



CubeSat Space Dust Analyser "HANKA"

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Mass spectrometry significantly contributes to space exploration by uniquely determining the **elemental composition** of micrometeorites, space dust, or particles from atmospheres and surfaces of distant objects.

HANKA becomes ideal payload candidate for a spectrum of future space missions, ranging from low-budget to ambitious projects. It is a high-resolution mass spectrometer (**HRMS**) specifically designed for *in-situ* analyses in resource limited environments like space. The core of the instrument is an electrostatic ion trap mass analyzer, **Orbitrap™**, which has broad applications in biological or environmental research. The first prototype of Orbitrap-based space analyzer was developed in LPC2E Orléans, known as CosmOrbitrap, and the mission of HANKA is to bring this new technology into the space.

A laboratory prototype of HANKA was constructed and tested (**Fig.1A**). Based on the first data, **HRMS requirements** were achieved while maintaining a **simple instrument design**. Mass spectrum of chondrite meteorite (**Fig.1B**) shows **high resolution** (**50 000** m/Δm_{FWHM}) at m/z 10-60, and with **mass accuracy** <20 ppm. In particular, a broad **mass range** (2-2000 amu) can be recorded within a **short acquisition time** (10-1000 milliseconds), providing comprehensive insight into the elemental and isotopic composition of solid particles.

Beyond its functional properties and **compact dimensions**, further **miniaturization** is planned, targeting to low-weight (less than **6 kg**), and minimal power consumption (**5-10 W**, mode-dependent). The **4U CubeSat** version of HANKA, designed for future *in-situ* analyses in space, consists of velocity/charge detector, **hypervelocity impact ionization source**, ion optics, and Orbitrap™ analyser (**Fig.1C**)

In summary, HANKA offers a unique combination of high-resolution mass spectrometry, compact design, and low resource demands. It can provide comprehensive and real-time analysis of complex space dust and micrometeorite particles characterization.

Fig.1: HANKA – laboratory prototype (**A**), mass spectrum of chondrite meteorite (**B**), and CubeSat space version (**C**)

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References

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