Development of the NIM Mass spectrometer for Exploration of Jupiter's Icy Moons Exospheres

Martina Föhn¹, Marek Tulej¹, André Galli¹, Audrey Helena Vorburger¹, Davide Lasi¹, Peter Wurz¹, Pontus Brandt², and Stas Barabash³

¹University of Bern, Physics Institute, Space Research & Planetary Sciences, Bern, Switzerland
( martina.foehn@space.unibe.ch )
²Johns Hopkins University Applied Physics Laboratory, Laurel, MD, USA
³Swedish Institute of Space Physics, Kiruna, Sweden

Investigation of habitable environments is one of the main objectives in upcoming space missions. The JUICE mission will investigate Jupiter's environment in the solar system and its icy moons Ganymede, Callisto and Europa as examples for potentially habitable worlds around a gas giant. The Particle Environment Package (PEP) on the JUICE satellite will investigate Jupiter's icy moons and their environment. As part of PEP, the Neutral gas and Ion Mass spectrometer (NIM) will measure the chemical composition of the exospheres of the icy moons. These measurements give information about the surface composition of the moons and will set constraints on their formation processes.

NIM is a Time of Flight mass spectrometer with two entrances for neutral particles and ions. The gas enters the instrument from spacecraft ram direction. With the open source neutral particles and ions enter the ionisation region directly. With the closed source neutral particles get thermalized using an antechamber before entering the ion source. Particles entering with higher velocity are therefore easier to detect through the antechamber.

Initial performance tests with the NIM Protoflight Model (PFM) were done. The storage capability of the ion source was tested, the functionality of the antechamber was verified and we measured masses up to 642 u to demonstrate the high-mass performance of NIM. Furthermore, different subunits of the NIM instrument were successfully tested, such as the redesigned ion source and flight electronics connected with the NIM sensor head.