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Mission Design, Operations & Optimization (2) (5)

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## DESIGN OF SCIENCE ORBITS TO OBSERVE DEIMOS

**Abstract**

The moons of Mars, Phobos and Deimos, are of scientific importance. Their exploration is to provide answers on their formation and evolution, and by extension those of the inner Solar System. The Martian Moons Exploration (MMX) mission is currently being developed by JAXA. The nominal plan is to perform in-situ observation of Phobos and bring back samples from its surface back to Earth. An additional phase to perform close-up observation of Deimos is considered too. This would provide additional science of the Martian system and the opportunity to visit regions of Deimos' surface that have not been observed yet. For this purpose, this work presents the additional phase, which consists of a resonance-hopping flyby trajectory that allows MMX to observe Deimos during a period of three months. In order not to interfere with the main goal of the mission, a multiflyby scheme performed during the Mars escape sequence provides multiple encounters with the moon at practically no extra delta-V. Since Deimos and Mars are tidally locked, the proposed trajectories make use of a combination of flyby orbits that maximize the total illuminated area that can be observed throughout the phase as a trade-off of the relative velocity at each encounter. This work presents the parametric study of this phase, as well as the resulting useful trajectories available for a potential implementation into the MMX mission.