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ExoMars Lander Radioscience LaRa, a Space Geodesy Experiment to Mars

Véronique Dehant, Sébastien Le Maistre, Marie Yseboodt, Marie-Julie Peters, Ozgur Karatekin, Bart Van Hove, Attilio Rivoldini, Rose-Marie Baland, and Tim Van Hoolst

Royal Observatory of Belgium, Brussels, Belgium (veronique.dehant@oma.be)

The LaRa (Lander Radioscience) experiment is designed to obtain coherent two-way Doppler measurements from the radio link between the ExoMars lander and Earth, covering at least one Martian year. The Doppler measurements will be used to observe the orientation and rotation of Mars in space (precession, nutations, and length-of-day variations), as well as polar motion. The ultimate objective is to obtain information on the Martian interior, and on the sublimation / condensation cycle of atmospheric CO_2. Rotational variations will allow us to constrain the moment of inertia of the entire planet, including its mantle and core, the moment of inertia of the core, and seasonal mass transfer between the atmosphere and the ice caps. The LaRa experiment will be combined with other ExoMars experiments, in order to retrieve a maximum amount of information on the interior of Mars. Specifically, combining LaRa Doppler measurements with similar data from the Viking landers, and of the forthcoming RISE (Rotation and Interior Structure Experiment) experiment on the NASA InSight lander mission, will allow us to improve our knowledge on the interior of mars with unprecedented accuracy, hereby providing crucial information on the formation and evolution of Mars.
The LaRa instrument consists of a coherent transponder with up- and down-links at X-band radio frequencies. The signals will be generated and received by Earth-based giant antennas belonging either to the NASA deep space network (DSN), the ESA tracking network, or the Russian ground stations network.
We will describe the experiment and discuss important aspects of the data analysis, which uses dedicated software developed for the determination of variations in the ExoMars lander position in space, as a function of time and relative to the Earth.