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The Mass Distribution of Interstellar Dust in the Heliosphere from In-situ Measurements

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1. Abstract

In the early 1990s, interstellar dust penetrating deep into the heliosphere was identified with the in-situ dust detector on board the Ulysses spacecraft [Grün et al., 1994]. Between 1992 and 2007 Ulysses monitored the interstellar dust stream at high ecliptic latitudes between 3 and 5 AU. The interstellar grains act as tracers of the physical conditions in the local interstellar medium surrounding our solar system. In the inner solar system the interstellar dust stream is altered by the solar radiation pressure force, gravitational focussing and the interaction of charged dust grains with the time varying interplanetary magnetic field (IMF). In particular, variations of the dust flux and impact direction can only be understood in terms of the grain interaction with the IMF [Landgraf et al., 1999].

Earlier analyses of the Ulysses interstellar dust data set measured between 1992 and 1998 implied the existence of a population of 'big' interstellar grains (up to 10^{-13} kg) [Landgraf et al., 2000, Frisch et al., 1999]. Furthermore, the derived gas-to-dust-mass ratio was smaller than the one derived from astronomical observations, implying a concentration of interstellar dust in the very local interstellar medium. In a recent re-analysis of the entire Ulysses dust data set we find a lower dust density than implied by Landgraf et al. and a larger gas-to-dust-mass ratio. Our value for the gas-to-dust-mass ratio is now in agreement with the more recent value re-determined from astronomical observations [Slavin and Frisch, 2008].

We present our results from the recent analysis of the entire Ulysses interstellar dust data set and discuss their implications for the physical and chemical state of the local interstellar cloud.

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