

Progress on Ultra-Heavy Cosmic-Ray Analysis with CALET on the International Space Station

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The measurement of ultra-heavy cosmic rays (UHCR), $_{30}\text{Zn}$ and higher charge elements, provide insight into the origins of cosmic rays. The UHCR composition shows enhancement in material produced in massive stars, both from stellar outflows during the stars' lives and in the ejecta from supernovae. This suggests that a significant fraction of the cosmic rays originate in OB associations, which is where the majority of supernovae that are believed to accelerate the galactic cosmic rays occur. The fact that the cosmic-ray source appears to be enhanced in massive star material compared to solar system would suggest that UHCR observations can help constrain the relative contributions of supernovae and binary neutron star mergers to the heavy r-process elements.

CALET observations contribute to the statistics of the UHCR data set and complement other existing measurements. CALET has measured cosmic-ray abundances in the $1 \leq Z \leq 40$ charge range and after 5 years has collected UHCR statistics similar to those achieved in the first flight of the balloon-borne SuperTIGER instrument. Previous CALET UHCR analyses using time and position corrections based on $_{26}\text{Fe}$ and a geomagnetic vertical cutoff rigidity selection have shown abundances of even nuclei in agreement with SuperTIGER. To further improve resolution and maximize statistics, a trajectory dependent geomagnetic rigidity selection has been employed. Additional work has been done to analyze events from the smaller data set of events that pass through the TASC, which provides energy information. In this ICRC, we show preliminary work on the TASC analysis, where relative abundances of odd-even paired nuclei ($_{27}\text{Co}$ & $_{28}\text{Ni}$, $_{29}\text{Cu}$ & $_{30}\text{Zn}$, etc.) are comparable to both ACE-CRIS's preliminary top-of-instrument and SuperTIGER's top-of-atmosphere abundances.

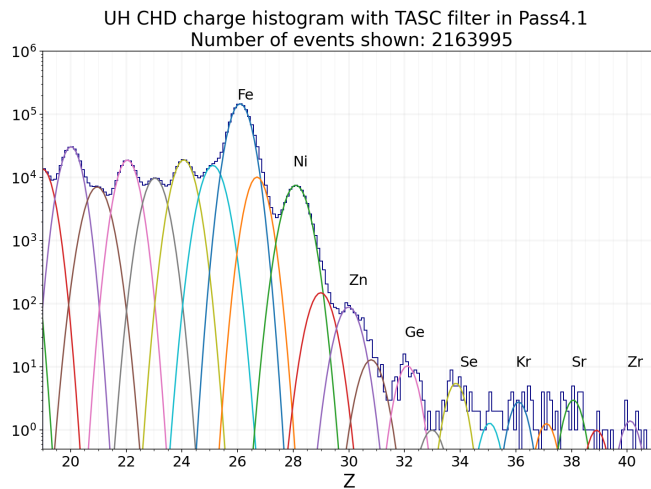


Figure 1(a): UHCR TASC analysis histogram with multiple gaussian fitting, bin size in 0.1 units of charge.

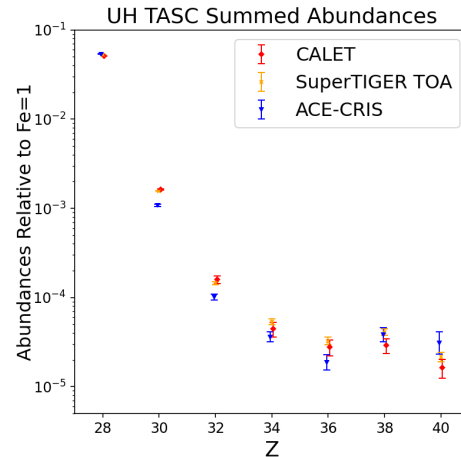


Figure 1(b): Comparison of the relative abundances of the summed odd-even pairs with SuperTIGER and ACE-CRIS for Z between $27 \leq Z \leq 40$. Errors bars are statistical only.