

Planetary surface research with acoustic sounding

C. Krause, K.J. Seidensticker

DLR Institute of Materials Physics in Space, Linder Höhe, 51170 Cologne, Germany
(Christian.Krause@dlr.de)

Planetary space missions like Rosetta and ExoMars put more and more emphasis on the in-situ investigation of planetary surfaces. The use of mechanical vibrations in the audible frequency range provide a new means to study the structure and properties of the surface layers of terrestrial planets and minor bodies like comets. As the first of this new type of instruments, the Comet Acoustic Surface Sounding Experiment (CASSE) [1] on the Rosetta Lander Philae intends to determine elastic parameters and the structure of the surface layer of the target comet. One drawback of CASSE is unknown possibly weak coupling to the cometary surface.

A DFG project is being conducted at the DLR - Deutsches Zentrum für Luft- und Raumfahrt - to test the applicability of planetary penetration instruments like PLUTO, planetary sampling tool [2], developed for the Mars Express lander Beagle 2, or MUPUS [3], a heat probe instrument also on Philae, as stronger acoustic sources as well as to develop new methods for the analysis of acoustic data.

From the analysis of the polarisation of the recorded acoustic signals it is possible to separate the mixture of different propagating wave types. These identified waves can be used for the determination of mechanical soil properties and near-surface layering. We also will present how acoustic receivers can be used to locate acoustic penetrators or nearby seismic sources using the travel time and/or the polarisation of the acoustic waves.

References

[1] Seidensticker, K. J., Möhlmann D., Apathy I., Schmidt W., Thiel K., Arnold W., Fischer H.-H., Kretschmer M., Madlener D., Péter A., Trautner R. and Schieke S., SESAME - An Experiment of the Rosetta Lander Philae: Objectives and General De-

sign, Space Sci. Rev., 2007, 128

[2] Richter, L., Coste P., Gromov V. V., Kochan H., Nadalini R., Ng T.C., Pinna S., Richter H.-E. and Yung K. L., Development and testing of subsurface sampling devices for the Beagle 2 lander, Planet. Space Sci., 50, 903-913, 2002.

[3] Spohn T., Seiferlin K., Hagermann A., Knollenberg J., Ball A. J., Banaszkiwicz M., Benkhoff J., Gedomski S., Grygorczuk J., Hlond M., et al., MUPUS - a Thermal and Mechanical Properties Probe for the Rosetta Lander PHILAE, Space Sci. Rev., 2007, 128