

## Mass spectrometry near comet 67P (Rosetta/COSIMA)

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### Introduction

The time-of-flight secondary ion mass spectrometer (TOF-SIMS) COSIMA on board of the Rosetta spacecraft has collected and analyzed dust particles near the comet 67P/Churyumov–Gerasimenko. Meteorite grains have been analyzed as reference samples using a laboratory twin instrument of COSIMA. Current results are summarized.

### Methods

The COSIMA instrument collected on metal targets (mostly Au, 1cm x 1cm) about 1400 particles (size up to 1 mm, ~35,000 fragments) during the >2 years next to the comet (typical distance to the comet 10 - 200 km, typical exposure time 1 - 7 days). On about 250 particles TOF-SIMS spectra have been measured, and about 33,000 full spectra have been sent to Earth, together with images (1024 x 1024 pixel) of the targets. Additionally, about 6,000 spectra have been measured on 10 meteorite samples from the collection in the Natural History Museum Vienna. Spectral data interpretation was mainly based on ratios of secondary ion counts, correlation of signals, and multivariate (chemometric) methods.

### Results

Aliquots of the reaction products were collected at 10, 30 and 60 min after mixing and incubating the samples at 37°C. The samples were infused into MS by chip-nanoelectrospray. The signals were acquired for only 1 min, sufficient to observe the Ctb5 monomer envelope with +9 to +14 charge states. (+) Chip-nanoESI MS also presented 25 signals corresponding to ions of the Ctb5 complexes with gangliosides belonging to G1 class. Certain complexes revealed Ctb5 monomer interaction with G1 species of high sialylation degree; besides the GM1 class, polysialylated G1 species have been found attached to the monomer. Another particular aspect was the formation of protein monomer complexes with five fucosylated gangliosides. ETD/CID MSn on the complex with Fuc-GT1 (d18:1/18:0) provided data supporting the binding of the c isomer to histidine 14 (H14).

### Innovative aspects

- Cometary particles consist of ~55% silicates and ~45% carbonaceous material (mass) [1].
- Carbonaceous material consists mostly of macromolecular substances [2].
- Presence of ions C<sub>3</sub>H<sub>0</sub>-4<sup>+</sup>, C<sub>4</sub><sup>+</sup> in the spectra indicate unsaturated organic compounds [3].
- Elemental composition of cometary particles is close to that of chondritic meteorites but enriched in Si and C [4].

**References** [www.lcm.tuwien.ac.at/comecs/](http://www.lcm.tuwien.ac.at/comecs/) (Project CoMeCS)

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