Seven particles of probable interstellar origin returned by Stardust

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We report on the analyses of seven particles of probable interstellar origin, discovered as part of the Stardust Interstellar Preliminary Examination (ISPE). The particles were discovered in the Stardust Interstellar Dust Collector (SIDC), which was exposed to the interstellar dust stream for 200 days onboard the Stardust spacecraft The SIDC consisted of silica aerogel (85%) and aluminum foils (15%).

The ISPE consisted of six parallel projects [1]. Impacts in aerogel were identified in stacks of high-resolution optical micrographs, acquired using an automated microscope. >30,000 citizen scientists collectively conducted ~10^8 searches of the optical data using an online virtual microscope [2]. We used automated SEM imaging and both visual and automated techniques to identify impacts in the foils [3]. Impact residues were analyzed by EDX and Auger spectroscopy. Particles were extracted from aerogel tiles using automatically controlled glass needle [4]. We analyzed impacts in aerogel using synchrotron-based infrared [5] and X-ray microprobes [6–10]. Laboratory simulations of impacts of interstellar dust [11] and numerical modeling of dust propagation in the heliosphere [12] supported the interpretation of the observations.

We identified three impacts in aerogel and four impacts in aluminum foil that are likely to have an interstellar origin. The particles show large diversity in composition, and in optical properties as derived from the impact speeds. The fluence of large particles ~1/10 of that expected, which may be consistent with an aggregate structure of a large fraction of dust in the local interstellar medium.

[1] Westphal *et al* (2014a) *Meteoritics and Planetary. Science (MaPS),* in press. [2] Westphal *et al* (2014b) *MaPS* in press. [3] Stroud *et al* (2014) *MaPS* in press. [4] Frank *et al* (2014) *MaPS* in press. [5] Bechtel *et al* (2014) *MaPS* in press. [6] Butterworth *et al* (2014) *MaPS* in press. [7] Brenker *et al* (2014) *MaPS* in press. [8] Simionovici *et al* (2014) *MaPS* in press. [9] Flynn *et al* (2014) *MaPS* in press. [10] Gainsforth *et al* (2014) *MaPS* in press. [11] Postberg *et al* (2014) *MaPS* in press. [12] Sterken *et al* (2014) *MaPS* in press.