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Charging of Interstellar Dust Grains Near the Heliopause

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The deflection of interstellar dust grains in the magnetic field near the heliopause has been investigated based on the assumption that interstellar grains are homogeneous spheres. However, remote observations have shown that interstellar grains are more likely to be composites of a large number of subunits. This has profound significance when interpreting data obtained through in-situ measurements, for the deflection of interstellar grains depends on their charge-to-mass ratio, and aggregates acquire different surface charges from spheres due to their complex structure. In this paper, the charging of aggregates near the heliopause is examined including both plasma charging and secondary electron emission. The results show that aggregates generally have a higher charge-to-mass ratio than spheres, and the small particle effect from secondary electron emission is evident for aggregates consisting of nano-sized particles. A new approach to estimate the aggregate charge with the aid of its structural characteristics is presented. The charge-to-mass ratio is used to derive the mass distribution of interstellar dust near the heliopause, and the result shows an overall agreement with Ulysses data.

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