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Latest advancements of the HERD space mission

The High Energy cosmic Radiation Detector (HERD) is one of the prominent space-borne instruments to be installed on-board the upcoming Chinese Space Station (CSS) around 2027 and represents a collaborative effort among Chinese and European institutions. Its primary scientific goals include: precise measurements of Cosmic Ray (CR) energy spectra and mass composition up to the highest achievable energies in space (~ few PeV), gamma ray astronomy and transient studies, along with indirect searches for Dark Matter particles. HERD is uniquely configured to accept particles from both its top and four lateral sides. Owing to its pioneering design, an order of magnitude increase in geometric acceptance is foreseen, compared to current generation experiments.

HERD is conceived around a deep (~55 X0, 3 λI) 3D cubic calorimeter (CALO), forming an octagonal prism. Fiber Trackers (FiTs) are instrumented on all active sides, with a Plastic Scintillator Detector (PSD) covering the calorimeter and tracker. Ultimately, a Silicon Charge Detector (SCD) envelops the above-stated sub-detectors, while a Transition Radiation Detector (TRD) is instrumented on one of its lateral faces, for energy calibration in the TeV scale. A detailed overview of HERD will be provided in this work, with great emphasis on recent detector advancements and space readiness aspects, along with novelties concerning its particle identification subsystem and double-readout calorimeter.

Primary experiment

HERD

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