Space Studies of the Earth-Moon System, Planets, and Small Bodies of the Solar System (B)
Small Body Science: New Progress by Space Exploration, Observatories, Laboratory Studies of Returned Sample and Theoretical Simulations (B1.1)

THE MARTIAN MOONS EXPLORATION (MMX) MISSION : UNVEILING THE MARTIAN SYSTEM

Sonia Fornasier, sonia.fornasier@obspm.fr
LIRA, Université Paris Cité, Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, Meudon, France
Tomohiro Usui, tomohirousui@gmail.com
Japan Aerospace Exploration Agency (ISAS/JAXA), Kanagawa, Japan
Kiyoshi Kuramoto, keikei@ep.sci.hokudai.ac.jp
Hokkaido University, Sapporo, Japan
Yasuhiro Kawakatsu, kawakatsu.yasuhiro@jaxa.jp
Japan Aerospace Exploration Agency, Kanagawa, Japan
MMX Science Board
Hisashi Otake, Maria Antonietta Barucci, Hidenori Genda, Naru Hirata, Takeshi Imamura, Shingo Kameda, Masanori Kobayashi, Hiroki Kusano, David J. Lawrence, Koji Matsumoto, Patrick Michel, Hideaki Miyamoto, Hiromu Nakagawa, Tomoki Nakamura, Sara Russell, Sho Sasaki, Hiroki Senshu, Naoki Terada, Stephan Ulamec, Koji Wada, Sei-ichiro Watanabe

The Martian Moons Exploration (MMX) mission led by the Japan Aerospace Exploration Agency (JAXA) is scheduled for launch in 2026, with the objective of returning samples from the surface of Phobos, conducting detailed observations of Phobos and Deimos, and monitoring the climate of Mars. MMX is the world's first sample return mission from a Martian moon. The primary scientific objectives of the mission are to elucidate the origin of the Martian moons and to constrain the processes of planetary formation and material transport in the inner Solar System. A key focus of the mission will be to understand how rocky planets were enriched in volatiles and water. To achieve these objectives, MMX is equipped with advanced onboard instrumentation, including imaging systems (TENGOO and OROCHI), an infrared spectro-imager (MIRS), a neutron and gamma-ray spectrometers (MEGANE), a laser rangefinder (LIDAR), a mass spectrometer (MSA), a dust monitoring instrument (CMDM), and a rover (IDEFIX) for in situ investigation, in addition to sampling and retrieval devices.
The MMX mission will make a five-year round trip, with the objective of collecting over 10 grams of samples from two distinct regions of Phobos and returning them to Earth in 2031. The probe is scheduled to arrive in the Martian system in 2027. For a period of three years, the satellite will remain in quasi-satellite orbits (QSO) around Phobos at varying altitudes, permitting an extensive characterization of Phobos, and the selection of landing sites. Deimos physical properties will be investigated throughout a series of flybys, and compared to those of Phobos to determine the origin and evolution of the moons. MMX will also undertake the

study of the Martian atmosphere, with a particular focus on the transport processes of dust and water, and the escape processes of the Martian atmosphere.
In preparation for the launch, JAXA has been conducting extensive testing of the propulsion, return, and exploration modules of the spacecraft, and of the onboard instruments. In addition, JAXA is engaged in the development of the ground system, encompassing control, communication, tracking, data processing, and the coordination with international stations.
The results from MMX observations of the Mars moons coupled with the advanced analysis of the unique Phobos samples in Earth laboratories will finally elucidate the origin of Phobos and Deimos, and provide valuable insight into the early Solar System composition and evolutionary processes.