

Analysis of Europa Surface Analogues With Laser-CosmOrbitrap High Resolution Mass Spectrometer

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Mass spectrometry is a reliable instrumentation for the characterization of atomic and molecular compounds in the planetary environments. The growing interest for astrobiological questions is driving us to develop instruments with better determination capabilities than those that previously flew. A new generation of space mass analyzer called CosmOrbitrap, as based on OrbitrapTM technology had currently achieved Technical Readiness Level (TRL) 5. CosmOrbitrap has a high mass resolving power and accuracy allowing to deeply constrain the composition of samples. Previous studies performed with the Laser-CosmOrbitrap prototype at LPC2E, have shown convincing performances in the positive ion mode ([1], [2], [3]). Detection of negative ion has relevant interest for small bodies and icy worlds exploration.

This work presents the capabilities of a Laser-CosmOrbitrap prototype to detect and identify Europa analogues. The laboratory prototype used for this work is composed of a commercial laser ablation/desorption system coupled with the TRL5 CosmOrbitrap, thereafter called LAB-CosmOrbitrap.

The samples studied here are salts analog of Europa's surface (e.g. MgSO₄, NaCl) mixed with organic molecules in traces. The LAB-CosmOrbitrap experiment enables detection with a high mass resolution and a low mass measurement error during a single laser shot experiment. It also gives us insights on the fragmentation pattern of these molecules using this specific prototype and it allows us to detect adducts between organic fragments and salts. It helps us to understand the effect of the presence of salts on the detection of organic compounds.

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References:

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