Sub-Iron Spectrum Analysis

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2024-10-23

Pre-Selection

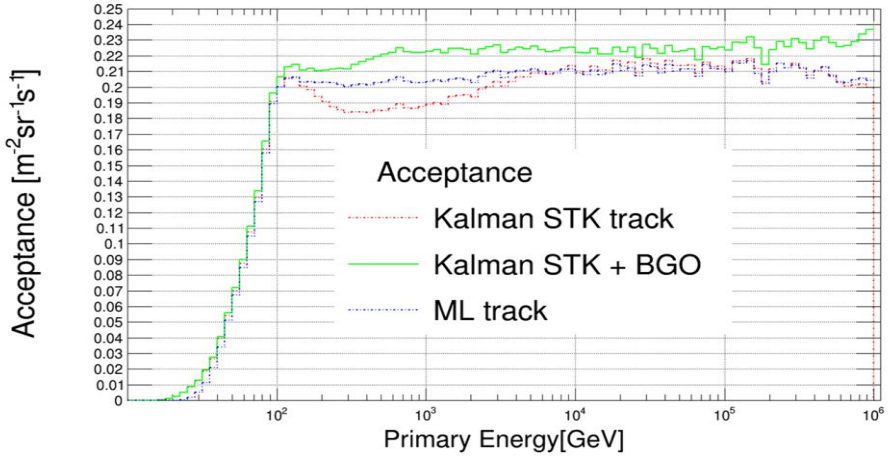
- $E_{dep} > 10$ GeV
- Has STK or BGO track
- STK track selection; (if there is no STK track, use BGO track instead)
  a) $chi^2/ndf < 50$ & Angle to BGO track < 15°
  b) Match with MGO shower
  c) Selected the track with max Energy deposition in STK detector
  d) Max $E_{Ratio} < 0.35$ & Track Pass PSD top and BGO buttle
- PSD selection

  ① PASS two layer PSD, $Q_0 > 10$ & $Q_1 < 10$

  ② $$Q_i = \begin{cases} \frac{(q_{i1}+q_{i2})}{2}, & for\ \frac{|q_{i1}-q_{i2}|}{Max\{q_{i1},q_{i2}\}} < 0.1 \\ Max\{q_{i1},q_{i2}\}, & for\ \frac{|q_{i1}-q_{i2}|}{Max\{q_{i1},q_{i2}\}} > 0.1 \end{cases}, \quad i = 0 \text{ or } 1$$
- HET

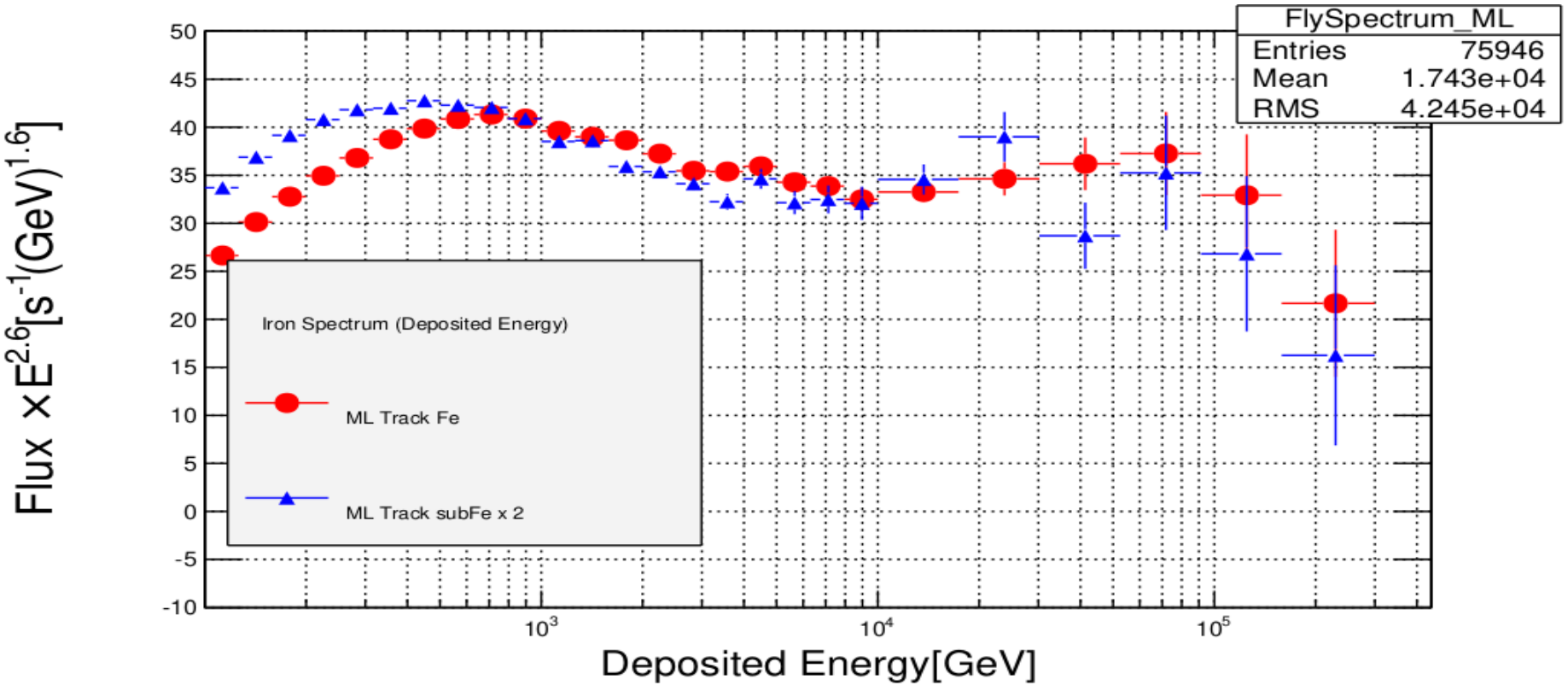
ML track

A. Tykhonov, et al. Astroparticle Physics, 146 (2023) 102795



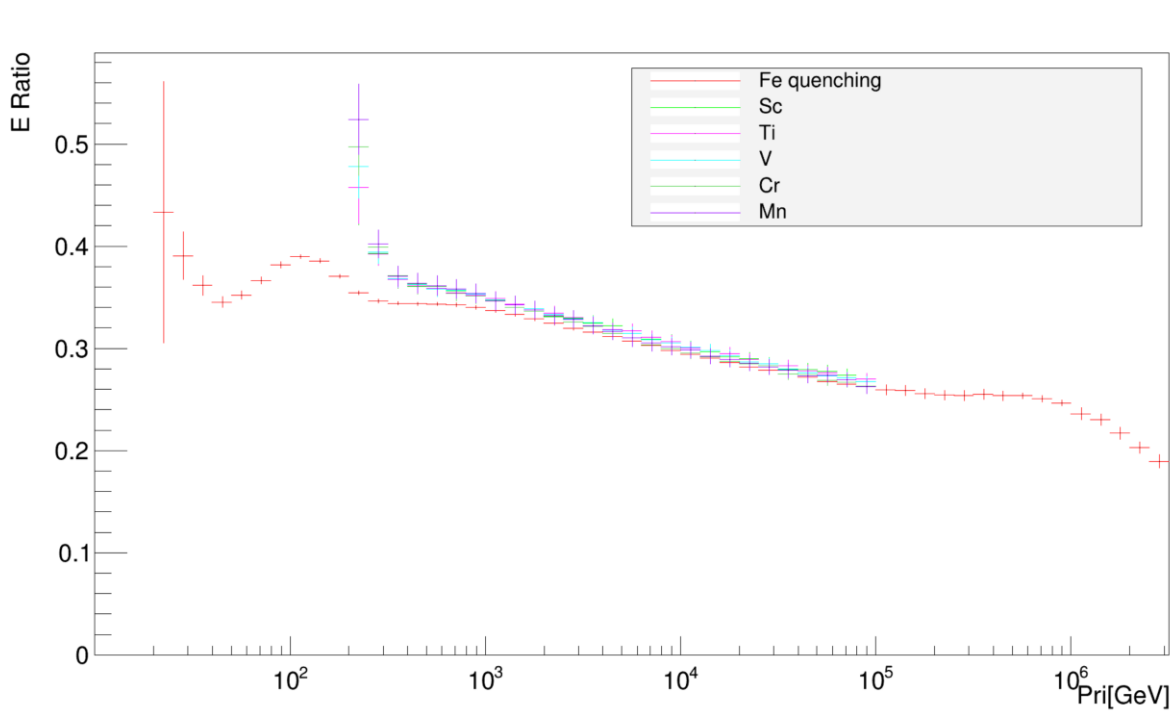
Sub-Fe and Fe Deposited Energy Spectrum

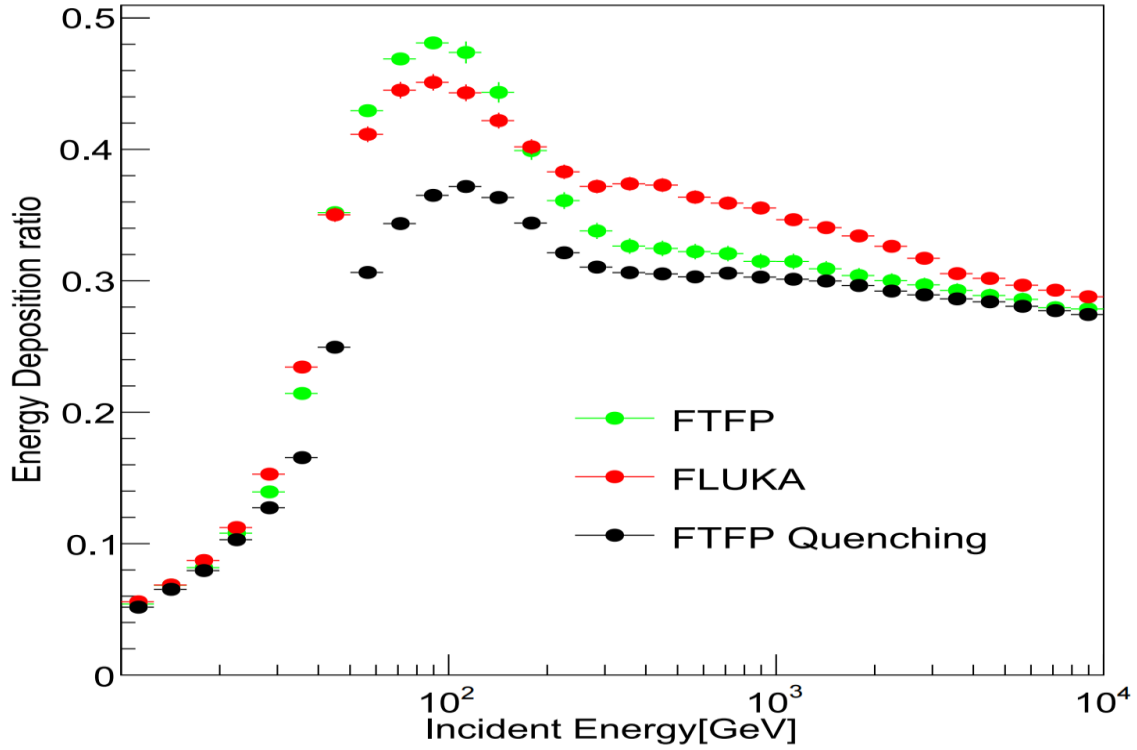
Sub-Fe Range:
20.5-25.4
Iron Range
25.5-27.2



the deposition energy spectrum of sub-iron also exhibits a bump structure.

Energy Deposition Ratio





Without the quenching effect, the energy deposition ratios of iron and sub-irons are essentially the same. Therefore, the energy response matrix of iron can be used for spectrum deconvolution.

Sub-iron Spectrum

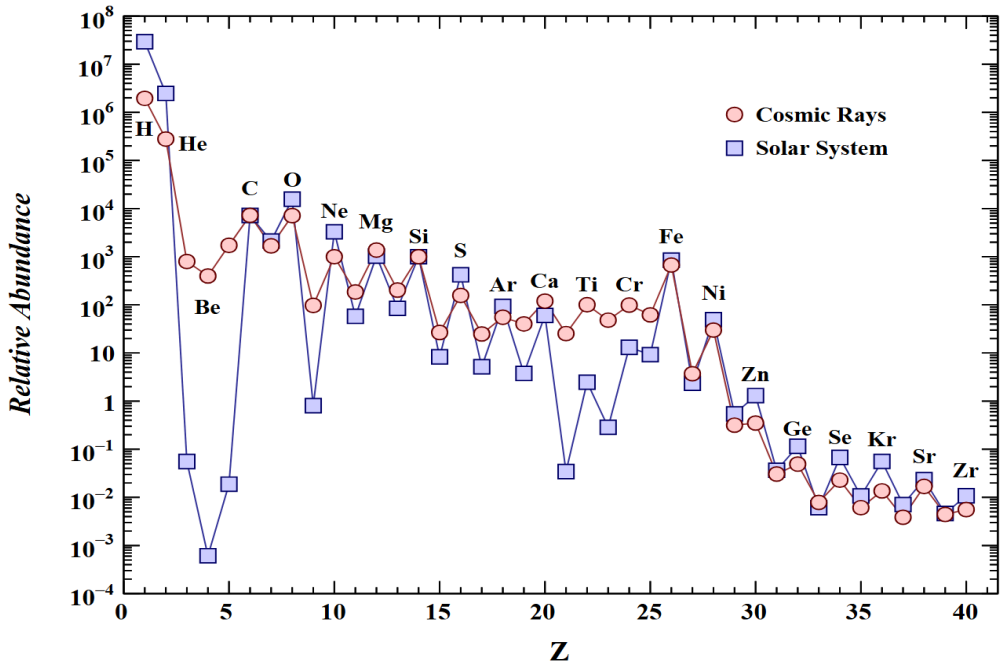
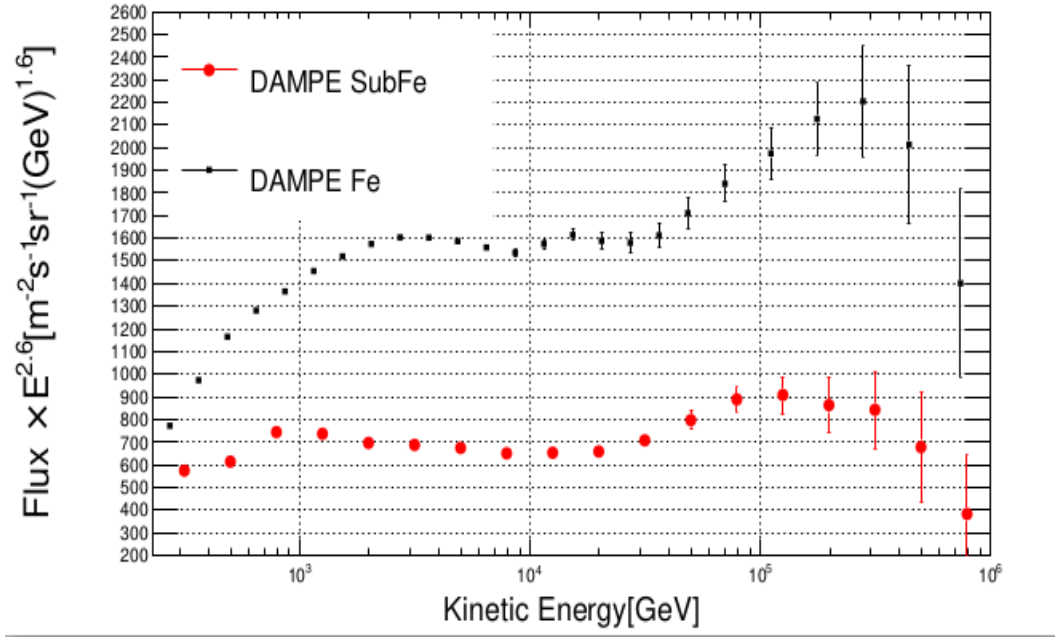
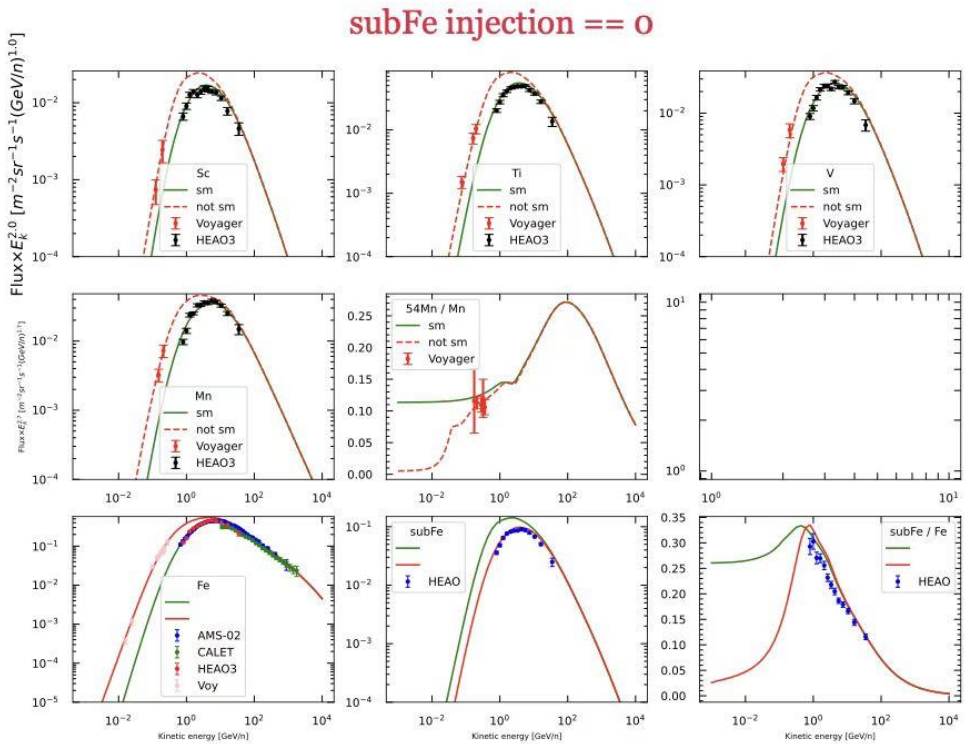


图 1.1　太阳附近与宇宙空间的核子丰度对比[14]。



The preliminary spectrum of sub-iron also exhibits a bump structure, which can help us understand the origin of the bump structure in the cosmic ray spectra.

Sub-Fe/Fe Spectrum



My preliminary analysis, not publish.

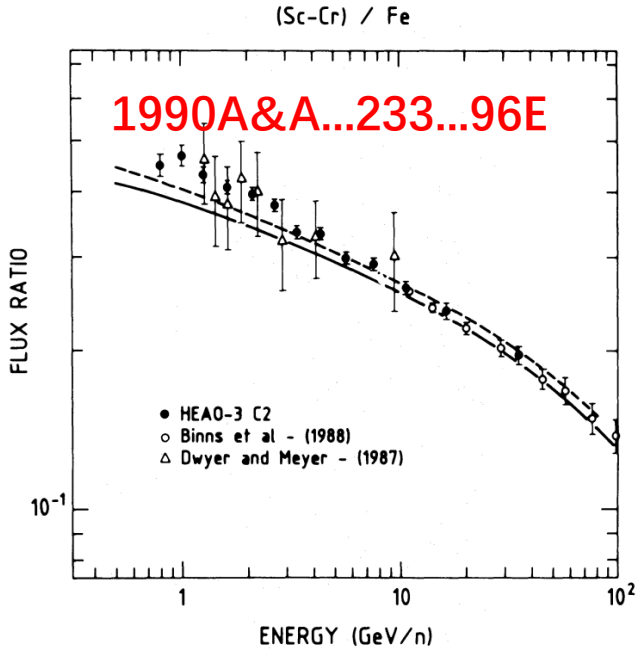


Fig. 16. Predicted and observed (Sc + Ti + V + Cr)/Fe ratio (see Fig. 7 caption). *Continuous curve*: interstellar medium: 90% H, 10% He. *Dashed curve*: interstellar medium: 100% H

The ratio of sub-irons to iron can be used to study the propagation and origin of cosmic rays, and may provide constraints on the origin of the bump structure in the cosmic ray energy spectrum.

summary

- The deposition energy spectrum of sub-iron also exhibits a bump structure.
- The energy deposition ratios of iron and sub-irons are essentially the same.
- The preliminary spectrum of sub-iron also exhibits a bump structure, This is the first measurement of the bump structure in the energy spectrum of secondary cosmic rays.
- The Ratio of sub-irons to iron is on going.