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Neutral Atom Imaging of Near-Earth Asteroids

A. Mura (1), C Plainaki (1), A Milillo (1), S Orsini (1), S Barabash (2), R Leoni (3), S Selci (3), I Dandouras (4), E Kallio (5), P Wurz (6), and A De Angelis (1)

(1) INAF, IFSI, Rome, Italy (alessandro.mura@ifsi-roma.inaf.it), (2) IRF, Kiruna, Sweden, (3) CNR, Roma, Italy, (4) IRAP, CNRS, France, (5) FMI, Finland, (6) UniBe, Swizerland

In many planetary environments of the solar system (Mercury, Moon, icy satellites, and more), direct solar wind precipitation results in neutral particle release via ion-sputtering (IS) process, as well as plasma reflection and neutralization (Backscattering, BS).
In particular, solar wind sputtering is one of the most important agents for the surface erosion of a near-Earth asteroid (NEA), acting together with other surface release processes, such as photon stimulated desorption, thermal desorption and micrometeoroid impact vaporization.
Detection and analysis of high-energy sputtered atoms gives important information on surface-loss processes as well as on surface elemental composition.
RAMON (Released Atoms and Ions MONitor) proposed as payload for the MarcoPolo-R Mission, consists of two neutral atom sensors and an ion monitor:
1) SHEAMON (Sputtered High-Energy Atoms MONitor) will investigate the ion-sputtering and backscattering process by detecting neutral atoms between $\sim$10 eV and $\sim$3 keV and determining their direction and velocity;
2) GASP (GAs SPectrometer) will analyse the mass of the low-energy (below 10 eV) neutral atoms released by different surface processes;
3) MIM (Miniaturized Ion Monitor) will measure the flux and energy spectra of precipitating and backscattered solar wind protons, which originate the Ion Sputtering and Backscattering processes investigated by SHEAMON.
By combining the measurements made by all three units, RAMON experiment will investigate on a) the processes happening on the surface of the NEA as a result of its exposure to space environment and collisions, b) the role of the surface release processes in the body evolution, c) the surface mineralogy and chemistry, derived from the composition of the released material, d) the magnitude of the erosion due to space weathering, e) the efficiency of each process as a function of environment conditions, and f) the possible non-uniform over the surface efficiency in particle release processes. Here we provide signal simulation and instrument description for the experiment.