EPSC Abstracts,
Vol. 4, EPSC2009-346-1, 2009
European Planetary Science Congress,

Modelling the interaction of Phobos' surface with the Solar Wind and Martian environment

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Abstract

Indirect evidence of a gas/dust tori along Phobos orbit has been inferred from data gathered during Viking orbiter and Phobos-2 missions (Ip and Banaszkiewicz 1990, Dubinin et al 1990), but never confirmed. Since Phobos' surface is directly exposed to the solar wind the structure and chemical nature of such tori would primarily depend on Phobos surface composition, which is in turn largely unknown, even though some proximity with D type asteroids can be inferred (Rivkin et al 2002).

In this study we carry out 3D Monte Carlo simulation of the interaction of Phobos surface with the Solar Wind and Martian environment. Such simulations intend to give information on the relative variability of the degassing rate of Phobos' surface along Phobos' orbit, based on different hypothesis on Phobos surface compositions (primitive carbon-rich or olivine rich), and describe the morphology of the cloud resulting from the ejection of neutral species along Phobos orbit.

Since Phobos' circular orbit is located approximately 6000 km above the surface, we consider and compare the efficiency of a variety of degassing processes (solar wind ions and electrons sputtering, martian exospheric picked up ions sputtering, micrometeorites vaporization, photo-stimulated desorption) according to the region (solar wind, dayside/nightside, magnetosphere) crossed by Phobos around Mars.

References

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