Abstract for 11th Low Cost Planetary Missions Conference
June 9-11, 2015, Berlin, Germany

The Alpha Particle X-Ray Spectrometer APXS on Rosetta Philae

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Introduction:
The Alpha Particle X-Ray Spectrometer (APXS) is one of the 9 scientific instruments on board Philae, the Rosetta mission´s lander. Rosetta reached comet 67P/Churyumov-Gerasimenko after a 10-year cruise in August 2014. Philae landed on November 12th, following a 7-hour descent. Philae did not get anchored to the surface at first touchdown and bounced off twice before coming to rest at its not yet precisely known final position., The APXS was deployed during the first science sequence to reach the comet's surface and determine its chemical composition.
APXS Sensor head:
The APXS combines an alpha mode for alpha backscattering spectroscopy and an XRF mode for X-ray fluorescence and PIXE (particle induced X-ray emission) spectroscopy in one single instrument, being low in mass (640g) and power consumption (1.5 W in operating mode) [1]. The target is irradiated by Curium 244 sources exciting characteristic X-rays of the elements present in the surface. The alpha mode allows detecting low-Z elements like C and O and groups of elements with a higher Z. The X-ray-SDD-detector allows the detection of most of the elements from Na up to Ni and above. The design of the Rosetta APX spectrometer is based on the experience gained with the APXS instruments built for the Russian Mars 96 spacecraft, NASA's Mars Pathfinder [2] and Mars Exploration Rover missions [3,4].
Results:
It is not yet understood what Philae´s position was at the time of the APXS deployment. The APXS shutters need contact with the surface to open. The analysis of the spectra shows that the instrument worked nominally but only a measurement on the calibration target was performed. The X-ray and alpha-spectra indicate good functionality and energy resolution of the instrument allowing the detection of energies down to ~1 keV for the X-ray channel and down to ~0.4 MeV for the alpha channel.
It is expected that Philae's solar panels will produce sufficient energy when the comet gets nearer to the sun. The APXS can then be deployed again and it is hoped that the lander compartment lowering together with the additional APXS deployment will provide the force needed for the opening of the shutters.
Conclusions:
The APXS has a long heritage from previous successful Mars exploration missions and has shown to be a reliable and powerful instrument for the determination of elemental composition in harsh

environments. Its advanced developmental state, performance, reliability, low mass and low power consumption make the APXS attractive for low cost missions such as Rosetta Philae.

Acknowledgements

This project is funded by the German Space Agency DLR under contracts 50-QP-0404 and 50-QP-0902 and the Max Planck Society.

References:

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