EPSC Abstracts
Vol. 9, EPSC2014-139, 2014
European Planetary Science Congress 2014

Determination of comet 67P/Churyumov-Gerasimenko gravity field by the Radio Science Experiment onboard Rosetta

M. Hahn (1), M. Pätzold (1), S. Tellmann (1), B. Häusler (2), J.-P. Barriot (3) and T.P. Andert (2)
(1) Rheinisches Institut für Umweltforschung, Abteilung Planetenforschung, Cologne, Germany (Matthias.Hahn@uni-koeln.de)
(2) Institut für Raumfahrttechnik, Universität der Bundeswehr, Munich, Germany
(3) Géosciences du Pacifique Sud, Université de la Polynésie Française, Tahiti, Polynésie Francaise

Abstract

The Rosetta spacecraft is now approaching comet 67P/Churyumov-Gerasimenko. The science objectives of the Radio Science Investigation experiment (RSI) addresses fundamental aspects of cometary science such as the determination of the nucleus mass and bulk density, its size and shape, its gravity field and internal structure.
The radio carrier links transmitted by the spacecraft and received on Earth will be used for these investigations. The perturbed motion of the spacecraft near the comet nucleus leads to perturbed Doppler frequency shifts of the transmitted radio signals recorded on Earth. Perturbing forces acting on the spacecraft are the asymmetric gravity field of the nucleus, third body perturbations, the solar radiation pressure and the cometary outgassing pressure.
Fitting a complex force model to the observed data by a least-square-fit algorithm, parameters of interest of these forces are determined. The anticipated extension of the gravity field up to the degree and order two estimation shall be shown. The precision will mainly depend on the Doppler frequency noise level, on the distance between the spacecraft and the comets nucleus and the uncertainty of the outgassing pressure. The radio frequency stability and noise level is known from checkout measurements done in the previous months. The spacecraft-nucleus distance will be gradually lowered which results in lower estimation errors during the comet approach phase. Constraints on the outgassing pressure by observations of other instruments onboard Rosetta will be used to distinguish between the forces acting on the spacecraft.