DUST SAMPLES FROM COMET WILD 2 AND INTERSTELLAR STREAM. P. Tsou1, D.E. Brownlee2, F. Hörz3, G. Flynn4, L. Keller5, K. McKeegan5, S. A. Sandford6, M. E. Zolensky3, 1Jet Propulsion Laboratory, California Institute of Technology, (peter.tsou@jpl.nasa.gov), 2Astronomy Department, University of Washington, 3NASA Johnson Space Center, 4State University New York-Plattsburgh, 5University of California, Los Angeles, 6NASA Ames Research Center

Introduction: STARDUST is the first mission designed to bring samples back to Earth from a known comet and also the first to bring back contemporary, free interstellar particles[1]. On January 2, 2004, for about five minutes about 19:21:32 UTC, STARDUST captured dust grains from comet 81P/Wild 2 at 236.4 ± 1 km from the nucleus [2]. On the reverse side of the Wild 2 sample collector tray, there are equal number of aerogel capture cells optimized to capture dust from the contemporary interstellar stream in the 2 AU range [3]. Interstellar dust collection began on February 16, 2000 through May 20, 2000 and again from July 27, 2002 through December 9, 2002, a total of 246 days.

Uniqueness of Samples: Wild 2 is a unique comet for coma sample return since it was relatively "fresh". Our sample collection was only the fifth perihelion passage. In 1974, the comet had a close encounter with Jupiter that dramatically changed its orbit [4]. The comet now has a perihelion distance of 1.58 AU and an aphelion near Jupiter’s orbit at 5.2 AU. The outer layers of Wild 2 have only been subjected to moderate solar heating allowing our samples to be more representative of the nucleus composition. Wild 2 samples represent well-preserved relics of the outer regions of our solar nebula and fundamental building blocks of our planetary system.

Interstellar grains are the main repositories of condensable elements, which permeate the galaxy. On the average, interstellar grains are expected to be considerably smaller than Wild 2 particles, mostly in the submicron size range, although interstellar particles as large as 10 µm are distinctly possibility [5]. It is most advantageous to capture these particles when the spacecraft’s orbit carries it in the same direction as the interstellar dust stream’s velocity vector to reduce the capture speed by the amount of the spacecraft speed. For STARDUST, this occurred as the spacecraft was on the inbound portion of the orbit.

The unique opportunity for STARDUST is to study the interstellar grains accreted in Wild 2 at the formation of the comet which can now be compared with dust captured from the contemporary interstellar stream, possibly billions of years apart.

Sample Instrument: These solid samples are captured in two back-to-back sample collection trays occupied by newly developed smooth-gradient-density silica aerogel. There are 132 silica aerogel capture cells of 3 cm and 1 cm thickness for the cometary and the interstellar sides, respectively. The aerogel capture cells were wedged into the sample collection trays and wrapped on all four sides with 101.6 µm thick 1100 aluminum foil to facilitate aerogel capture cell removal as well as serving as a small grain capture medium. The total exposed Wild 2 aerogel surface area is 1039 cm² and 153 cm² of aluminum foil.

Preliminary Examination: On January 15, 2006, these samples will be returned to Earth in a direct reentry capsule at the Utah Test and Training Range. There are about 150 sample analysts in six disciplines (optical, composition, mineralogy/petrology, isotopes, organics and cratering) who will participate in the Preliminary Examination of the Wild 2 samples. Preliminary results for Wild 2 will be reported by September 2006 and the interstellar samples results a year later.

References: