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Laboratory Gas Dynamic Measurements of the Comet Pressure Sensor COPS on the Rosetta Spacecraft

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Rosetta is part of the cornerstone missions executed by the European Space Agency (ESA). It is the first space mission to orbit and also land on a comet. By the end of July 2014 Rosetta will be able to carry out a close study of comet 67P/Churyumov-Gerasimenko. The Rosetta Orbiter Spectrometer for Ion and Neutral Analysis (ROSINA) is one of the core payloads on board of the Rosetta spacecraft [Balsiger et al, 2007]. ROSINA's main objective is to determine the major atmospheric and ionospheric composition in the coma and to investigate the gas dynamics around the comet.

ROSINA consists of two mass spectrometers and a pressure sensor. The Comet Pressure Sensor (COPS) is not only a pressure sensor but also plays the role of a safety instrument for Rosetta by providing high-density alerts to the other payload instruments. It includes two gauges: the "nude gauge" measures total neutral density in the coma and the "ram gauge" measures the dynamic pressure of the cometary gas flux to obtain the bulk velocity of the neutral gas. The combination of these two gauges makes COPS capable to derive the gas dynamics in the coma.

We recently performed laboratory gas dynamic measurements with the identical flight-spare instrument of COPS. Using the Calibration System for The Mass Spectrometer Instrument ROSINA (CASYMIR) we produce neutral gas beams to model cometary gas jets with velocities from thermal to 2 km/s. For COPS calibration we measure gas beams with different incident angles to derive the velocity and the temperature of the gas using different mixtures expected at the comet. We demonstrate that COPS will be ready for the prime mission and it will be fascinating to compare COPS measurements with numerous observation results and computer models starting in summer 2014 to gain new insights into the gas dynamics around a comet.

Reference:
Balsiger, H. et al.: ROSINA-Rosetta Orbiter Spectrometer for Ion and Neutral Analysis, Space Science Reviews, Vol. 128, 745-801, 2007.