T 14: Gammaastronomie 1

Zeit: Montag 16:45–19:05 Raum: H 2

Gruppenbericht T 14.1 Mo 16:45 H 2

Highlights from MAGIC in 2016 — •Karl Mannheim for the MAGIC-Collaboration — Institut für Theoretische Physik und Astrophysik, Universität Würzburg

The MAGIC Collaboration has carried out observations of cosmic gamma ray sources with the full efficiency and nominal sensitivity of its stereoscopic 17m telescope system throughout the year of 2016. Here, we report some outstanding results such as the detection of the gravitationally lensed blazar QSO B0218+357 at a cosmological redshift of 0.96, multiple emission components in blazars, gamma ray pulses from the Crab pulsar at TeV energies, and improved dark matter limits from the Perseus cluster and from dwarf galaxies. We also give a perspective on recent developments regarding follow-up observations of transients in the multi-messenger era of astroparticle physics.

T 14.2 Mo 17:05 H 2

Towards an automated data analysis for MAGIC — •Robert Berse for the MAGIC-Collaboration — TU Dortmund University, Germany

MAGIC consists of two Imaging Atmospheric Cherenkov Telescopes with a diameter of 17 m each. The system is dedicated to the observation of very-high-energy (VHE) gamma-rays from Galactic and extragalactic sources. The MAGIC analysis software is designed as a collection of executables for different analysis tasks. Performing an analysis of a specific source, several user interactions are required, such as the data selection and the adjustment of executable settings according to the data. The data selection and analysis are dependent on observation conditions, including e.g. the atmospheric transmission, sky brightness, zenith angle of the telescope and many more.

An automation will not only simplify this analysis procedure, it will also allow for consistent analyses of long-term observations or systematic analyses of weak sources. The first step for this automation is to improve the data selection procedure. For this purpose, a database is developed, providing access to all required parameters.

In this talk, the concept of an automated analysis and the development of a database are presented.

T 14.3 Mo 17:20 H 2

Observation tailored instrument response functions for the MAGIC telescopes — Christian Fruck, •Marcel C. Strzys, and Ievgen Vovk — Max-Planck-Institut für Physik, München

Over the recent years the sensitivity of Imaging Air Cherenkov Telescopes (IACTs) has greatly improved, enabling the observations of weaker sources, often having complex morphology. This creates a challenge to the traditional analysis techniques based on “aperture photometry” like approaches. Due to this, we develop more advanced likelihood analysis methods, which are common practice in space high-energy observatories, but rely on an accurate knowledge of the detector response. Here, we will report on the next step towards this goal - the software package describing the MAGIC off-axis performance for different energies. This package relies on Monte-Carlo simulations and provides the accurate description of the instrument. This allows to easily adapt the data analysis to any source shape or observational conditions. Though right now this method is developed for MAGIC, in the future it can be transferred also to other IACTs - such as the up-coming Cherenkov Telescope Array (CTA).

T 14.4 Mo 17:35 H 2

Deep learning algorithms applied to camera images of the MAGIC telescopes — •Konrad Mielke for the MAGIC-Collaboration — TU Dortmund University, Germany

MAGIC is a system of two ground-based Imaging Air Cherenkov Telescopes with a diameter of 17 meters, designed for the detection of very-high-energy gamma-rays. Its cameras are equipped with 1039 photomultiplier tubes each, providing a charge curve for every camera pixel. Integrated pixel charges and arrival times are extracted from these curves and combined to one camera image per event. Subsequent to the image cleaning, the image parameters are calculated to estimate the type of the incident particle as well as its direction and energy. Currently, this is achieved by individual methods. As an alternative, these tasks could be accomplished all at once, using machine learning algorithms on the uncleaned camera images which would render the image cleaning and the image parameter calculation redundant.

A promising and novel approach in the field of astroparticle physics - especially suited for the task of image classification - is the application of deep learning algorithms (DLAs). They consist of multiple layers of neurons addressing different levels of data abstraction. The aim of this work is to obtain a DLA and compare its performance to that of the currently used methods.

In this talk, the project of applying DLAs to camera images of MAGIC is introduced and the current status is presented.

T 14.5 Mo 17:50 H 2

Perspektiven für Multiwellenlängenanalysen von aktiven galaktischen Kernen durch das Radioteleskop Astropeiler — •Kevin Schmidt[1], Wolfgang Herrmann[2], Elke Fischer[2] und Thomas Buchsteiner[2] — [1]Technische Universität Dortmund, Deutschland — [2]Astropeiler Stockert e.V., Bad Münstereifel, Deutschland

Multiwellenlängenanalysen sind ein wichtiger Bestandteil in der Astroteilchenphysik, um Aufschluss über die Emissionsmechanismen und die Variabilität kosmischer Quellen zu geben. Da viele Teleskope keinen großen Himmelsbereich messen können, sondern interessierende Quellen einzeln observieren, ist ihre Messzeit für Multiwellenlängen-Kampagnen stark begrenzt. Dies kann dazu führen, dass nicht alle Wellenlängenbereiche in einer simultanen Multiwellenlängenanalyse abgedeckt werden. Das Radioteleskop Astropeiler besitzt viel freie Messzeit, die zur Beobachtung ausgewählter Quellen verwendet werden kann, da der regelmäßige wissenschaftliche Betrieb eingestellt wurde. Somit bietet der Astropeiler die Möglichkeit, gezielt Daten von aktiven galaktischen Kernen im Radiobereich zu sammeln, damit diese für Multiwellenlängenanalysen verwendet werden können. Die Flexibilität des Astropeilers ist insbesondere für bildgebende Cherenkov-Teleskope von Interesse, da diese in ihrer Messzeit sehr eingeschränkt sind und eine simultane Messung in anderen Wellenlängenbereichen oft nicht realisierbar ist. In diesem Vortrag wird anhand exemplarischer Messungen von Flachspektrum-Radioquasaren gezeigt, dass der Astropeiler für Messungen von aktiven galaktischen Kernen geeignet ist.

T 14.6 Mo 18:05 H 2

FACT - Monte Carlo Noise Generation — •Michael Bulinski for the FACT-Collaboration — TU-Dortmund, Germany

The generation of the Monte Carlo data for the First G-APD Cherenkov Telescope (FACT) consists of several steps, one of them being the creation of noise. This includes varying night sky background light and contributions from the electronics. The current approach is simulating each contribution individually and adding them up. This has several shortcomings, as it needs full knowledge about all the different noise sources and their structure.

In this contribution, instead of trying to simulate the static noise sources, we evaluate the option of extracting the necessary noise information from real data, taken directly with the detector. This is done by using dedicated measurements with a random trigger as background which is then superimposed with simulations of Cherenkov showers. We will present the method used and compare it to the current approach.

T 14.7 Mo 18:20 H 2

FACT - Towards 100% Observation Efficiency — •Dominik Neise and Thomas Bretz — ETH Zürich, Schweiz

The First G-APD Cherenkov Telescope (FACT) is monitoring the brightest gamma-ray sources since 2012. Due to automatic operation and if weather permits FACT's observation efficiency reaches 93%.

Imaging Atmospheric Cherenkov Telescopes (IACT) typically observe a source displaced from camera center to estimate the hadronic background from locations away from the source position. In order to mitigate effects of camera inhomogeneities, the telescope is periodically repositioned and the trigger thresholds are adjusted to the modified star field. This is called wobble mode.

FACT's camera trigger is devided into patches, whose threshold is regulated to keep the rate per patch at about 0.1Hz. Measuring such low rates with high enough precision needs some time before optimal observation conditions are reached, and can hardly deal with stars moving fast through the field-of-view.

We investigate methods to further increase an IACT's ontime. The orbit observation mode allows to let the source position continuously revolve around the camera center and thus avoids repositioning time. But this causes stars to move faster through the field-of-view than with the wobble mode. A novel threshold regulation entirely based on the supply current of each photon detector can react faster on varying ambient light conditions and allows to omit dedicated threshold adjustments. In this talk, the concept and first tests will be presented.

T 14.8 Mo 18:35 H 2

FACT - Time-Resolved Spectral Energy Distributions from Blazar Flares — •Daniela Dorner[1] and Thomas Bretz[2] for the FACT-Collaboration — [1]Universität Würzburg, Germany — [2]RWTH Aachen, Germany

The First G-APD Cherenkov Telescope (FACT) is monitoring blazars at TeV energies. Based on the results of a fast quick look analysis, alerts are sent to the astronomy community with low latency. This allows to set up target-of-opportunity programs, as it has been done with the X-ray satellites Swift, INTEGRAL and XMM-Newton.

While FACT provides the monitoring at TeV energies on a nightly basis, Swift monitors weekly at X-rays to check for time-lags or correlations. In case FACT measures a flux above 70 events/hour, more sensitive observations with INTEGRAL or XMM-Newton are triggered to study the evolution of the spectrum during and after the flare.

Based on this program, time-resolved spectral energy distributions are compiled and used to discern radiation mechanisms such as synchrotron-self-Compton emission (X-ray flux and gamma-ray flux strictly correlated) from photo-hadronic cascade emission, allowing more complex variability patterns.

Here, we present preliminary results of simultaneous and time-resolved broadband observations of Mrk 421 during a moderate-high flux state in December 2015, which were triggered by FACT and include simultaneous observations with the X-ray telescopes Swift and INTEGRAL.

T 14.9 Mo 18:50 H 2

Gravitational microlensing and gamma-ray emission of Active Galactic Nuclei — •Ievgen Vovk for the MAGIC-Collaboration — Max Planck Institute for Physics, Munich, Germany

The Active Galactic Nuclei (AGNs) constitute half of all known gamma-ray sources. Their high-energy emission is believed to be produced in the jets, powered by the central supermassive black holes. At the same time the location of the emission region within the jet is presently uncertain – mainly due to its extremely small angular size, far beyond the capabilities of the existing gamma-ray instruments. However, in the rare case of the gravitationally lensed AGNs, it is possible to use the natural “magnifying lens” to assist the situation. I will review the recent observation Fermi/LAT and MAGIC observations of such lensed sources, which have led to the first detection of the gravitational microlensing effect for two gamma-ray loud AGNs – PKS 1830-211 and B0218+357. This allowed for the first time to resolve their emission regions, providing strong arguments for their connection with the direct vicinities of the corresponding central black holes. I will further describe the potential of the microlensing observations for the studies of the AGN physics and give the prospects for the upcoming CTA observatory.