

The High Energy Particle Detector (HEPD-02) for the second China Seismo-Electromagnetic Satellite (CSES-02)

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The CSES (China Seismo-Electromagnetic Satellite) is a multi-instrumental scientific space program whose objectives are to investigate the near-Earth electromagnetic, plasma and particle environment and for studying the seismo associated disturbances in the ionosphere-magnetosphere transition zone, the anthropogenic electromagnetic noise as well as the natural non-seismic electromagnetic emissions, mainly due to tropospheric activity. In particular, the mission aims at confirming the existence of possible temporal correlations between the occurrence of earthquakes for medium and strong magnitude and the observation in space of electromagnetic perturbations, plasma variations and precipitation of bursts of high-energy charged particles from the inner Van Allen belt.

The first satellite (CSES-01) was launched on 2018, while the second one (CSES-02) is expected to be launched in the first half of 2024.

As in CSES-01, the suite of instruments on-board CSES-02 will comprise a particle detector (HEPD-02, High-energy Particle Detector) to measure the increase of the electron and proton fluxes due to short-time perturbations of the radiation belts induced by solar, terrestrial, or anthropic phenomena in the energy range 3-100 MeV for electrons and 30-200 MeV for protons. In addition, HEPD-02 can detect different particle populations (solar, trapped, galactic, etc.) according to the satellite position and energy. Moreover, HEPD-02 implements trigger configurations dedicated to gamma rays on a time basis of 5 milliseconds, to measure photon fluxes in the MeV-tens of MeV energy range and provide sensitivity for rare events, such as Gamma Ray Burst.

HEPD-02, which will be integrated on board CSES-02 in the second half of 2023, comprises a tracker made of CMOS Monolithic Active Pixel Sensors (MAPS), a double layer of crossed plastic scintillators for trigger and a calorimeter, made of a tower of plastic scintillators and a matrix of LYSO crystals, surrounded by plastic scintillator veto planes.

We present the main characteristics and as well as the performance of HEPD-02.

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