POSSIBLE PRESENCE OF SPALLATION NEON IN THE OUTER LAYER OF PARTICLE-FREE AEROGEL FLOWN ON BOARD OF THE STARDUST MISSION.

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Introduction: The purpose of this work is to estimate the possibility of collecting gas-rich submicron particles with aerogel collector flown on the Stardust mission. If these invisible particles were exposed to intense solar and/or other open space irradiation in the comet-forming region and if they somehow were incorporated into the comet Wild-2 before being pushed out by radiation pressure or dragged in by the Poynting-Robertson effect, we may have a chance to find them in the Stardust aerogel collectors. The best place to look for submicron dust is in areas of the aerogel free of visible tracks made by cometary particles. Since we cannot observe and analyze an individual submicron particle we can only study them collectively. Noble gases are similarly studied in invisible meteoritic nanodiamonds or the elusive phase-Q.

Experimental: A track-free aerogel block was cut into several 7×6 mm slices, each 200 micron thick and placed between fused quartz slides. This "sandwich" was then mounted into a laser extraction cell equipped with two sapphire veiwports allowing any unabsorbed laser beam to leave the cell (only ~7% of IR power is adsorbed by aerogel). The cell was kept for two weeks at 175°C in order to reduce noble gas blank. Each aerogel slide was rastered with slightly defocused 1064 nm beam generated by Q-switched Nd-YAG laser. Finally He and Ne isotopes were analyzed. No He anomalies were found within experimental errors while Ne showed small but statistically significant excesses of ^{21}Ne in the 1st (outermost), 2nd and probably 3rd aerogel layers:

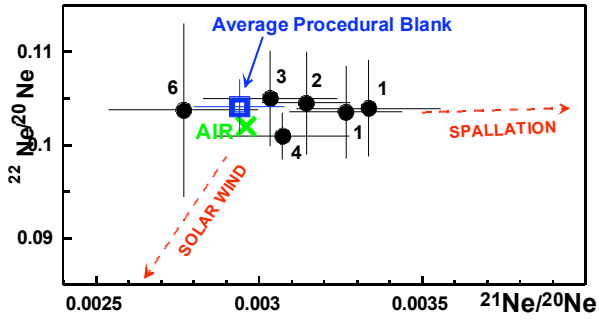

Fig.1. Ne composition in 0.2 mm slices of Stardust aerogel. Numbers indicate the distance of slices from the aerogel front surface (1 – outermost, 2 – from 0.2 to 0.4 mm, *etc*).

Results: The spallogenic ^{21}Ne excess observed in track-free aerogel is depth-dependant: $(19 \pm 5) \times 10^{-15}$ ccSTP/cm^2 in layer 1, and $(9 \pm 6) \times 10^{-15}$ ccSTP/cm^2 in layer 2, and no statistically significant amounts in layers 3, 4 and 6. Considering the extremely low density of aerogel and short exposure to energetic particles it is unlikely that ^{21}Ne was produced in the aerogel itself. Most probably it is carried by irradiated submicron dust grains.

We plan more experiments to confirm this observation and more work to understand the origin and behavior of submicron dust. This work is supported by NASA grant NNX07AM76G.