EP 7: Planets and Small Bodies III

Time: Wednesday 11:00–12:05 Location: ZHG005

EP 7.1 Wed 11:00 ZHG005

Collecting a regolith sample from a near-Earth asteroid (NEA): A very fast sample return mission opportunity — •Martin Hilchenbach[1], Thorsten Kleine[1], Bastian Gundlach[2], Jens Biele[3], Stephan Ulamec[3], Tra-Mi Ho[4], Jan Thimo Grundmann[4], Carsten Güttler[3], Markus Patzek[3], Moritz Goldmann[3], Oliver Stenzel[1], Christian Renggli[1], Norbert Krupp[1], and Matthias Noeker[1] for the APOSSUM-Collaboration — [1]Max-Planck-Institute for Solar System Research, Göttingen, Germany — [2]Universität Münster, Institut für Planetologie, Münster, Germany — [3]Deutsches Zentrum für Luft- und Raumfahrt (DLR-MUSC), Cologne, Germany — [4]Institute of Space Systems (DLR), Bremen, Germany

The close flyby of asteroid (99942) Apophis would offer a unique opportunity to collect and return a regolith sample. The European Space Agency (ESA) is currently exploring the possibility within the RAMSES mission study to observe Apophis before its closest approach to Earth on Friday, April 13, 2029. We present the findings of our concurrent engineering (CE) studies evaluating the feasibility of a sample return capsule, named APOphiS SUrface saMpler (APOSSUM). The APOSSUM design envisions a detached, touch-and-go mission with semi-autonomous navigation and thruster-based control, collecting regolith using rotating brushes. By mid-March 2029, the capsule would be guided towards Earth, with a velocity offset of only a few tens of meters per second relative to the asteroid.

EP 7.2 Wed 11:15 ZHG005

Dust Measurements with the DESTINY+ Mission to the Active Asteroid (3200) Phaethon — •Harald Krüger[1,2], Masanori Kobayashi[2], Ralf Srama[3], Tomoko Arai[2], and DESTINY Dust Science Team[1,2,3] — [1]MPI für Sonnensystemforschung, Göttingen, Germany — [2]PERC, Chiba Institute of Technology, Narashino, Japan — [3]Institut für Raumfahrtsysteme, Universität Stuttgart, Germany

The DESTINY+ spacecraft will be launched by the Japanese Space Agency JAXA in 2028. The main mission target will be the active asteroid (3200) Phaethon, with a close flyby in 2030. Together with two cameras on board, the DESTINY+ Dust Analyzer (DDA) will perform in-situ measurements at Phaethon to solve essential questions related to the evolution of the inner Solar System, including heating processes and compositional evolution of small solar system objects. Phaethon is believed to be the parent body of the Geminids meteor shower and may be a comet-asteroid transition object. Such objects can likely provide information to better understand the nature and origin of mass accreted onto Earth. DDA is an upgrade of the Cassini Cosmic Dust Analyzer (CDA) which very successfully investigated the dust environment of the Saturnian system. DDA is an impact ionization time-of-flight mass spectrometer with integrated trajectory sensor, which will analyse sub-micrometer and micrometer sized dust particles. We give an overview of the DESTINY+ mission, the Dust Analyzer DDA and the science goals for the analysis of Phaethon dust, as well as interplanetary and interstellar dust to be measured en route to Phaethon.

EP 7.3 Wed 11:30 ZHG005

"Dark Comets" among the Near-Earth Asteroids — •Jessica Agarwal[1], Nicholas Attree[2], Pedro Gutierrez[2], Oriel Humes[1], and Manuela Lippi[3] — [1]TU Braunschweig, Germany — [2]Instituto de Astrofisica de Andalucia, Granada, Spain — [3]INAF, Osservatorio astrofisico di Arcetri, Firenze, Italy

The "dark comets" are a handful of near-Earth asteroids (NEAs) that have their orbits perturbed by a non-gravitational acceleration inconsistent with radiative processes of momentum transfer like radiation pressure and the Yarkowsky effect (Seligman et al., 2023, 2024, Farnocchia et al. 2023).

Asymmetric outgassing has been suggested as the next straightforward explanation of this acceleration, despite, but not inconsistent with a non-detection of emitted dust. Taylor et al. (2024) propose a model where the sublimating region would be located near the poles, and the rotation axes of the "dark comets" would have to be highly tilted. Thermophysical models (e.g., Schoerghofer & Hsieh, 2018), however, predict that, if at all, ice can be preserved in asteroids this close to the sun only in permanently shadowed polar regions, requiring a near-zero tilt.

This contribution reviews the available evidence concerning the "dark comets" and discusses the implications for the distribution and preservation of volatiles (i.e. water ice) in the asteroid population.

References: Seligman et al. (2023), PSJ, 4, 35; Seligman et al (2024) PNAS, 121, 51; Farnocchia et al. (2023), PSJ, 4, 29; Schoerghofer & Hsieh (2018), JGRP, 123, 2322.

EP 7.4 Wed 11:45 ZHG005

Investigating the activity of the disrupted asteroid 62412 (2000 SY178) — •Maria Mastropietro[1,2], Oriel Humes[1], Yoonyoung Kim[3], and Jessica Agarwal[1,2] — [1]Institut für Geophysik und Extraterrestrische Physik, TU Braunschweig, Germany — [2]Max Planck Institute for Solar System Research, Göttingen, Germany — [3]Department of Earth, Planetary and Space Sciences, UCLA, Los Angeles, USA

Dust emission from asteroids is often attributed to sublimation of exposed ice, causing comet-like activity in main-belt comets, or disruption from impacts or fast rotation, which in some cases can also expose subsurface ice for sublimation.

Asteroid 62412 (2000 SY178) exhibited dust emission after its 2013 perihelion, likely due to rotational destabilization due to its nature as a fast rotator [1]. Our analysis of archival data and pre-2024 perihelion observations shows significant changes in the asteroid's lightcurve amplitude and brightness after the 2013 activity, indicating changes in its shape and size.

If confirmed, the absence of reactivation in later perihelion passages may result from a lack of exposed ice or low surface temperatures due to high perihelion distance (2.9 AU).

[1] Sheppard, S. S. & Trujillo, C. 2015, AJ, 149, 44

Poster pitch: EP 10.15 (Markkanen)