

Status and perspectives of the CSES-Limadou project

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The China Seismo-Electromagnetic Satellite (CSES-01) is a sophisticated space observatory to monitor the ionosphere and study its coupling with the magnetosphere and the lithosphere. Launched in February 2018, in the framework of a joint cooperation program between the Chinese and Italian Space Agencies, it includes payloads to measure the electric and the magnetic field, plasma, X rays and electrons and protons in a wide energy range. The High-Energy Particle Detector (HEPD-01) is a large field-of-view instrument, optimised to measure electrons (3-100 MeV), protons (30-300 MeV), and light nuclei (up to a few hundreds of MeV/nucleon). The HEPD has been designed and constructed by the Limadou collaboration, which also controls operations in flight and performs analysis and calibration to provide high-quality data to the scientific community. HEPD is maintained on a Sun-synchronous orbit and performs extremely well in particle identification and energy resolution, all features making it a sensitive probe for galactic, solar and trapped particles with energies between tens and hundreds of MeVs.

The launch of CSES-02, the second satellite of the constellation, is foreseen by mid-2023. Together with CSES-01, they will constitute the first multi-site cosmic-ray observatory in space. The second version of HEPD has been designed to improve the performance of HEPD-01 under all aspects, extending the energy range, increasing angular and energy resolution and refining upon particle identification, with good sensitivity also to gamma-ray transients. This progress is due two major technological innovations: the first use of Monolithic Active Pixel Sensors to track particles in space and a flexible trigger system prioritising and managing data acquisition from different signal patterns.

I will report on the results obtained with HEPD-01 in four years of data acquisition, with particular regard to the solar energetic particles and galactic cosmic rays measurements. Finally, I will describe the expected gain in sensitivity due to the combined operation of HEPD-01 and HEPD-02 from 2023.

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