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Transport of dust across the Solar System: Insights from cosmic-ray exposure dating

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Determining the precise origin of individual micrometeorites (MMs) in our Solar System remains an open challenge. An important step towards identifying the origin and evolution of cosmic dust in our Solar System is the study of the irradiation histories of MMs [1-3].

During their million-year-long space travel on spiral orbits to Earth, the interplanetary dust particles are exposed to cosmic radiation, which produces radionuclides such as ^{26}Al and ^{10}Be [4]. The amount of these cosmogenic nuclides increases with their time having spent in space. Hence, making certain considerations, it is possible to estimate from which heliocentric distance in the Solar System the MMs originated [1].

We analyzed the ^{26}Al and ^{10}Be content of six urban and six Antarctic MMs. This data was compared with results of numerical simulations calculating ^{26}Al and ^{10}Be concentrations in MM progenitors using various orbital parameters, compositions, and irradiation profiles [1].

The results show a broad spectrum of exposure durations in space, ranging from nearly 0 up to 5.8 Myr, and a similarly broad spectrum of heliocentric distances of origins from Near-Earth orbits to the Kuiper Belt.

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