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Estimation of cometary surface layer properties from grazing angle measurements done by the CONSERT instrument

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Abstract

The main scientific objective of the Comet Nucleus Sounding Experiment by Radiowave Transmission (CONSERT) [1] is to determine the dielectric properties of comet 67P/Chuyurmov-Gerasimenko's nucleus. This will be achieved by performing a sounding of the comet's core between the lander "Philae" launched onto the comet's surface and the orbiter "Rosetta". For the sounding the lander will receive and process the radio signal emitted by the CONSERT instrument aboard the orbiter and retransmit a signal to the orbiter.

With data measured during the first science phase, a three-dimensional model of the material distribution with regard to the complex dielectric permittivity of the comet's nucleus is to be reconstructed.

In addition to the sounding through the comet's core the instrument will be operated under grazing incidence, i.e. on a part of the orbit where the orbiter moves below the horizon and the direct path between orbiter and lander vanishes. From these measurements the the properties of the surfaces layers are to be estimated.

In order to investigate and understand the influence of the permittivity distribution of the surface layers on the grazing angle and the CONSERT signal in case of grazing incidence, simulations of the electromagnetic wave propagation were performed using the well know pseudo-spectral-time-domain method and differential raytracing.

The simulations were performed on actual shape models of comet 67P/Chuyurmov-Gerasimenko and material models described in [2]. Exemplary results of these simulations are shown in Fig. 1 and indicate the feasibility of using grazing angle measurements to estimate properties of the surface layering.

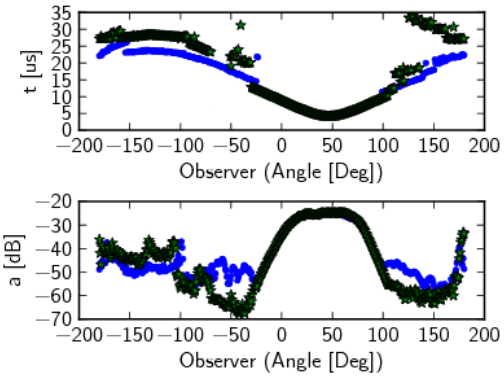

Figure 1: Exemplary simulated amplitude- and propagation-time-distributions for two different permittivity distributions given on a circular orbit.

Acknowledgements

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References

[1] W. Kofman, A. Herique, J.-P. Goutail, T. Hagfors, I. Williams, E. Nielsen, J.-P. Barriot, Y. Barbin, C. Elachi, P. Edenhofer, A.-C. Levasseur-Regourd, D. Plettemeier, G. Picardi, R. Seu, and V. Svedhem. The Comet Nucleus Sounding Experiment by Radiowave Transmission (CONSERT): A Short Description of the Instrument and of the Commissioning Stages. Space Science Reviews, 128:413–432, 2007

[2] E. Heggy and E. M. Palmer and W. Kofman and S. M. Clifford and K. Righter and A. Herique: Radar properties of comets - Parametric dielectric modeling of Comet 67P/Churyumov–Gerasimenko, Icarus, 221:2:925-939, 2012