Space Studies of the Earth-Moon System, Planets, and Small Bodies of the Solar System (B)
Sample Returns from Everywhere (B0.3)

PHOBOS SAMPLE RETURN BY THE MARTIAN MOONS EXPLORATION (MMX) MISSION

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The Martian Moons eXploration (MMX) mission, led by the Japan Aerospace Exploration Agency (JAXA),

is the first sample return mission of a Martian moon. MMX is scheduled for launch in October 2026, and

the primary objective of the mission is to collect samples from the surface of Phobos. More than 10

grams of material will be collected from two distinct regions using coring and pneumatic sampling

devices, and the samples will return to Earth in 2031. Prior to this, extensive observations of Phobos

will be conducted to select the most scientifically valuable sampling sites using the MMX onboard

instrumentation, comprising 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). The surface of Phobos will also

be

investigated in-situ with the rover IDEFIX.

In addition, MMX will also characterize the physical properties of Deimos throughout a series of flybys,

and compared them 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.

The origin of the Martian moons is still debated. They are believed to be either small bodies captured

by Mars or to have formed in situ from the debris generated by an impact on Mars. The mission's primary

scientific objectives are to elucidate the moons' origin by combining MMX observation results with

detailed analysis of the Phobos samples on Earth, and to constrain the processes of planetary formation

and material transport — notably volatiles and water — in the inner Solar System.

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.