HIGH FIDELITY STUDIES OF INTERSTELLAR DUST ANALOGUE IMPACTS IN STARDUST AEROGEL AND FOILS

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In 2000 and 2002 the Stardust Mission exposed aerogel collector panels for a total of about 200 days to the stream of interstellar grains sweeping through the solar system. The material was brought back to Earth in 2006.

We present laboratory calibration of the collection process by shooting high speed [3 - 30km/s] interstellar dust (ISD) analogues onto Stardust aerogel and foil flight spares. Particle impact speeds up to 50 km/sec can only be achieved by a Van de Graaff accelerator such as operated at the MPI für Kernphysik (Heidelberg) [1], and requires coating of non-conductive particles with thin films of either platinum [2] or polypyrrole [3].

Particle impact tracks in aerogel were identified by an optical microscope. Track diameters and depths were measured optically at high magnification using an encoded stage with 0.5µm precision. Subsequently tracks in picokeystones were extracted and analyzed with Scanning Transmission X-ray Microscopy (STXM). This enabled an investigation into both the morphology of impact tracks as well as structural and chemical modification of projectile and collector material. Major campaigns were completed in spring 2011 with the goal to characterize tracks of interstellar grains with respect to the projectile speed, size, and density. Three different materials (orthopyroxene, iron, polystyrene) were therefore shot within several narrow speed and size windows (e.g. 14 - 16 km/s, 0.37 – 0.43µm). For each set of parameters, about 50 particles were collected.

First results show a bulbous track shape at 15 km/s similar to type A Stardust tracks with a terminal particle. For the first time it could be shown experimentally that cores of sub-micron minerals survive aerogel capture at speeds well above 10km/s. The calibration is not only important for the systematic search and analyses of foils and aerogel [4,5], but also allows recalculation of the ISD flux [6] for the Stardust collection period.

References: [1] Stübig M. et al. (2001), Planet. Space Sci. 49, p. 853 [2] Hillier J.K. et al. (2009), Planet. Space Sci. 57, p. 2081 [3] Armes S. et al. (1991), Polymer 32, p. 2325 [4] Floss C. et al. 2011. *This Volume* [5] Stroud R. M. et al. 2011. *This Volume* [6] Landgraf, M., Müller, M., Grün, E. (1999), Planet. Space Sci. 47, p. 1029.