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Predicting the UHE photon flux from GZK-interactions of hadronic cosmic rays using CRPropa 3

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The spectrum of ultra high energy (UHE) cosmic rays as measured by the Pierre Auger Observatory indicates a strong flux suppression above 50 EeV. The origin of this suppression is still unclear. One possible explanation is the Greisen-Zatsepin-Kuzmin (GZK) process, in which UHE protons interact with the cosmic microwave background. Indirect evidence for the GZK-process could be provided by the search for UHE photons produced in such an interaction. A signal of UHE photons could not yet be identified among the cosmic rays. Hence, upper limits on the UHE photon flux have been derived from experimental data of various experiments. In order to interpret these limits, theoretical predictions are needed.
In this contribution, new predictions on the UHE photon flux above 0.1 EeV are derived assuming both pure and mixed compositions of the initial cosmic rays. The
simulation study has been done using CRPropa 3 taking into account latest results
regarding the composition as measured by the Pierre Auger Observatory
and the extragalactic medium. For all compositions, the predictions stay below the current upper limits on the UHE photon flux derived from experimental data. The main uncertainties on the predictions originate from the lack of knowledge about the sources of UHE cosmic rays. Future experiments like the AugerPrime upgrade of the Pierre Auger Observatory are expected to shed further light on the origin and composition of UHE cosmic rays and, hence, will help to improve the predictions.

Keywords

cosmic ray propagtion; CRPropa 3; GZK-process; GZK-cutoff; ultra-high-energy photons;

Collaboration

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Subcategory

Theoretical Results

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