T 60: Gamma astronomy 3

Time: Wednesday 16:00–18:00 Location: Geb. 30.22: kl. HS A

T 60.1 Wed 16:00 Geb. 30.22: kl. HS A

Searching for photons beyond PeV energies from galactic sources — •Chiara Jane Papior, Markus Risse, and Marcus Niechciol — Universität Siegen, Siegen, Deutschland

Recently, observations of photons in the low PeV range originating from several galactic sources have been presented. Sources that are responsible for the emission of such energetic photons are candidates for cosmic-ray acceleration as well. Fits to the measured fluxes of the photon signals have been produced for many of the newly found sources. In this contribution, several sources with high photon fluxes at high energies are examined in detail. Their spectra are extrapolated beyond the PeV range to energies that might be accessible by present and future large-scale cosmic-ray observatories (i.e., beyond 10 PeV). Based on the continuation of these spectra and potential propagation effects, the expected photon flux is estimated for each source as a function of energy. The requirements for a detection of such photons with present and future observatories is discussed as well as prospects for actual observations.

This work is supported by the Deutsche Forschungsgemeinschaft (DFG).

T 60.2 Wed 16:15 Geb. 30.22: kl. HS A

Gamma-ray pulsar glitches: a study of variability in Fermi-LAT data — •Giovanni Cozzolongo[1,2], Massimiliano Razzano[2,3], Alessio Fiori[2,3], and Pablo Saz Parkinson[4] — [1]Erlangen Centre for Astroparticle Physics, Friedrich-Alexander-Universität Erlangen-Nürnberg — [2]University of Pisa — [3]Istituto Nazionale di Fisica Nucleare — [4]University of California at Santa Cruz

Pulsars are the largest class of Galactic sources detected by NASA's Large Area Telescope (LAT) on the Fermi mission. Pulsars are generally acknowledged as very stable astrophysical rotators, that gradually slow down by emitting radiation at the expense of their rotational energy. Occasionally, pulsars can undergo transient events called glitches, which are rapid changes in their rotational parameters and typically followed by a relaxation phase. Variability in the emission features correlated to glitches has been observed in a small family of radio pulsars and in the radio-quiet PSR J2021+4026, the only variable pulsar observed by the LAT. Here we present a novel analysis of LAT gamma-ray pulsars consisting of a study of variability correlated with changes in the spin-down rate. We perform a maximum likelihood spectral analysis of LAT data around detected glitches, aiming at measuring variations in the gamma-ray flux and spectral parameters. We present results for a subset of glitches that we consider particularly promising. Our study suggests the importance of variability analysis to achieve a deeper understanding of pulsar physics.

T 60.3 Wed 16:30 Geb. 30.22: kl. HS A

Longterm Variability Study of the Crab Nebula with the MAGIC Telescopes — •Felix Wersig and Jan Lukas Schubert for the MAGIC-Collaboration — Technische Universität Dortmund, D-44221 Dortmund, Germany

The MAGIC telescopes are two Imaging Air Cherenkov Telescopes designed for observations of gamma rays in an energy range from about $\sim$25 GeV to $\sim$100 TeV.

Like other IACTs, they use the Crab Nebula as standard candle, assuming that the flux is constant for very-high-energy gamma rays. From radio to X-rays, small scale variability has been observed. Further, flares of the Crab Nebula have been observed in the low-energy gamma range.

There are two types of variability that can be tested for: Variations on short timescales such as flares or a longterm increase or decrease of the flux. In this work, tests utilizing maximum likelihood methods are developed that can quantify the variability of the flux and its statistical significance.

These tests are developed based on DL3 data which represents the standard data format in gamma astronomy making use of the open-source gamma-ray analysis package gammapy.

With this the observed variability of the Crab Nebula can be constrained and the assumption that it has a constant flux in the very-high-energy gamma-ray regime can be reevaluated.

T 60.4 Wed 16:45 Geb. 30.22: kl. HS A

Uncovering axion-like particles in supernova gamma-ray spectra — •Giuseppe Lucente[1,2,6,7], Francesca Calore[3], Pierluca Carenza[4], Christopher Eckner[3], Maurizio Giannotti[5], Alessandro Mirizzi[6,7], and Francesco Sivo[6,7] — [1]Institut für Theoretische Physik, Universität Heidelberg, Philosophenweg 16, 69120, Heidelberg, Germany — [2]Universität Heidelberg, Kirchhoff-Institut für Physik, Im Neuenheimer Feld 227, 69120 Heidelberg, Germany — [3]LAPTh, CNRS, F-74000 Annecy, France — [4]The Oskar Klein Centre, Department of Physics, Stockholm University, Stockholm 106 91, Sweden — [5]Centro de Astroparticulas y Fisica de Altas Energias (CAPA), Universidad de Zaragoza, Zaragoza, 50009, Spain — [6]Dipartimento Interateneo di Fisica "Michelangelo Merlin", Via Amendola 173, 70126 Bari, Italy. — [7]Istituto Nazionale di Fisica Nucleare - Sezione di Bari, Via Orabona 4, 70126 Bari, Italy.

A future Galactic Supernova (SN) explosion can lead to a gamma-ray signal induced by ultralight Axion-Like Particles (ALPs) thermally produced in the SN core and converted into high-energy photons in the Galactic magnetic field. The detection of such a signal is in the reach of the Large Area Telescope aboard the *Fermi* Gamma-Ray Space Telescope. The observation of gamma-ray emission from a future SN has a sensitivity to $g_{a\gamma} \gtrsim 4 \times 10^{-13}$ GeV^{-1} for a SN at fiducial distance of 10 kpc and would allow us to reconstruct the ALP-photon coupling within a factor of ~ 2, mainly due to the uncertainties on the modeling of the Galactic magnetic field.

T 60.5 Wed 17:00 Geb. 30.22: kl. HS A

Insights into the broadband emission of TeV blazars during the first X-ray polarization measurements — •Lea Heckmann[1,2], Axel Arbet-Engels[1], Felix Schmuckermaier[1], David Paneque[1], and Ioannis Liodakis[3,4] — [1]Max-Planck-Institut für Physik, D-85748 Garching, Germany — [2]Universität Innsbruck, Institut für Astro- und Teilchenphysik, Technikerstr. 25/8, 6020 Innsbruck, Austria — [3]Finnish Centre for Astronomy with ESO, 20014 University of 1396 Turku, Finland — [4]NASA Marshall Space Flight Center, Huntsville, AL 35812, USA

Blazars are prime objects to be studied in the current multi-messenger era and even though they have been investigated for decades, the underlying emission mechanisms are far from understood. In 2022, the first detection of X-ray polarization in blazars was obtained by IXPE, which opened a new window for probing blazar acceleration and radiation processes. In this contribution, we investigate the multiwavelength picture during the first IXPE observations of the two blazars Mrk 501 and Mrk 421, including data from the radio regime up to the very-high-energy (>0.1 TeV, VHE) γ-rays. We examine the X-ray polarization evolution, and compare it to various features in other wavebands including also, for the first time, the VHE band.

T 60.6 Wed 17:15 Geb. 30.22: kl. HS A

FACT - A Decade of TeV Observations — •Daniela Dorner[1] and Bernd Schleicher[2] for the FACT-Collaboration — [1]Universität Würzburg, Deutschland — [2]ETH Zürich, Schweiz

Operational since October 2011, the First G-APD Cherenkov Telescope (FACT) has been monitoring bright TeV blazars. A design for remote and automatic operation and the usage of semiconductor photosensors maximize its duty cycle and minimize the gaps in the light curves. An unbiased observing strategy results in unique and unprecedented long-term gamma-ray light curves. Among other results, the time-series analysis of the blazar 1ES1959+650 and a long-term study of the index-vs-flux correlation of blazars will be showcased. The presentation summarizes the lessons learned from ten years of operation and the results of FACT's legacy data sample.

T 60.7 Wed 17:30 Geb. 30.22: kl. HS A

FACT - Follow-up of Multi-Wavelength and Multi-Messenger Alerts — •Marcel Vorbrugg and Felix Pfeifle for the FACT-Collaboration — Julius-Maximilians-Universität Würzburg, Fakultät für Physik und Astronomie, Institut für Theoretische Physik und Astrophysik, Lehrstuhl für Astronomie, Emil-Fischer-Str. 31, D-97074 Würzburg, Germany

The First G-APD Cherenkov Telescope (FACT) is a gamma-ray observatory located on the Canary Island of La Palma. Employing Geiger-mode avalanche photodiodes (G-APDs), also known as SiPM, FACT monitors bright gamma-ray sources at TeV energies. The distinguishing aspect of its follow-up program lies in the pursuit of emission from potential gamma-ray candidates, utilizing skymaps for multi-messenger alerts. This program aims to automatically follow up on flare alerts from various channels including different sources types. Among others, FACT conducts target-of-opportunity observations of gamma-ray bursts and public neutrino alerts by IceCube. As the position uncertainty for these alerts tends to be large, a skymap analysis is crucial to the broader understanding of these high-energy phenomena. In this work, the outcomes and automatic observations of FACT's follow-up program will be analyzed. These alerts are essential for exploring possible emissions from unknown sources. The final goal is to search the aforementioned skymaps to potentially detect TeV emission from gamma-ray bursts or neutrino source candidates or set upper limits on their very-high-energy emission. An overview of results from 10 years of follow-ups will be given.

T 60.8 Wed 17:45 Geb. 30.22: kl. HS A

FACT - Two-Dimensional Analysis of Unidentified Gamma-Ray Sources — •Katharina Brand[1] and Daniela Dorner[1,2] for the FACT-Collaboration — [1]Julius-Maximilians-Universität Würzburg, Fakultät für Physik und Astronomie, Institut für Theoretische Physik und Astrophysik, Lehrstuhl für Astronomie, Emil-Fischer-Str. 31, D-97074 Würzburg, Germany — [2]ETH Zurich, Institute for Particle Physics and Astrophysics, Otto-Stern-Weg 5, 8093 Zürich, Switzerland

The First G-APD Cherenkov Telescope (FACT) focuses on monitoring a small sample of bright high-energy gamma-ray sources. Additionally, it also responds regularly to alerts from other experiments like IceCube. However the specified position often has a large uncertainty. Therefore a simple analysis on a given source position is not sufficient, but the whole field-of-view needs to be searched for an excess of gamma rays. Furthermore, not all sources are point like. If we want to see the extension of such objects, we need to analyse a larger sky region. To this end, we implemented a database-based skymap analysis technique using FACT data to search for gamma-ray sources at unknown positions. While the method is also used for other source candidates in the multi-wavelength and multi-messenger follow-up program of FACT, this work focuses on a follow-up analysis of LHAASO detected gamma-ray source J2108+5157.