

Interstellar particles in the Solar system's interplanetary medium

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Abstract

Detection and identification of interstellar particles moving through our solar system is of utmost importance to scientists, because it enables us to study material originating from outside our solar system. However, even though we have already confirmed presence of the interstellar dust and sub-km interstellar bodies inside our solar system, we have yet to reliably confirm the presence of interstellar meteoroids, particles bigger than dust but smaller than asteroids and comets. The meteoroids are too small to be observed by telescopes and we can only study them once they enter the Earth's atmosphere and create a meteor phenomena.

The interstellar particles can be distinguished from the solar system ones through their heliocentric velocity, as they move in hyperbolic orbit relative to Sun. However, hyperbolic orbits within the meteor databases are usually attributed to observational or reduction errors.

The aim of this thesis is not to search for interstellar particles, but to demonstrate the difficulties in observation and identification of interstellar particles in meteor data as well as in selected dust dataset. Through examination of the datasets and the hyperbolic orbits within them we aim to identify potential weaknesses that may lead to false interstellar particle labeling. The results of this work emphasize the importance of data quality and highlight various contributing aspects, from careful inspection of raw meteor images and derivation of meteor parameters to the calculation of meteoroid orbital elements, including their uncertainties, as well as the need for comprehensive analysis of whole datasets.

Keywords: meteor, meteoroid, interstellar particle, error analysis