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GeoMagFilter: Modeling the Angular-Rigidity Joint Distribution of Galactic Cosmic Rays on Low Earth Orbit

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We report the GeoMagFilter database for modeling the angular-rigidity joint distribution of galactic cosmic rays on low Earth orbit caused by the shielding of geomagnetic field and the Earth atmosphere. We use a backtracing software which integrates the particle trajectory with eight order Runge-Kutta algorithm in the geomagnetic field described by the IGRF13 model. At every 10 degree in longitude and 5 degree in latitude, backtracing is performed for 54 rigidities from 0.2 to 91.2 GV and 13963 arriving directions uniformly sampling the unit sphere. An altitude of 400 km and a latitude range of ±60 degree are used to cover the orbit of the International Space Station and the China's Space Station. The detailed structures of the allowed cone, which is the arriving directions of galactic cosmic rays, are observed as a function of rigidity and geographic location. Comparisons of allowed cones are performed for understanding the impact from external geomagnetic field, variation of orbital altitude, evolution over time, and variation of particle flight time limit. Furthermore, the GeoMagFilter database is straightforwardly used in the precise calculation of radiation dose rate and orbit-averaged geomagnetic transmission function to account for the anisotropic distribution of the galactic cosmic rays on low Earth orbit.

Collaboration(s)

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