ハビタブル惑星の形成を探る火星衛星探査計画MMX
Martian Moon's Exploration MMX as a mission revealing the formation of habitable planets

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JAXA’s Martian Moons eXploration (MMX) is a planned round-trip mission to the Martian moons to be launched in mid-2020’s. Currently, its conceptual studies are being proceeded as a pre-project of ISAS/JAXA. In this paper, we will report the present status of conceptual study for MMX.

The main science objectives of MMX are to reveal the origin of the Martian moons under debate among primitive asteroid capture and giant impact, and then to make a progress in our understanding of planetary system formation and primordial material transport around the border between the inner- and the outer-part of the early solar system. To achieve those science objectives, MMX will carry out close-up observations of the two moons and sample return from Phobos.

A set of mission instruments is going to be prepared to achieve major mission goals. A sampler system is studied for acquisition of more than 10 g of Phobos regolith samples. MEGANE (Neutron and Gamma-Ray Spectrometer), WAM (Wide Angle Multiband cameras), MacrOmega (Near IR Spectrometer), TL (TeLescope camera), LIDAR (LIght Detection And Ranging), CMDM (Circum-Martian Dust Monitor) and MSA (Mass Spectrum Analyzer) are specified as nominal science instruments. Some optional mission instruments are under discussion (a small surface science package, etc.). MEGANE and MacrOmega will be prepared by CNES and NASA under the participation of researchers from Japan.

Close-up sensing data will provide constraints for the elemental and mineralogical compositions of Phobos and Deimos, which are key parameters to clarify the origin of the two moons. Isotopic, elemental and mineralogical compositions of sample particles will be examined with chronological analysis to obtain unambiguous evidence for the moon’s origin and the cosmochemical nature of Phobos in the context of

planet formation and Martian system evolution. These data are expected to tell us the birthplace and migration of Phobos until the capture event if capture origin is the case. Alternatively, the source region of the moon-forming giant impactor, the age and processes of the giant impact event, and the physico-chemical state of primordial Martian mantle will be clarified if the giant impact origin is the case. Survey and analyses (if available) of younger materials originated from Mars would provide us information on the evolutionary history of Mars. By applying onboard instruments for monitoring observations of Mars and the surrounding space, MMX will also aim to understand physical processes in circum-Martian environment and Mars atmosphere. This would enhance our views of evolution of Martian moons as well as the surface environmental transition of Mars.

キーワード：火星、フォボス、ダイモス、惑星形成、火星衛星探査計画
Keywords: Mars, Phobos, Deimos, Planet formation, MMX

