



## **The BepiColombo SERENA/ELENA unit development: a new technique to detect sputtered neutral atoms escaping from Mercury surface.**

ANDREA MARIA DI LELLIS (2), STEFANO SELCI (3), ELISABETTA DE ANGELIS (1), ROBERTO LEONI (4), ANNA MILILLO (1), STEFANO ORSINI (1), IANNIS DANDOURAS (5), and the ELENA Team  
(2) AMDL srl, ROME Italy, (3) ISC-CNR, ROME Italy, (1) IFSI-INAF, ROME, Italy ([elisabetta.deangelis@ifsi-roma.inaf.it](mailto:elisabetta.deangelis@ifsi-roma.inaf.it)),  
(4) IFN-CNR, ROME, Italy, (5) Centre d'Etude Spatiale des Rayonnements, Toulouse France

ELENA (Emitted Low-Energy Neutral Atoms) is one of the four units of the SERENA experiment for the ESA cornerstone BepiColombo mission to Mercury. It is primarily devoted to understanding of Ion Sputtering processes and emission from planetary surfaces, particle back-scattering and Charge Exchange via neutral atoms detections in the energy range  $\sim$ 20 eV - 5 keV

ELENA instrument is the first attempt of a new design techniques approached for the neutral particles identification in the low energy range. It is a Time-of-Flight system based on a peculiar Start section: an oscillating shutter (operated at frequencies up to a 100 kHz) and mechanical grating (two self-standing silicon nitride (Si<sub>3</sub>N<sub>4</sub>) membranes, patterned with arrays of long and narrow openings) that allows to identify the start time of the particles entering in the Time-of-Flight chamber. The Stop section at the end of the pattern is a 1-dimensional array composed by MCPs detector with discrete anodes corresponding to a Field of View of 4,5°x76°. This system allows having the determination of velocity and direction of the incoming particles.

The instrument has a good capability to reject UV photons with the start section and to reject charged particle with a deflector system.

In this paper the crucial parts of the instrument and test results will be described: the nano-structure membranes manufacturing, the shuttering system, the position encoder, the optical propriety of the membranes, the photon and particle test, the electronic box.