Scientists learn how to predict space radiation levels

December 28 2018

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Experts from the National Research Nuclear University MEPhI (Russia), the University of Oulu (Finland), and the St. Petersburg-based Ioffe Physical-Technical Institute of the Russian Academy of Sciences (Russia) have compared the effect of cosmic ray solar modulation as recorded by neutron monitors and the PAMELA (Payload for Antimatter Matter Exploration and Light-Nuclei Astrophysics) satellite experiment.

According to the scientists, this will make it possible to predict radiation levels in near-Earth space more accurately, an important aspect of planning space missions. The results of this project were published in the *Journal of Geophysical Research: Space Physics*.

Launched in 2006, the PAMELA satellite experiment aims to locate and record antimatter and to measure the spectrum bands of cosmic radiation components, as well as near-Earth radiation conditions, and to establish the origin of dark matter.

The research paper's authors compare the effects of the solar modulation of cosmic rays, recorded by the PAMELA international experiment and neutron monitors. These neutron monitors are a chain of ground-based units that have been operating since the 1950s and which record secondary particles generated during interaction between cosmic rays and atmospheric nuclei. Russian scientists used data recorded in real time by a neutron monitor in Oulu, Finland.

These results will help gauge the neutron monitors' correct response function during solar activity. This was only made possible after launching the PAMELA experiment, said Sergei Koldobsky, a senior lecturer with MEPhI's Institute of Nuclear Physics and Engineering.

"The correct responses of neutron monitors, as well as huge statistical records of uninterrupted operation over the past 70 years, allow us to predict radiation levels in near-Earth space, and this has tremendous significance for planning space missions," Sergei Koldobsky told.

Direct measurements conducted during the PAMELA experiment made it possible to check the accuracy of the neutron monitors' response function, which links the cosmic ray spectral band that reaches the top layers of the terrestrial atmosphere with the number of neutrons being recorded by a given monitor. The research paper also mentions the

calibration of ground-based neutron monitors using PAMELA experiment data.

More information: Sergey A. Koldobskiy et al. A Solar Cycle of Cosmic Ray Fluxes for 2006-2014: Comparison between PAMELA and Neutron Monitors, *Journal of Geophysical Research: Space Physics* (2018). DOI: 10.1029/2018JA025516

Provided by National Research Nuclear University