The Future of Stardust Science

Andrew Westphal[1]

[1] *U. C. Berkeley*

westphal@ssl.berkeley.edu

Over 99% of the small bodies in the Solar System reside in its outer reaches - in the Kuiper Belt and Oort Cloud. Kuiper Belt bodies are probably the best preserved representatives of the icy planetesimals that dominated the bulk of the solid mass in the early Solar System. Despite their importance, they are relatively underrepresented in our extraterrestrial sample collections by many orders of magnitude ($\sim 10^{13}$ by mass) as compared with the asteroids, represented by meteorites, which are composed of materials that have generally been strongly altered by thermal and aqueous processes. We have only begun to scratch the surface in understanding Kuiper Belt objects, but it is already clear that the very limited samples of them that we have in our laboratories hold the promise of dramatically expanding our understanding of the formation of the Solar System. Stardust returned the first samples from a known small solar-system body, the Jupiter-family comet 81P/Wild 2, and, in a separate collector, the first solid samples from the local interstellar medium. Analyses of these surprising samples continue to yield unexpected discoveries and to raise new questions about the history of the early Solar System. I identify 9 high-priority scientific objectives for future Stardust analyses that address important unsolved problems in Planetary Science, all of which can be addressed in the laboratory, with an emphasis on those questions that can be answered by coordination and comparison with Rosetta in situ observations of 67P/Churyumov-Gerasimenko, and with laboratory analyses of Chondritic Porous Interplanetary Dust Particles.