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Impact of AMS-II measurements on reducing GCR model uncertainties

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For vehicle design, shield optimization, mission planning, and astronaut risk assessment, the exposure from galactic cosmic rays (GCR) poses a significant and complex problem both in low Earth orbit and in deep space. To address this problem, various computational tools have been developed to quantify the exposure and risk in a wide range of scenarios. Generally, the tool used to describe the ambient GCR environment provides the input into subsequent computational tools and is therefore a critical component of end-to-end procedures. Over the past few years, several researchers have independently and very carefully compared some of the widely used GCR models to more rigorously characterize model differences and quantify uncertainties. All of the GCR models studied rely heavily on calibrating to available near-Earth measurements of GCR particle energy spectra, typically over restricted energy regions and short time periods. In this work, we first review recent sensitivity studies quantifying the ions and energies in the ambient GCR environment of greatest importance to exposure quantities behind shielding. Currently available measurements used to calibrate and validate GCR models are also summarized within this context. It is shown that the AMS-II measurements will fill a critically important gap in the measurement database. The emergence of AMS-II measurements also provides a unique opportunity to validate existing models against measurements that were not used to calibrate free parameters in the empirical descriptions. Discussion is given regarding rigorous approaches to implement the independent validation efforts, followed by recalibration of empirical parameters.

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