



PhoDEx — a mission to explore the interiors of Phobos and Deimos

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PhoDEx (Phobos and Deimos Explorer) shall be launched on a Soyuz Fregat in 2024 or 2026, to explore the origin and evolution of Phobos and Deimos, as well as their interactions with the environments. The mission will shed light on the formation of the Martian satellites and thus on evolution processes of the solar system. Do they represent captured asteroids, or did they form from Martian ejecta? What are the interactions of Phobos/Deimos with Mars today? PhoDEx will use a variety of complementary techniques to study interior structures, chemical and mineralogical compositions of the two Martian companions as well as their environmental interactions. When arriving in the Martian system the spacecraft will first rendezvous with Deimos before proceeding to Phobos. At the two satellites comprehensive mapping and characterization for morphology, gravity field, and studies of their spectral and thermal soil characteristics will be carried out on a global scale. Crater statistics will be used to determine the ages of surface geological units and time scales of processes. A powerful short-wave radar will explore the global regolith structure. Sensors will monitor the solar wind interaction with the surfaces to help understand the evolution of regolith and space weathering. Using impact detectors, we wish to identify sources and sinks of the micrometeoroid population and address the question of Phobos/Deimos dust rings. The spacecraft will then deploy an experiment platform in the polar areas of Phobos for an operation through the summer season of more than 3 months. The package is equipped with a powerful LIBS/Raman sensor to obtain precise data on the chemistry and mineralogy of Phobos soils at the landing site. A seismometer will capture seismic signals from impacts and thermal quakes. A radio science experiment will provide accurate measurements of Phobos orbital motion and rotational librations to determine the time scales of Phobos' orbital decay. PhoDEx, benefitting from heritage of the extremely successful Mars Express mission, will give us a new picture of the Martian satellites, which have been identified as crucial stop-points in support of future missions to Mars, including those by humans. Our investigations of Phobos and Deimos will also improve our understanding of other planetary systems.