Simulation of Phobos gravity field estimation from Tianwen-1 flybys and implications for the modeling of Phobos' internal structure

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Doppler radio tracking data from Tianwen-1, China's first Mars mission, could contribute to a better estimate of the gravity field of Phobos. In this study, we show that a determination up to degree and order three is feasible by considering five additional flybys of Phobos by the Tianwen-1 spacecraft, in addition to the previous flybys already done by the Mars-Express spacecraft, and probably degree and order five is within reach. Three cases of mass repartition are considered: 1/ a homogeneous case, 2/ a core-dominated Phobos, 3/ a mantle-dominated Phobos. The case of a mantle-dominated Phobos is the easiest to detect, followed by a homogeneous Phobos, and finally by a core-dominated Phobos. We also discuss implications about the modeling of the internal structure of Phobos.

Keywords: Phobos, gravity recovery, layered interior

