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Marek Tulej, Andreas Riedo, Maike Neuland, Stefan Meyer, Peter Wurz, and Nicolas Thomas
University Bern, Physics Institute, Bern, Switzerland (marek.tulej@space.unibe.ch)

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CAMAM instrument suite for MarcoPolo-R mission to an asteroid

M. Tulej, A. Riedo, M. Neuland, S. Meyer, P. Wurz, and N. Thomas
Physics Institute, Space Research and Planetary Sciences, Sidlerstrasse 5, 3012 Bern, Switzerland.
Contact: marek.tulej@space.unibe.ch

Abstract:
CAMAM (Composition And Morphology of Asteroid's Material) is an analytical instrument suite developed for investigation of composition and morphology of asteroidal matter for the MarcoPolo-R sample return mission from a primitive near-Earth asteroid. The instrument combines a microscope-camera system (MCS), a laser ablation time-of-flight mass spectrometer (LMS), and a regolith particle trap (PT). PT uses a charged metallic foil to attract mm-sized or smaller regolith particles from a dust cloud that will be lifted up during the sampling phase. A translational mechanism will deliver the samples to the measurement location inside the CAMAM instrument.
CAMAM will conduct measurements by complementary methodologies in a symbiotic way and will allow characterisation of regolith samples by optical investigation and mass spectrometry. MCS will identify and characterise sample components, such as chondrules, matrix, refractory inclusions, down to individual micrometre-sized grains and particles. Surface features larger than a few μm will be characterised by multicolour imagery, imagery of fluorescence induced by UV sample irradiation, and polarisation analysis of light reflected from the surface. The microscope will yield structural details and morphology of a sample including sample shape, size and texture. Investigation of optical spectral properties of the sample surface will also provide an insight to surface mineralogy and help in identification of organic compound deposits. LMS will conduct measurements of the elemental composition of a sample down to a level of ppm, the isotopic distribution of elements, and also will investigate the molecular compounds that are located on the sample surface. CAMAM studies will allow a comprehensive investigation of the interrelationship between grains, their structure, chemical composition, mineralogy, and adsorbed molecules. We will discuss concepts underlying CAMAM instrument operation and demonstrate instrumental performance.

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