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## A Nanosatellite-sized detector for sub-MeV charged Cosmic Ray Fluxes in Low Earth Orbit: The Low Energy Module (LEM) onboard the NUSES Space Mission

Thursday 15 May 2025 22:00 (2 minutes)

Operating a space-based detector in high-radiation regions such as the South Atlantic Anomaly (SAA) presents challenges for both hardware design and data acquisition. The Low Energy Module (LEM) has been conceived to address these demands, offering robust measurement capabilities even under hostile conditions. NUSES is a forthcoming space mission intended to test innovative observational and technological methods for studying relatively low-energy cosmic rays, gamma rays, and high-energy astrophysical neutrinos. Two scientific payloads will be aboard: Terzina and Zir'e. Terzina is an optical telescope equipped with SiPM arrays for detecting and analyzing Cherenkov light generated by Extensive Air Showers produced by high-energy cosmic rays and neutrinos in the atmosphere. Zir'e, meanwhile, will detect protons and electrons up to a few hundred MeV as well as photons in the MeV range, and it incorporates the LEM.

The LEM is a compact particle spectrometer dedicated to measuring fluxes of relatively low-energy electrons (0.1–7 MeV) and protons (3–50 MeV) in Low Earth Orbit. For event-based particle identification, it employs the well-established  $\Delta E-E$  (Delta E-E) technique, commonly used in particle physics. Observing Particle Bursts (PBs) in this energy regime may illuminate correlations between seismic or volcanic events and the collective motion of particles in the Van Allen belts. With its limited acceptance and small footprint ( $10 \times 10 \times 10 \text{ cm}^3$ ), the LEM can effectively operate in high-radiation areas such as the SAA and the inner Van Allen belt, where electron fluxes can reach  $10^6\text{--}10^7 \text{ cm}^{-2} \text{ s}^{-1} \text{ sr}^{-1}$ .

In this presentation, we will discuss the design of the Flight Model, the current integration status, experimental results from proton beam tests on the silicon detectors, and the expected performance of the system, drawing on both Monte Carlo simulations and preliminary data analysis.

### Eligibility for "Best presentation for young researcher" or "Best poster for young researcher" prize

Yes

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