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Surface Experiments on a Jupiter Trojan Asteroid in the Solar Powered Sail Mission

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Introduction: A new mission to a Jupiter Trojan asteroid is under study us-ing a solar-powered sail (SPS), and a science lander is being investigated in the joint study between Japan and Europe [1]. We present here the key sci-entific objectives and the strawman payloads of science experiments on the asteroid.

Science Objectives: Jupiter Trojan asteroids are located around the Sun-Jupiter Lagrange points (L4 or L5) and most of them are classified as D- or P-type in asteroid taxonomy, but their origin still remains unknown. A classi-cal (static) model of solar system evolution indicates that they were formed around the Jupiter region and survived until now as the outer end members of asteroids. A new (dynamical) model such as Nice model suggests that they were formed at the far end of the solar system and transferred inward due to dynamical migration of giant planets [2]. Therefore physical, miner-alogical, and isotopic studies of surface materials and volatile compounds could solve their origin, and then the solar system formation [3].

Strawman Payloads: The SPS orbiter will be able to carry a 100 kg class lander with 20 kg mission pay-loads. Just after landing of the lander, geolog-ical, mineralogical, and geophysical observations will be performed to char-acterize the site using a panoramic optical camera, an infrared hyperspectral imager, a magnetometer, and a thermal radiometer. The surface and subsur-face materials of the asteroid will be collected into a carousel by the bullet-type and the pneumatic drill type samplers, respectively. Samples in the carousel will be investigated by a visible and an infrared microscope, and transferred for performing high resolution mass spectrometry (HRMS). Mass resolution m/dm > 30,000 is expected to investigate isotopic ratios of D/H, 15N/14N, and 18O/16O, as well as molecules from organic matters. A set of strawman payloads are tentatively determined during the lander system study [4]. The constraints to select the strawman payloads have the total mass of 20 kg, and the total consumption energy of 600 WHr. In the SPS mission, the sample-return is also studied as an option, and the lander should bring the mechanisms for sample collection and sample transfer to the mother ship.

[1] Mori O. et al. (2015) 11th Low-Cost Planetary Missions Conf., S3-10. [2] Morbidelli A. et al. (2005) Nature 435, 462-466. [3] Yano H. et al., (2014) CO-SPAR 2014, B0.4-2-14. [4] Mori O. et al., Lunar Planet. Sci. Conf., 47, #1822.