Geophysical Research Abstracts
Vol. 14, EGU2012-7752, 2012
EGU General Assembly 2012

Ganymede Europa Neutral Imaging Experiment at the Jupiter's icy moons

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GENIE (Ganymede Europa Neutral Imaging Experiment) (energy range 10 eV – 10 keV) is a high-angular-resolution detector, based on the ToF technique. Its objective is to map the origin sites of the most energetic neutral particles of the icy moons' exospheres, in order to investigate the interaction between the surface and the environment.
The investigation of plasma interaction with the Jupiter's moons and the processes responsible for surface space weathering is one of the coolest topics of the proposed Cosmic Vision mission JUICE since it directly relates to energy exchange within the Jupiter's system, to the moon evolution and finally to the habitability in the harsh radiative environment.
Icy surfaces of the Jupiter's moons are continuously irradiated by intense ion fluxes of H+, O+ and S+ in the energy range from keV to MeV. These ions are expected to impact the moon icy surface producing relevant and observable effects such as particles release and chemical and structural modifications of the surface. In particular, the plasma impacting onto the surface causes, via ion-sputtering, radiolysis and backscattering processes, release of neutrals that constitute the exospheres. The energy spectrum of this particle population peaks in the eV range with a non-negligible tail up to hundred eVs. The knowledge of the effectiveness of these processes in this environment is important in order to understand the evolution of the moons and their interactions within the Jupiter's system.
The detection of neutral atoms above few 10 eVs (LENA) is a way to univocally relate the exosphere to surface features and to monitor instantaneously the effect of plasma precipitation onto the surface. Thus, GENIE is fully complementary to INM spectrometer, devoted to infer exospheric composition and density. Coupled measurements of LENA and gas composition will improve our knowledge in surface release mechanisms. The observation of LENA at different latitudes and longitudes, resulting in a 2D imaging of plasma precipitation, will provide important information on the plasma circulation at the orbits of the moons. Furthermore, a joint measurement of precipitating ions will permit to estimate the efficiency of the release process. Finally, GENIE jointly with an ion-sensor and a mass spectrometer in the JUICE mission will be for the first time an outstanding opportunity to better understand also the magnetosphere-moon coupling within the Jupiter's system. In particular, a comparison between the surface interaction with the intense radiation at Europa and with the plasma shielding by the internal magnetic field at Ganymede, will provide a unique opportunity to investigate the different evolution scenarios of the Jupiter's moons.
In this presentation, the science requirements for GENIE, to be proposed for the JUICE mission, are discussed, in view of the possibility of performing LENA measurements at Ganymede, Callisto and Europa.