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The High Energy cosmic Radiation Detector

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The High Energy cosmic-Radiation Detection (HERD) facility is one of several space astronomy payloads onboard the future Chinese Space Station (CSS), planned for operation starting around 2027 for about 10 years. HERD is a China-led mission with key European contributions led by Italy. The primary scientific objectives of HERD are: Indirect dark matter search with unprecedented sensitivity; precise cosmic ray spectrum and composition measurements up to the knee energy; gamma-ray monitoring and full sky survey. HERD is composed of five scientific instruments. The central one (CALO) is a homogeneous, almost cubic calorimeter made of about 7500 LYSO cubic crystals and capable of accepting particles incident on its top face and four lateral faces. All the five sides of CALO are covered by layers of fiber trackers (FIT), plastic scintillators (PS) and silicon charge detectors (SCD), from inside out. Additionally, a transition radiation detector is located on one lateral face for energy calibration of TeV particles. The total weight of HERD is about 4 tons. This design results in an effective geometric factor more than one order of magnitude larger than that of previous missions, and also excellent lepton/hadron separation capabilities thanks to the 3D nature of the calorimeter. The novel design and key specifications of HERD instruments have been successfully verified with four beam tests at the CERN SPS.

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