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Flux of solar energetic particles in the distant past: Data from lunar rocks

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The era of direct measurements of solar energetic particle (SEP) fluxes is limited to the last few decades and largely overlaps the Modern grand maximum of solar activity with unusually high solar activity. However, for many purposes it is important to know the fluxes of SEPs on much longer time scale. This can be made only using indirect proxies. Terrestrial proxy archives, such as the isotopes C-14 and Be-10, may potentially resolve strongest SEP events but cannot evaluate the average SEP flux. On the other hand, lunar rock samples, collected during the Apollo missions and measured later at Earth, may provide information on the average fluxes of SEPs throughout millennia and millions of years in the past. This option had been explored earlier, and here we revisit the approach, using the newly calculated yield functions of cosmogenic isotope production in lunar rocks and re-analyzing the published results of measurements of lunar rocks. As a result, a new improved estimate of the averaged SEP flux in the past is obtained and compared with the present day values.

Collaboration

– not specified –

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Primary author: POLUIANOV, Stepan (University of Oulu, Finland)

Co-authors: ARTAMONOV, Anton (University of Oulu, Finland); KOVALTSOV, Gennady (Ioffe Physical-Technical Institute, Russia); USOSKIN, Ilya (University of Oulu, Finland)

Presenter: POLUIANOV, Stepan (University of Oulu, Finland)

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