ICRC
The Astroparticle Physics Conference
34th International Cosmic Ray Conference
July 30 - August 6, 2015
The Hague, The Netherlands

Contribution ID: **1395** Type: **Invited Review talk**

Status overview of gamma-ray astronomy

Monday 3 August 2015 09:45 (45 minutes)

Gamma-ray astronomy reveals the sites and mechanisms of powerful astrophysical accelerators and tests the limits of our understanding of matter and energy in the Universe. Current instruments, both in space and on the ground, are deepening the view of the gamma-ray sky, broadening spectral coverage, and capturing variability and transient activity in a rich variety of astrophysical objects.

The Fermi Gamma-ray Space Telescope has dramatically expanded the known classes of gamma-ray emitters and resolved new features of the gamma-ray sky. Fermi's Large Area Telescope (LAT) and Gamma-ray Burst Monitor (GBM) have captured activity that pushes the limits of existing emission models. The newly released reconstruction of the entire LAT data set provides an immediate boost to all high-energy photon studies and extends the energy reach of the instrument.

Meanwhile, the ground-based gamma-ray detectors, such as VERITAS, MAGIC, and HESS, have been enhancing performance at the low energy end of their range, bringing overlap in the observations between these techniques. Ground-based efforts have expanded the catalog of sources above 100 GeV in both size and variety, and the freshly completed HAWC array now provides wide-field observations that open up new monitoring and survey capability.

The expanded, complementary coverage across a broad segment of the gamma-ray spectrum has brought new insights into the acceleration of energetic particle populations and the resulting, often complex gamma-ray emission components. The future promises a continued wealth of discoveries with current instruments and next-generation observatories. In this review, I will highlight select areas within gamma-ray astronomy that have shown significant progress and raised new questions. I will also consider some topics that may be addressed by future observations and instruments.

Registration number following "ICRC2015-I/"

1075

Collaboration

– not specified –

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Session Classification: Invited Review Talks

Track Classification: GA-EX