



Contribution ID: 170

Type: Oral

## The future of the high energy cosmic ray direct detection: HERD

*Wednesday, 5 September 2018 17:20 (20 minutes)*

The High Energy cosmic Radiation Detection (HERD) facility will be one of the future space astronomy payloads onboard the upcoming Chinese space station. The ambitious aim of HERD is the direct detection of cosmic rays towards the “knee” region ( $\sim 1$  PeV), with a detector able to measure electrons, photons and nuclei with an excellent energy resolution (1 % for electromagnetic components at 200 GeV and 20 % for nuclei at 100 GeV - PeV), an acceptance 10 times larger than the one of present generation missions ( $\sim 1 \text{ m}^2 \text{ sr}$ ), and long lifetime ( $> 10$  years). The primary objectives of HERD are the indirect search for dark matter particles and the precise measurement of energy distribution and composition of primary cosmic rays from 30 GeV up to PeV in order to determine the origin of the “knee” structure in the spectrum. Moreover, HERD will monitor the high energy gamma ray sky, from 500 MeV, thus observing gamma-ray bursts, active galactic nuclei and galactic microquasars. HERD will be composed of a homogeneous electromagnetic calorimeter made of 7500 LYSO crystals, surrounded by a particle tracker, a plastic scintillator detector and a transition radiation detector. Two possible trackers are under study: a 5-side tracker made of silicon micro-strip detectors and a 4-side scintillating fiber tracker surmounted by a silicon micro-strip tracker. The total weight of HERD will be around 4 t with a volume of  $(2.3 \times 2.3 \times 2.6) \text{ m}^3$ . The entire project: design, perspectives, expected performances in terms of energy sensitivity and acceptance as well as some alternative sub-detectors that are under investigation will be presented in this contribution.

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**Session Classification:** CR