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Sensitivity and fragmentation calibration of the time-of-flight mass spectrometer RTOF on board ESA's Rosetta mission

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The European Space Agency's Rosetta mission will rendez-vous comet 67P/Churyumov-Gerasimenko (67P) in September 2014. The Rosetta spacecraft with the Rosetta Orbiter Spectrometer for Ion and Neutral Analysis (ROSINA) onboard will follow and survey 67P for more than a year until the comet reaches its perihelion and beyond. ROSINA will provide new information on the global molecular, elemental, and isotopic composition of the coma [1].

ROSINA consists of a pressure sensor (COPS) and two mass spectrometers, the Double Focusing Mass Spectrometer (DFMS) and the Reflectron Time Of Flight mass spectrometer (RTOF). RTOF has a wide mass range, from 1 amu/e to >300 amu/e, and contains two ion sources, a reflectron and two detectors. The two ion sources, the orthogonal and the storage source, are capable to measure cometary ions while the latter also allows measuring cometary neutral gas. In neutral gas mode the ionization is performed through electron impact. A built-in Gas Calibration Unit (GCU) contains a known gas mixture composed of He, CO_2, and Kr that can be used for in-flight calibration of the instrument.

Among other ROSINA specific scientific goals, RTOF's task will be to determine molecular composition of volatiles via measuring and separating heavy hydrocarbons; it has been designed to study the development of the cometary activity as well as the coma chemistry between 3.5 AU and perihelion.

From the spectroscopic studies and in-situ observations of other comets, we expect to find molecules such as H_2O, CO, CO_2, hydrocarbons, alcohols, formaldehyde, and other organic compounds in the coma of 67P/Churyumov-Gerasimenko [2]. To demonstrate and quantify the sensitivity and functionality of RTOF, calibration measurements have been realized with more than 20 species among the most abundant molecules quoted above, as well as other species such as PAHs.

We will describe the applied methods used to realize this calibration and will discuss our preliminary results, i.e. RTOF capabilities in terms of sensitivity, isotopic ratios, and fragmentation patterns. We will demonstrate that RTOF is well capable to meet the requirements to address the scientific questions discussed above.

[1] Balsiger, H. et al.: ROSINA-Rosetta Orbiter Spectrometer for Ion and Neutral Analysis, Space Science Reviews, Vol. 128, 745-801, 2007.
[2] Bockelée-Morvan, D., Crovisier, J., Mumma, M. J., and Weaver, H. A.: The Composition of Cometary Volatiles, in Comets II (M. C. Festou et al., eds), Univ. Arizona Press, Tucson, 2004