T 58: Gamma astronomy I

Time: Wednesday 16:00–18:25 Location: Th

Group Report T 58.1 Wed 16:00 Th

The MAGIC gamma-ray telescopes: Highlights and recent developments — •Moritz Hütten for the MAGIC-Collaboration — Max-Planck-Institut für Physik, München, Germany

MAGIC is a stereoscopic system of two imaging-atmospheric Cherenkov telescopes located on the Canary island of La Palma. MAGIC is measuring very-high-energy (VHE) gamma rays in the range from $\sim$ 20 GeV to 100 TeV from to date more than 70 astrophysical sources of Galactic and extragalactic origin, up to distances of redshift $\sim$ 1. During the last years, the instrumental performance was enhanced by several upgrades. In this report, we present recent highlights of the diverse science programme: Galactic observations of the Geminga and Crab pulsars above 20 GeV and of the Crab Nebula up to 100 TeV; the measurement of the extragalactic background light and multi-wavelength observations of AGN flares; and fundamental physics searches for Lorentz Invariance Violation and combined searches for Dark Matter. A special focus will be drawn on MAGIC's transient programme with multiple recent results, including the discussion of GRB190114C, the first gamma-ray burst found to emit photons at TeV energies.

T 58.2 Wed 16:20 Th

The Intermittently Extreme Behaviour of the High-peaked BL Lac Type Blazar 1ES 2344+514 — •Axel Arbet-Engels[1], Daniela Dorner[2], and Marina Manganaro for the FACT and MAGIC Collaborations[3] — [1]ETH Zürich, Switzerland — [2]Universität Würzburg, Würzburg, Germany — [3]University of Rijeka, Rijeka, Croatia

MAGIC and FACT investigate the very-high-energy (E>100GeV) gamma rays emitted by BL Lac type objects, which are active galactic nuclei with a relativistic jet pointing towards the observer. Past observations have revealed that the VHE emitting BL Lac type object 1ES2344+514 shows strong flux variability and the spectral energy distribution shifts towards unusually high energies during active states. Previous studies show that the synchrotron component could reach a peak frequency above 1 keV during some past flares, making it a member of the extreme high-peaked BL Lac family. We present results of a dense multi-wavelength observing campaign during a flaring event of 1ES2344+514 in August 2016. The VHE flux measured by MAGIC and FACT is comparable to the historical maximum observed in 1995 by Whipple. The X-ray spectrum is hard with a shift of the synchrotron peak frequency by more than an order of magnitude with respect to low activity states, implying an intermittent extreme high-peaked BL Lac behaviour. Combining multi-wavelength observations, we obtain an unprecedented characterisation of the inverse Compton component during a flare. We interpret the emission within a leptonic and hadronic scenario.

T 58.3 Wed 16:35 Th

Analyses of Neutrino Follow-Up Observations of IC171106 and IC190922 with MAGIC — •Hendrik Bökenkamp for the MAGIC-Collaboration — TU Dortmund, Experimentelle Physik Vb, Deutschland

One of the long-standing questions in astroparticle physics is the origin of the measured cosmic neutrino flux. In order to understand physical processes of neutrino sources, it is crucial to find correlations to other cosmic messengers like gamma-rays. In the framework of multi-messenger programs, the MAGIC telescopes are doing the follow-up of neutrino alerts by IceCube. The two Cherenkov telescopes are measuring very high energy (VHE) gamma-rays in the range between 20 GeV and 100 TeV and are located in the Canary Island of La Palma.

In 2017 it was the very first time that VHE gamma-rays were observed by MAGIC coincidently with a neutrino from IceCube. Both, the gamma-rays and the neutrino could be assigned to the the blazar TXS 0506+056.

Two of the follow-up observations with MAGIC in recent years are presented here. MAGIC data from the neutrino alerts IC190922 and IC171106A are analyzed to extract source information by using the MAGIC analysis software `MARS`. With this procedure the significance of these sources is presented.

T 58.4 Wed 16:50 Th

The MAM telescope subsystem of MAGIC as a monitor for atmospheric transmission — •Marine Pihet, Jürgen Besenrieder, and Razmik Mirzoyan for the MAGIC-Collaboration — Max Planck Institute for Physics, Munich

Monitoring of atmospheric transmission is a crucial part for the measurement and analysis of data from Imaging Atmospheric Cherenkov Telescopes like the MAGIC telescopes, located at the Roque de los Muchachos European Northern Observatory on the Canary Island of La Palma. It is especially important when searching for PeVatron candidate sources emitting gamma rays above 10TeV by using the very large zenith angle (VLZA) observation technique. The latter significantly increases the collection area and as a result increases the detection rate of gamma rays by the MAGIC telescopes at the highest energies. In this report, we present the current work on the MAGIC Atmosphere Minion (MAM) telescope as an optical subsystem of MAGIC for atmospheric monitoring. It includes a 5-inch and an 11-inch optical telescope with a CMOS and a CCD camera respectively, a filter wheel, and a spectrograph, attached to the 11-inch. All these are mounted on a precision drive system and enclosed in the 2.5 m size high-quality dome from Baader, located just next to the MAGIC-I telescope. We developed a concept for photometric measurements of transmission with MAM at VLZA using aperture photometry and tested it in November 2020. Results from the photometric calibration of the subsystem and recent progress are presented, along with the planned work on improvements and anticipated long term goals.

T 58.5 Wed 17:05 Th

Automated analysis of MAGIC Sum-Trigger-II data — •Jan Lukas Schubert, Simone Mender, and Lena Linhoff for the MAGIC-Collaboration — Technische Universität Dortmund

The MAGIC telescopes are a stereoscopic system of Imaging Air Cherenkov Telescopes. They are used for the detection of gamma-ray sources at energies between tens of GeV and tens of TeV. With Sum-Trigger-II, data with a threshold as low as ~25 GeV can be taken. This data requires a special analysis adapted to the low energies. The aim of this work is to integrate the automated analysis of Sum-Trigger-II data in the automated analysis AutoMAGIC. This will reduce the human interaction needed and enable completely reproducible results.

Later, the automatization of the analysis of Sum-Trigger-II data could be used to compute some standard cleaning thresholds for different conditions for a special cleaning algorithm used in the analysis of Sum-Trigger-II data.

T 58.6 Wed 17:20 Th

Multiwavelength Analysis of NGC1275/3C84 — •Lena Linhoff — TU Dortmund, Dortmund, Germany

The radio galaxy 3C 84 is a well studied source of radio emission and was detected as misaligned blazar NGC 1275 also in the very high-energy regime by gamma-ray detectors like MAGIC and FermiLAT. Unless the innermost structure of 3C 84 can be resolved with radio observations at 43 GHz, the mechanisms producing gamma-ray emission are still not fully understood. A necessary step to understand the production of high-energy photons, is to localize the emission region of gamma-rays in the central region of the source. For this aim, we use calculations of the optical depth within the broad line region to constrain the origin of the gamma-ray emission. In this talk we place our results in the context of theoretical models and other multi-wavelength analysis results.

Group Report T 58.7 Wed 17:35 Th

Performance of the CTA Large Size Telescope — •Martin Will for the CTA-Collaboration — Max-Planck-Institut für Physik, München

The Large Size Telescope (LST) is the largest of the several sizes of telescopes that will comprise the Cherenkov Telescope Array (CTA). With its reflective surface of 23 meters in diameter, the LST is optimized to detect gamma rays in the energy range between 20 and 200 GeV. The use of lightweight materials to construct the telescope is crucial for fast repositioning and follow-up of transients. In 2019, operations of the LST prototype on the Canary island of La Palma started as part of the telescope commissioning. In this presentation, some results on the performance evaluation as well as some prelimi-

nary data on the Crab Nebula and pulsar gamma-ray sources will be presented.

T 58.8 Wed 17:55 Th

Data Volume Reduction for the LST Prototype — •Jonas Hackfeld for the CTA-Collaboration — Institute for theoretical physics IV, Ruhr-University Bochum, Germany

The prototype of the Large Size Telescope (LST) of the Cherenkov Telescope Array (CTA), which is going to be the next-generation gamma-ray observatory, was inaugurated in October 2018 and has already observed several bright gamma-ray sources during its commissioning phase. For the next years, in addition to 3 more LSTs, several Medium Size Telescopes (MST) are planned, which together will form the northern array CTA-N. Due to the locally limited data transfer rates and the technical and economic effort to store data quantities of 100 PByte/year permanently over a planned duration of 30 years, a low level data volume reduction is inevitable. In addition to lossless compression methods for volume reduction, there are lossy methods such as pixel selection. In this process, the pixels with signal are isolated from the background, so that the physics are impacted as minimally as possible during subsequent reconstruction. In this talk, pixel selection algorithms and their impact on higher data level analysis will be presented.

T 58.9 Wed 18:10 Th

Crab Nebula Observations with the LST prototype — •Lukas Nickel für die CTA-Kollaboration — TU Dortmund

The lowest energy range of the Cherenkov Telescope Array, which is going to be the next-generation gamma-ray observatory, will be covered by the Large-Sized Telescope (LST). The prototype of the LST was inaugurated in October 2018 on the Canary Islands of La Palma and has since performed observations of bright gamma-ray sources as part of the commissioning process. In this talk, high-level results of Crab Nebula observations will be presented using the package for gamma-ray astronomy gammapy and the recently reworked code for the generation of the instrument response function pyirf.