



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

Matthias Hahn (1), Martin Pätzold (1), Silvia Tellmann (1), Bernd Häusler (2), Jean-Pierre Barriot (3), and Tom Andert (2)

(1) Rheinisches Institut für Umweltforschung, 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 Française

The Rosetta spacecraft is in orbit about comet 67P/Churyumov-Gerasimenko since August 2014. The science objectives of the Radio Science Investigation (RSI) experiment addresses fundamental aspects of cometary science such as the determinations of the nucleus mass and bulk density, its size and shape, its gravity field and internal structure as well as its outgassing behavior.

The radio carrier links transmitted by the spacecraft and received on Earth is 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 degree and order two shall be shown. The gravitational forces and the outgassing pressure are highly correlated. At large heliocentric distances (3.5 - 3.0 AU) the solar radiation impact on the comet nucleus was still low and only weak outgassing was observed. During this period a precise determination of the gravity field was made. Using the knowledge about the nucleus mass and its extended gravity field, it is now possible to determine the outgassing pressure acting on the spacecraft. A temporal evolution of the outgassing activity shall be shown.