



A novel - very high sensitivity mass spectrometer for planetary atmospheres measurements

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The neutral gas spectrometer Strofio is a high mass resolution, time-of-flight system for low energy neutral particles. Stemming from ancient Greek, the word Strofio means rotor or to rotate, and indeed, a rotating field is used to enable extremely high mass resolution observations. Strofio can measure the chemical composition of low-pressure gases, the relative abundance of different species, and (albeit at low accuracy) the particle flow direction and velocity.

Incoming neutral gas is first ionized by a continuous, open source. Following ionization, the start times are “encoded” into the particle trajectories by a radiofrequency (RF) electric field. Once the particles leave the dispersing region they move on a constant trajectory to the 2D MCP detector system where the time of flight is measured, from which the mass/charge can be calculated. The time of flight and the spatial position of an ion uniquely determine its mass/charge.

The design of the Strofio sensor is driven by the attempt to achieve both isotopic resolving capability (goal is a cross talk of 10-5 or better between two adjacent masses at the 50% level) and temporal resolution (a full-range spectrum can be collected in as short as 100 ms) within very limited resources (goal is 1 kg, 1W, 1,000 cm³). Laboratory tests on an available prototype show that these goals are within reasonable reach.

This instrument is currently been developed as integral part of the Serena/BepiColombo project, but could be readily adapted to a number of future missions, including missions to study planetary atmospheres and exospheres, cometary missions, and fast flybys.