

Stochastic Fluctuations of Low-Energy Cosmic Rays and the Interpretation of Voyager Data

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The propagation distances of MeV cosmic rays is significantly limited due to ionisation loss in the interstellar medium. Therefore, the density of cosmic rays will depend sensitively on the exact distribution of the sources in space and time. For an ensemble of source distributions, the fluxes will follow a strongly non-Gaussian distribution. Here, we show that the typical flux, that is the median of the distribution, significantly deviates from the average flux, that is the expectation value of the distribution. Taking this into account allows for a consistent fit of data from Voyager 1 and AMS-02 without any unmotivated breaks in the source spectrum or mean-free path where earlier models needed to introduce those in an ad hoc fashion. We conclude with a discussion of the implication of these results for the discrepancy between the observed and predicted ionization rate induced by low-energy cosmic rays.

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Collaboration

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Subcategory

Theoretical Results

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