Abstract for 11th Low Cost Planetary Missions Conference
June 9-11, 2015, Berlin, Germany

Radiation testing for the Jovian environment: RATEX-J on a CubeSat and in the laboratory

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The harsh Jovian radiation environment is one of the main drivers for the design of instruments to be flown to Jupiter.
The RAdiation Test EXperiment for JUICE (RATEX-J) is a test setup for an anti-coincidence system for the Jovian plasma Dynamics and Composition analyzer (JDC). The anti-coincidence system is based on a solid state detector (SSD) and is one of the several radiation mitigation techniques used in JDC. RATEX-J consists of two detector stacks, a multi channel plate (MCP) with an SSD shield and a ceramic channel electron multiplier (CCEM) with an SSD shield, front-end electronics, high voltage supply, and a simple data processing unit. This setup allows flexibility and mobility of the unit.
To simulate Jupiter's radiation environment and to verify the performance of the detector system is a complex experimental task. Two radiation tests will be conducted in order to test the efficiency of the anti-coincidence system and to test the detection efficiency of CCEMs and MCPs for penetrating radiation. RATEX-J will be irradiated with energetic electrons (MeV range) at accelerator facilities and is furthermore an accepted payload on a 3-unit CubeSat to be flown on a polar sun-synchronize orbit. Also a mission design with a dedicated 1-unit CubeSat is investigated. CubeSats provide a relatively easy-to-access platform to test small payloads in the natural radiation belt environment at Earth and are considered valuable for future instrument and subsystem testing, even for environments as harsh as Jovian.
JDC is one of six sensors within the Particle Environment Package (PEP) on ESA's JUICE mission to Jupiter in 2022. JDC measures 3D distribution functions of positive and negative ions (incl. electrons) in the energy range 1 eV per charge to 41 keV per charge.