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Event-by-event studies of the ultrahigh-energy cosmic-ray composition

Abstract content

Recently we suggested a method which improves the precision of studies of the primary composition of ultra-high-energy cosmic rays. Two principal ingredients of the method are (1) comparison of the observed and simulated parameters for individual showers, without averaging over arrival directions and (2) event-by-event selection of simulated showers by the physical observables and not by the reconstructed primary parameters. A description of the algorithm is presented and illustrated by several examples including study of samples of highest energy events with known muon content which resulted in the most stringent limits on photon fraction: at the 95% confidence level these limits are 12% for primary energies $E_0 > 2 \cdot 10^{19}$ eV, 22% for $E_0 > 4 \cdot 10^{19}$ eV and 36% for $E_0 > 10^{20}$ eV. The sensitivity of the results to systematic uncertainties, in particular to those of the energy determination for non-photon primaries, is discussed.

If this papers is presented for a collaboration, please specify the collaboration

Summary

Reference

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