

Research Report
ICRR Inter-University Research Program 2019

Research Subject:

Principal Investigator:

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Participating Researchers:

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Summary of Research Result :

- 1) First detection of photons with energy beyond 100 TeV from an astrophysical source. In 2019, we discovered the highest energy cosmic gamma rays ever observed from an astrophysical source – the “Crab Nebula.” The experiment detected gamma rays ranging from >3 TeV to 450 TeV (see Fig.1). Previously, the highest energy ever observed for a gamma-ray photon was 75 TeV, by the HEGRA Cherenkov telescope. This result was published on P.R.L (Phys. Rev. Lett. 123, 051101(2019)) and was recommended as the two highest level highlight papers (Physics Viewpoint and Editor's recommendation).
- 2) Evaluation of the Interplanetary Magnetic Field Strength Using the Cosmic-Ray Shadow of the Sun. We analyze the Sun's shadow observed with the Tibet-III air shower array and find that the shadow's center deviates northward (southward) from the optical solar disk center in the “away” (“toward”) interplanetary magnetic field (IMF) sector. (see Fig.2)

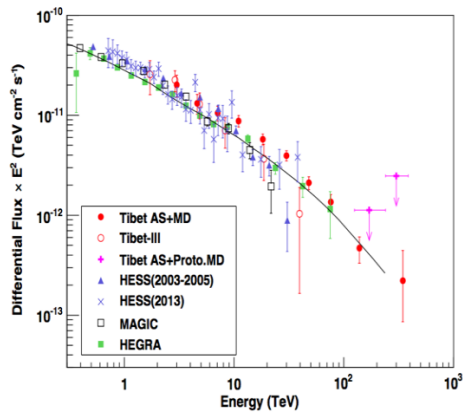


Fig.1 Differential energy spectrum of Crab photons. Highest energy photon is approximately 450 TeV.

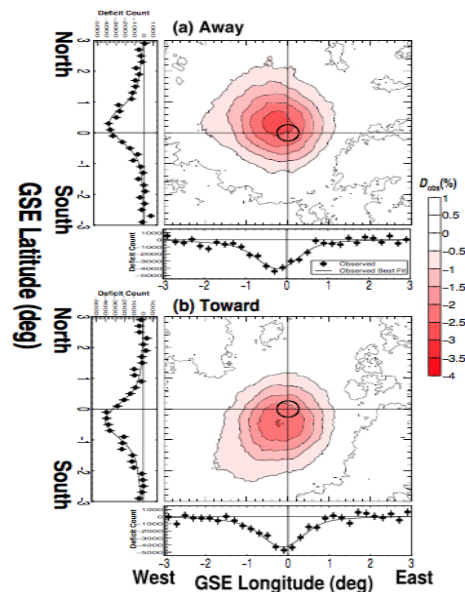


Fig.2 Two dimensional maps of Dobs in "Away" (top) and "Toward" (bottom) sectors in 2000-2009.

(3) Recent published papers (May include presentations at academic conferences.

- 1) First Detection of Photons with Energy beyond 100TeV from an Astrophysical Source, M.Amenomori et al., PRL, 123, 051101 (2019).
- 2) Evaluation of the Interplanetary Magnetic Field Strength Using the Cosmic-Ray Shadow of the Sun, M. Amenomori et al., PRL, **120**, (2018) 031101
- 3) Influence of Earth-directed Coronal Mass Ejections on the Sun's Shadow Observed by the Tibet-III Air Shower Array, M. Amenomori et al., ApJ, **860**, (2018) 13 (1-7).
- 4) Energy Determination of gamma-ray induced air showers observed by an extensive air shower array, K. Kawata et al., Exp Astron (2017) 44-1-9.

No.