

# CALETによる10GeVから3TeVの全電子スペクトル観測

All-Electron Energy Spectrum from 10GeV to 3TeV with CALET

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<u>概要:</u> CALETは、2015年10月から国際宇宙ステーションにて長期観測を継続している高エネルギー宇宙線観測装置である. 撮像型と全吸収型 を組み合わせた計30放射長の厚いカロリメータを搭載し、TeV領域に至る全電子(電子+陽電子)スペクトルの精密測定を第一の目的とする.本 講演では、CALETカロリメータの10GeV-3TeVのエネルギー領域における宇宙線全電子スペクトル観測成果と今後の展望について報告する.

### 1. Measurements of Cosmic-Ray All-Electron Spectrum (e<sup>+</sup>+e<sup>-</sup>)





Fully active thick calorimeter (30X<sub>0</sub>) optimized for electron spectrum measurements well into the TeV region

P-037





Cutoff due to radiative energy loss of electrons from distant SNe?

Short propagation distance of HE electrons might reveal nearby cosmic-ray accelerator!

Due to huge proton background (1:1000) and low-energy flux of electrons at high energies, it is very difficult to measure all-electron spectrum into the TeV region.

### 3. CALET Capability of All-Electron Measurements

#### **3TeV Electron Candidate**



**Corresponding Proton Background** 

- CALET is a dedicated detector for all-electron spectrum measurements.
- **1. Reliable tracking** well-developed shower core 2. Fine energy resolution full containment of TeV showers
- **3. High-efficiency electron ID** 30X<sub>o</sub> thickness

# 5. Systematic Uncertainties

Stability of resultant flux are analyzed by scanning parameter space

- Normalization:
- Live time
- Radiation environment
- Long-term stability
- Quality cuts

- Divided into 4 sub-periods (134days each)
- 2. spectrum in each sub-period is compared with the one from the whole period.
- standard deviation of the relative 3. difference distribution is taken as
- systematic uncertainty (1.4%)
- **Absolute Energy Scale:**
- Energy scale is determined by the calibration using cutoff rigidity. The uncertainty in absolute energy scale is not included in the systematic error.





CALET is best suited for observation of possible fine structures in the allelectron spectrum up to the trans-TeV region.

# 6. CALET All-Electron Spectrum

and Comparison with Other Space Experiments



## 4. Event Selection





(a) Electron efficiency as a function of energy for each important selection step. (b) Same for protons. Black, green, yellow, blue and red histograms show the efficiency after (1) offline trigger, (2) geometrical condition with (3) track quality cuts, (4) charge selection, and (5)&(6) shower development consistency cuts, K-estimator cut and BDT cut with 80% efficiency, respectively. The resultant contamination ratios of protons in the final electron sample is ~5% up to 1 TeV, 10%–15% in the 1–3 TeV region, while keeping a constant high efficiency of 80% for electrons.

結論と展望: CALETの3TeVまでの全電子スペクトルをPRLにて発 表した. 結果はAMS-02と誤差の範囲で合致しており, 互いの系統誤 差評価の妥当性を示唆する.また,統計的には有意ではないものの スペクトルに構造がある可能性がある.CALETの1月後にDAMPE の結果が発表され、それらの比較がとても重要になってきている。 CALETは2017年11月までにPRLの2倍の統計量のデータを蓄積して 、おり、エネルギー範囲の拡大を含めた、新たな論文を準備中である.