



## **Feasibility study for a precise mass determination of the moon Phobos by the radio science experiment MaRS on Mars-Express**

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Mars-Express will perform a number of close flybys ( $< 400$  km) at the moon Phobos in 2005 and hopefully during the extended mission. The gravity attraction by the moon will change the orbit of Mars-Express slightly. The perturbed velocity will lead to an additional Doppler frequency shift of the two-way radio carrier signal exchanged between the spacecraft and the ground station. The magnitude frequency shift depends on flyby distance, flyby velocity and finally on the mass of the moon.

Based on a Phobos topography model by Duxbury (1991) the moon's gravity field was modeled assuming a constant body density. Numerical values of the low degree and order gravity coefficients  $C_{20}$  and  $C_{22}$  have been estimated. Using this gravity model for Phobos and taking further perturbing forces into account, several flybys which will occur in 2005 have been simulated to study the effect on the motion of the spacecraft and to assess the feasibility to extract the true gravity field of Phobos.