T 45: Gamma Astronomy 2

Time: Tuesday 16:15–18:15 Location: T-H30

T 45.1 Tue 16:15 T-H30

The Crab pulsar wind nebula in high-energy gamma-rays and its flaring emission — •Michelle Tsirou[1], Brian Reville[1], Emma de Oña-Wilhelmi[2], Gwenaël Giacinti[1], and John Kirk[1] — [1]MPIK, Heidelberg, Germany — [2]DESY, Berlin-Zeuthen, Germany

The Crab nebula system is one of the brightest gamma-ray sources in the Milky Way, extensively observed across the electromagnetic spectrum. Recent studies purport intermittent flaring events deviating from the continuous flux associated with its synchrotron spectrum below a few hundreds of MeV, straining the theoretical synchrotron burn-off limit in these energy ranges. By analysing available Fermi-LAT data across a thirteen-year-long monitoring, we study the energy-dependence of its flaring behaviour in a few hundred MeV up to a few GeV energy ranges. We explore acceleration mechanisms prone to explain the variability of the observed emission and discuss its implication on our current understanding of this extreme system.

T 45.2 Tue 16:30 T-H30

Machine learning methods for constructing probabilistic Fermi-LAT catalogs — •Aakash Bhat[1] and Dmitry Malyshev[2] — [1]Dr. Karl-Remeis Strernwarte, Bamberg — [2]ECAP Erlangen

Classification of sources is one of the most important tasks in astronomy. Sources detected in one wavelength band, for example using gamma rays, may have several possible associations in other wavebands or there may be no plausible association candidates. In this work, we aim to determine probabilistic classification of unassociated sources in the third and the fourth data release 2 Fermi Large Area Telescope (LAT) point source catalogs (3FGL and 4FGL-DR2) into two classes (pulsars and active galactic nuclei (AGNs)) or three classes (pulsars, AGNs, and other sources). We use several machine learning (ML) methods to determine probabilistic classification of Fermi-LAT sources. We evaluate the dependence of results on meta-parameters of the ML methods, such as the maximal depth of the trees in tree-based classification methods and the number of neurons in neural networks. We determine probabilistic classification of both associated and unassociated sources in 3FGL and 4FGL-DR2 catalogs. We cross-check the accuracy by comparing the predicted classes of unassociated sources in 3FGL that have associations in 4FGL-DR2. We find that in the 2-class case it is important to correct for the presence of other sources among the unassociated ones in order to realistically estimate the number of pulsars and AGNs.

T 45.3 Tue 16:45 T-H30

Classification of Fermi-LAT blazars with Bayesian neural networks — Anja Butter[1], •Thorben Finke[2], Felicitas Keil[2], Michael Krämer[2], and Silvia Manconi[2] — [1]Institut für Theoretische Physik, Universität Heidelberg, Germany — [2]Institute for Theoretical Particle Physics and Cosmology, RWTH Aachen University, Germany

We apply Bayesian neural networks on the classification of γ-ray sources within the Fermi-LAT catalog. We focus on blazar candidates and their sub-classification into BL Lacertae and Flat Spectrum Radio Quasars. We explore the correspondence between conventional dense and Bayesian neural networks and the effect of data augmentation. We find that Bayesian neural networks provide a robust classifier with reliable uncertainty estimates and are particularly well suited for classification problems that are based on comparatively small and imbalanced data sets. The results of our blazar candidate classification are valuable input for population studies aimed at constraining the blazar luminosity function and to guide future observational campaigns.

T 45.4 Tue 17:00 T-H30

Analysis of the high energy γ-ray emission from HESS J1813-178 with H.E.S.S and Fermi-LAT data — •Tina Wach, Vikas Joshi, Alison Mitchell, and Stefan Funk — Erlangen Center for Astroparticle Physics

HESS J1813-178 is one of the brightest and most compact objects detected by the HESS Galactic Plane Survey. Within the extent of the TeV emission lies a young Supernova Remnant G12.8-0.02 and a pulsar wind nebula driven by a pulsar with the second highest spin-down luminosity of known pulsars in the Galaxy PSR J1813-1749. The origin of the TeV emission is still not clear. Because of the young age of the system, the pulsar wind nebula and the Supernova Remnant overlap and present a good opportunity to examine how the interactions between these two components influence the acceleration of particles in the system. In previous analyses, a discrepancy in extension has been observed between a point-like component seen in TeV γ-rays measured by H.E.S.S and a extended component in GeV γ-ray observations from the Fermi-LAT satellite. We used 3 dimensional map-based analysis with gammapy to do a morphological and spectral analysis of this region in GeV and TeV energy ranges, as well as a joint-analysis of both datasets. We find a new significant extended emission component in the TeV energy range, with a morphology close to the GeV energy range. While the question of the origin of the very high γ-ray emission from HESS J1813-178 could not be answered yet, our analysis allows a consistent description and a smooth energy spectrum of the region across five decades of energy.

T 45.5 Tue 17:15 T-H30

Science verification and highlights of the new FlashCam-based camera in the 28m telescope of H.E.S.S. — •Simon Steinmassl for the H.E.S.S.-Collaboration — Max Planck Institut für Kernphysik, Heidelberg, Germany

In October 2019, the 28m telescope in the centre of the H.E.S.S. array was upgraded with a new camera. The camera itself is a prototype based on the FlashCam design, which was originally developed for the Cherenkov Telescope Array (CTA). We report here the results of the validation and science verification programme that has been performed after the commissioning period. From that, we conclude that the camera, analysis and simulation pipelines are working up to expectations. Finally, we discuss some highlights of the scientific results obtained during the first two years of science operation with the new camera, as well as possible future science cases.

T 45.6 Tue 17:30 T-H30

Lake Deployment of Southern Wide-field Gamma-ray Observatory Detector Units — •Hazal Goksu for the SWGO-Collaboration — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

This contribution is about the lake concept, one of the possible detector designs for Southern Wide-field Gamma-ray Observatory (SWGO). SWGO will be a next-generation high altitude gamma-ray survey observatory in the southern hemisphere consisting of an array of water cherenkov detectors. With its energy range, wide field of view, large duty cycle, and location it will complement the other existing and planned gamma-ray observatories. The lake concept is an alternative to the HAWC-like separate detector unit design, and the LHAASO-style artificial ponds. Instead of having tanks filled with water, bladders filled with clean water are deployed near the surface of a natural lake, where each bladder is a light-tight stand-alone unit containing one or more photosensors. We will give an overview of the advantages and challenges of this design concept and describe the first results obtained from prototyping.

T 45.7 Tue 17:45 T-H30

Status and first results from TAIGA — •Michael Blank and Martin Tluczykont — Institut für Experimentalphysik, Universität Hamburg

TAIGA has implemented a new, unique observation technique, based on a combination of the imaging air Cherenkov telescope (IACT) technique, and the HiSCORE timing array concept. TAIGA aims to further explore the celestial gamma-ray sources at energies of a few 10s of TeV to several 100 TeV. This energy range is particularly important to spectrally resolve the cutoff regime of the galactic Pevatrons, the cosmic-ray accelerators to PeV energies. TAIGA currently consists of an array of 121 wide angle (0.6 sr) air Cherenkov timing stations distributed over an area of about 1 km^2 and two IACTs with a diameter of 4.75 m and a field of view of 9.7°. A third IACT will be completed during this year.

In this presentation, the current status of the experiment and the analysis is discussed and the detection of the Crab Nebula with data of previous seasons, with a smaller size array and only with the first IACT in operation, is shown.

T 45.8 Tue 18:00 T-H30

COMCUBE: Exploring the violent Universe with CubeSat Technology — •Jan Lommler for the COMCUBE-Collaboration — Johannes Gutenberg-Universität Mainz

Gamma Ray Bursts are a window into some of the most energetic processes in the Universe. Due to the energy range of the emitted electro-magnetic radiation, measurements have to be performed in space by a network of either dedicated observatories like SWIFT and POLAR or secondary detectors mounted on larger observatories like Fermi GBM. Most detectors only allow the measurement of the burst's energy-spectrum and time evolution, missing out on polarization of the incident photons. Using Compton scattering as main detection channel, Cubesats offer the opportunity to setup a network of small-scale dedicated detectors at relatively low cost that are able to pinpoint GRBs, measure their spectra and temporal evolution while obtaining polarization information. In this talk, we want to present the detector concept of COMCUBE, performance estimates and the status of the balloon prototype.