

# Indirect measurement of cosmic-ray proton spectrum using $\gamma$ -ray data from *Fermi* Large Area Telescope

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## Abstract

Cosmic rays (CRs) are high-energy particles, mostly protons, propagating in space. The rigidity (momentum per charge) spectrum of CRs is well described by a power law for which the spectral index is approximately 2.8 around 30 - 1000 GV. Recent measurements by PAMELA and AMS-02 indicate an abrupt change of the CR proton spectral index at about 336 GV. When CRs interact with the Earth's upper atmosphere,  $\gamma$  rays can be produced and detected by space-based detectors. Here we use the Earth's  $\gamma$ -ray data collected by the *Fermi* Large Area Telescope along with a proton-air interaction model to indirectly determine the CR proton spectral index and compare against observations by other instruments. This requires intensive computing power for data and statistical analysis. This research project is partially supported by Thailand Science Research and Innovation (RTA6280002).

**Keywords**— Cosmic rays, gamma-rays, *Fermi*-LAT

## References

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