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The TIGERISS Galactic Cosmic Ray Mission

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The Trans-Iron Galactic Element Recorder for the International Space Station (TIGERISS) is a NASA Astrophysics Pioneers mission in Phase B development with a planned launch to the ISS in 2027 and manifested on the Starboard Overhead X-Direction (SOX) location on the Columbus External Payload Facility. TIGERISS will be the first Galactic Cosmic Ray (GCR) detector to measure elemental abundances from $_{5}$B to $_{82}$Pb over ∼400 MeV/nucleon to ∼10 GeV/nucleon with single-element resolution. It builds on the heritage of the predecessor TIGER and SuperTIGER stratospheric balloon-borne experiments flown from Antarctica and uses the proven combination of ionization (dE/dx) detectors with acrylic (n = 1.5) and silica aerogel (n = 1.05) Cherenkov-light-radiator ($\propto\beta$) detectors for charge and energy measurement. Introducing silicon strip detectors (SSDs) in place of both scintillating fiber hodoscopes for track reconstruction and large area scintillator detectors for dE/dx measurement and the instrument trigger reduces material in beam and shortens instrument stack height, and CERN beam tests have demonstrated that SSDs provide superior charge resolution (σ_Z < 0.25) and signal linearity over the full dynamic range. TIGERISS is using silicon photomultipliers (SiPMs) instead of photomultiplier tubes to avoid the need for high voltage and to provide more compact Cherenkov detector readout needed to maximize the instrument geometry within the SOX payload envelope. The shorted stack height and maximized instrument area provide a geometry factor of 1.21 m^2sr that allows for TIGERISS in one year to have comparable GCR exposure to that achieved in the first 55-day SuperTIGER flight over their common measurement range without the systematics from atmospheric propagation corrections. Aiming to extend TIGERISS operations through the end of the ISS, the data collected would allow it to make the best test of models of GCR origins, including their source environments and acceleration mechanisms. TIGERISS measurements over nearly the entirety of the s-process and r-process (slow and rapid) neutron capture processes and the rp-process rapid-proton capture process of heavy-element nucleosynthesis will enable it to make a significant contribution to the wider multi-messenger effort to determine the relative contributions of supernovae and neutron star merger events to r-process nucleosynthesis.

Eligibility for ”Best presentation for young researcher” or ”Best poster for young researcher” prize

No

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