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Data-driven model of the cosmic-ray flux and mass composition over all energies

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We present a parametrisation of the cosmic-ray flux and its mass composition over an energy range from 1 GeV to 10^{11} GeV, which can be used for theoretical calculations. The parametrisation provides a summary of the experimental state-of-the-art for individual elements from proton to nickel. We seamlessly combine measurements of the flux of individual elements from high-precision satellites and balloon experiments with indirect measurements of mass groups from the leading air shower experiments. We propagate both statistical and systematic uncertainties with correlations, and obtain a large flux covariance matrix as a result which can be further propagated. Variations in the energy scales of individual experiments are taken into account with nuisance parameters. We obtain a unified energy scale and adjustment factors for the energy scales of the participating experiments. Our fit has a reduced chi2 value of 1, showing that the data sets are in good agreement, if systematic uncertainties are taken into account.

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