and the depth of the maximum of longitudinal development of the showers, are rather difficult to reproduce with such modifications, in particular when taking into account other cosmic-ray data. While some of these results are related to the assumptions we place on the modifications, the overall lessons are general and provide valuable insight into how the UHECR data can be interpreted from the point of view of hadronic physics

Author: EBR, Jan (FZU - Instituted of Physics of the Czech Academy of Sciences)

Presenter: EBR, Jan (FZU - Instituted of Physics of the Czech Academy of Sciences)