A Complete Model of the Signal in Surface Detector Arrays and its Application for the Reconstruction of Mass-sensitive Observables

Executive Summary

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What is this contribution about?

Describing the air-shower phenomenon in a way that allows for the reconstruction of the atomic mass of the primary particle, using only surface detector data.

Why is it relevant?

The chemical composition of the highest energetic particles known to mankind is yet to be unraveled.

What has been done?

We formulated and parameterized a model that predicts the expected spatial and temporal distribution of the signal of air showers as a function of X_{max} and the muon content, R_{μ}.

What is the result?

Based on simulations, we are able to reconstruct $\ln A$ with a precision of ca. $\sigma(\ln A) \lesssim 1.5$ for the highest energetic cosmic rays.