# T 88: Gamma Astronomy IV

Time: Wednesday 17:30–19:00 Location: POT/0151

T 88.1 Wed 17:30 POT/0151

**Simulated galactic SNR populations compared to experimental data** — •Rowan Batzofin[1], Kathrin Egberts[1], Constantin Steppa[1], and Pierre Cristofari[2] — [1]University of Potsdam, Potsdam, Germany — [2]Observatoire de Paris, PSL Research University, LUTH, France

For a long time it has been believed that supernova remnants are the primary source of galactic cosmic rays up to the knee although it has not been conclusively proven yet. Supernova remnants are expected to produce VHE gamma rays via hadronic interactions between the cosmic rays accelerated at the shock and the ambient gas in the interstellar medium. There are many supernova remnants detected in the radio energy range but very few of them have been identified at VHE.

To study the VHE emission of galactic supernova remnants we create a model for supernova remnant populations. The supernova remnant population model ingredients are: The acceleration physics of the supernova remnants, the matter distribution of the interstellar medium in the Milky Way and the source distribution for the supernova remnants in the Milky Way. We utilise population synthesis to optimise some of the parameters for the model to best fit the experimental data. We compare our simulated populations to experimental data by looking at the source distribution and the detectability of the simulated sources.

We test the simulated populations of galactic supernova remnants against the experimental observations to show whether supernova remnants could be the primary accelerators of cosmic rays.

T 88.2 Wed 17:45 POT/0151

**What we can learn from blazar light curves** — •Lea Heckmann, David Paneque, and Axel Arbet-Engels — Max-Planck-Institut für Physik, D-80805 München, Germany

Blazars are among the most energetic sources in our Universe. However, even though they have been studied for decades over a wide range of the electromagnetic spectrum, they are far from being understood.

In this contribution, we would like to give some insights into what we can learn from studying the multi-wavelength light curves of blazars. It includes on the one hand the features in each single waveband, such as the degree of variability or signs of potential periodicity. On the other hand, the the connection between different wavebands can also be investigated by studying the correlations between them. In addition to introducing the theory behind these characteristics, we will use a long-term data set of the archetypal blazar Mrk 501 to demonstrate their capabilities when applied to real data.

T 88.3 Wed 18:00 POT/0151

**Intergalactic magnetic fields and Mkn 421 gamma-ray observations** — •Matias Sotomayor Webar and Dieter Horns — Institut für Experimentalphysik, Universität Hamburg, Luruper Chausseee 149, D-22761 Hamburg

The existence of intergalactic magnetic fields as a relic of a phase transition in the early universe has so far not been confirmed through observations. While Faraday rotation measure provide an upper bound ($\lesssim 10^{-9}$ G), lower bounds have been proposed via the non-detection of gamma-ray emission produced in inverse Compton/pair production cascades. Sufficiently large magnetic fields ($\gtrsim 10^{-16}$ G are required to deflect the secondary electrons out of the line of sight and suppress the visible inverse Compton emission. The interpretation of these limits is however debatable, as oblique pair instabilities could be a dominating energy-loss mechanism, providing the long sought additional heating of the intergalactic medium to explain Ly$-\alpha$ forest data. In this contribution, we present the results for a search for a strongly suppressed cascade emission from the direction of the prominent nearby blazar Mkn 421 ($z = 0.031$) using *Fermi* LAT data. Preliminary results will be presented at the conference.

T 88.4 Wed 18:15 POT/0151

**3D Shower Reconstruction with the Cherenkov Telescope Array*** — •Stefan Fröse and Lukas Nickel for the CTA-Collaboration — TU Dortmund University, Dortmund, Germany

The Cherenkov Telescope Array (CTA) is the next-generation telescope array for high-energy gamma-ray astronomy. The Imaging Atmospheric Cherenkov Telescopes (IACTs) will be able to make precise measurements of the Cherenkov light induced by incident primary particles, such as photons or ions. To determine the direction and energy of these particles, the characteristics of the atmospheric shower have to be reconstructed.

One possible method is the reconstruction using a three-dimensional rotationally invariant Gaussian shower model, as introduced by the H.E.S.S. collaboration. This model is fitted directly to the images of the shower in the triggered cameras using a maximum likelihood approach. This talk will summarize the current implementation as part of the ctapipe analysis package and the initial results.

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T 88.5 Wed 18:30 POT/0151

**MAGIC Event Reconstruction with Deep Learning** — •Jarred Gershon Green for the MAGIC-Collaboration — Max Planck Institute for Physics, Munich, Germany

The Major Atmospheric Gamma Imaging Cherenkov (MAGIC) telescope is a stereoscopic system used for detecting gamma rays in the GeV to TeV range. When gamma rays and cosmic rays interact with the atmosphere, an air shower is initiated which itself emits Cherenkov photons detectable by MAGIC. After parametrizing the images of each shower, machine learning algorithms like random forests are used to reconstruct the properties of each primary particle, including their type, energy, and arrival direction. Convolutional Neural Networks offer a promising way to perform this reconstruction directly on pixelated camera images. In this contribution, we explore how deep learning algorithms like convolutional and graph neural networks can be used to reconstruct events, first by introducing architectures and then showing their performance as applied to real MAGIC data.

T 88.6 Wed 18:45 POT/0151

**ctapipe – Prototype Open Event Reconstruction Pipeline for the Cherenkov Telescope Array** — •Maximilian Linhoff, Lukas Nickel, and Noah Biederbeck for the CTA-Collaboration — Astroparticle Physics, TU Dortmund University, Germany

The Cherenkov Telescope Array (CTA) is the next-generation ground-based, very high energy gamma-ray observatory currently under construction. It will improve over the current generation of imaging atmospheric Cherenkov telescopes (IACTs) by a factor of five to ten in sensitivity and it will be able to observe the whole sky from its two sites: La Palma, Spain, and Paranal, Chile.

CTA will also be the first open ground-based gamma-ray observatory. Accordingly, the data analysis pipeline is developed as open-source software. The event reconstruction pipeline accepts raw data from the telescopes and processes it to produce suitable input for the high-level science tools. Its primary tasks include reconstructing the physical properties of each recorded shower and providing the corresponding instrument response functions.

ctapipe is a python framework to facilitate calibration of the raw data, image extraction, image parameterization and event reconstruction. Though the current focus has been the analysis of simulated data, the software has also been successfully applied to the data obtained with the first CTA prototype telescopes, such as Large-Sized Telescope (LST-1). A plugin system also allows processing of comparable data from other IACT facilities. Recent updates, new features and the planned roadmap towards a 1.0 release will be discussed.