T 87: Gamma-Astronomie II

Zeit: Donnerstag 16:00–18:35 Raum: S14

Gruppenbericht T 87.1 Do 16:00 S14

The CTA Large Scale Telescope Prototype in La Palma — •Martin Will for the CTA-Collaboration — Max-Planck-Institut für Physik, München

The Large Scale Telescope (LST), an Imaging Atmospheric Cherenkov Telescope with a reflective surface of 23 meter diameter and a focal length of 28 meters, is the largest of the several sizes of telescopes that will comprise the Cherenkov Telescope Array (CTA). The large reflective surface allows the LST to extend the energy range set by current IACTs below 30 GeV. It is built mainly of carbon fiber and aluminum, the use of such light weight materials is crucial for very fast repositioning and follow-up of transients.

Currently, the LST prototype is being commissioned on the Canary island of La Palma and about to start its first science run. In this report the first data taken with the LST prototype is presented and the future operation and science goals during commissioning and withing the CTA Observatory are presented.

T 87.2 Do 16:20 S14

A Novel Glass Mirror Design for Imaging Atmospheric Cherenkov Telescopes — •Juliane van Scherpenberg[1], Razmik Mirzoyan[1], Martin Will[1], Markus Garczarczyk[2], and Masahiro Teshima[1] — [1]Max-Planck Institut für Physik, München, Deutschland — [2]DESY Zeuthen, Deutschland

The large dimensions of Imaging Atmospheric Cherenkov Telescopes (IACTs) make it practically unfeasible to protect them from environmental influences. Due to this, the mirrors which are installed on the telescopes are affected by corrosion from wind, dust, and rain. In current mirror technologies the reflective material is covered by a thin quartz layer for protection. However, still a significant decrease in reflectivity can be observed over the timescale of a few years. Additionally, current mirrors are impossible to clean from deposited dust and dirt without damaging their delicate surface, leading to an unstable reflectivity over short timescales. I present a novel glass mirror design which is easily cleaned and very resistant to degradation due to environmental influences. This new technology could provide a stable performance over a period comparable to the lifetime of an IACT. Results of tests which were performed on first prototypes in terms of reflectivity, focusing and stability under exposure to the environment will be presented.

T 87.3 Do 16:35 S14

Developing stacked-analysis methods for γ-ray search in air shower arrays — •Victoria Tokareva[1], Andreas Haungs[1], and Dmitriy Kostunin[2] — [1]Institut für Kernphysik, Karlsruher Institut für Technologie, DE-76021 Karlsruhe, Germany — [2]Deutsches Elektronensynchrotron, D-15738 Zeuthen, Germany

In cosmic ray studies, detection of neutral particles like gammas and neutrinos is especially important since they are not deflected by galactic magnetic fields and thus allow to identify the direction to their sources. At the moment, the search for gamma rays at ultra-high energy (10^{14}–10^{18} eV) is of high interest to identify the PeVatrons.

Satellite experiments allow observation of gamma-rays with energies up to hundreds GeV, while higher energies can only be accessed with ground-based setups. Recently, HAWC announced the registration of several sources with an energy of more than 56 TeV. The Carpet-2 experiment performed a stacked analysis of IceCube neutrino events.

One of the recent KASCADE results in gamma-ray studies is putting a limit on the flow of diffuse gammas which is currently the best limit in its energy range. The programme of gamma-ray investigations is continued where we are developing methods for stacked-analysis using the KASCADE-Grande archival data as well as data from other experiments like Tunka-133. The talk presents the current status of this work.

T 87.4 Do 16:50 S14

Extending ctapipe image reconstruction using FACT methods — •Lukas Nickel and Maximilian Nöthe — TU Dortmund

The Cherenkov Telescope Array aims to increase sensitivity for gamma ray astronomy compared to the currently operating experiments H.E.S.S, MAGIC and VERITAS while operating as an open observatory. The first CTA telescope, the 23m diameter LST-1, was inaugurated in October 2018 on the northern site in La Palma, Spain.

CTA analyses will be performed using the low-level framework ctapipe which is based on the scientific python stack. The framework is still under active development.

In this contribution, the ongoing work of extending ctapipe with image reconstruction techniques that have been developed for the First G-APD Cherenkov Telescope will be presented.

With this we hope to improve future CTA analyses using the experience in monoscopic reconstrucion gained during the seven years of FACT operation, which will be especially important for the first CTA telescopes.

T 87.5 Do 17:05 S14

FACT - Measuring the Evolution of the Optical Point Spread Function using Muon-Rings — •Laurits Tani — ETH Zürich, Switzerland

In ground-based gamma-ray astronomy, muon events have a distinct feature of casting ring-like images on the sensor plane, thus forming a well known signal class for Cherenkov telescopes. These ring-like images can then be used to deduce the optical point spread function (PSF) which is a highly important measure of the optical quality of the system. In this talk the observed width of a muon ring is used as a measure to infer the PSF. However to have a good estimate for this width, the reconstruction of the ring center and ring radius itself needs to be accurate, so different methods of ring feature extraction were studied. To check the accuracy of the ring reconstruction and correlation between the width of the ring and PSF, a simulation is done. Measuring the evolution of the PSF over time allows to adjust the instrument response function postliminary. Furthermore, no dedicated observations are needed and no human activity is required on site. The best found reconstruction method is applied on FACT data and the plots for accuracy of the ring feature extraction and for PSF vs. time will be presented.

T 87.6 Do 17:20 S14

Photon bunching in starlight with optical telescopes — •Peter Deiml[1], Stefan Funk[1], Gisela Anton[1], Adrian Zink[1], Dmitry Mayshev[1], Thilo Michel[1], Andreas Zmija[1], Katja Gumbert[1], Manami Sasaki[2], Uli Heber[2], Jörn Wilms[2], Simon Kreuzer[2], Joachim von Zanthier[3], Stefan Richter[3], and Sebastian Karl[3] — [1]Erlangen Centre for Astroparticle Physics, Universität Erlangen-Nürnberg, 91058 Erlangen — [2]Dr. Karl Remeis Observatory, Universität Erlangen-Nürnberg, Sternwartstraße 7, 96049 Bamberg — [3]Institut für Optik, Information und Photonik, Universität Erlangen-Nürnberg, 91058 Erlangen

Imaging air Cherenkov telescopes provide excellent opportunities for Hanbury Brown-Twiss intensity interferometry with unprecedented angular resolution. For this purpose, new detector electronics were tested and measurements of temporal photon correlations were carried out in the laboratory and using an optical telescope in the observatory of Bamberg. We will present the experimental setup and will discuss the obtained results regarding sensitivity and backgrounds. Finally, observations of Sirius, Arcturus and Vega are discussed and the temporal intensity correlations are highlighted.

T 87.7 Do 17:35 S14

FACT - Improvement of Background Suppression — •Marvin Beck, Marc Klinger, Fabian Theissen, and Thomas Bretz for the FACT Collaboration-Collaboration — RWTH Aachen, Germany

Imaging Air Cherenkov Telescopes (IACTs) observe extended air showers developing in the atmosphere. The First G-APD Cherenkov Telescope (FACT), located on the Canary Island of La Palma, is dedicated to the long-term monitoring of the brightest TeV blazars and has been operational for over seven years.

The measured events are highly dominated by charged particles (protons and other atomic nuclei), leading to the need to discriminate air showers by their incident particle. The large amount of available data taken from the Crab Nebula under many different conditions, e.g. various zenith angles and ambient light levels, allows to study the performance of classical background suppression methods in depth. This study focuses on the optimization of the currently applied background suppression algorithms and the understanding of their evolution as

function of observation conditions.

T 87.8 Do 17:50 S14

FACT - Investigations of Long Term Performance — •Fabian Theissen, Marvin Beck, Marc Klinger, and Thomas Bretz for the FACT Collaboration-Collaboration — RWTH Aachen, Germany

The First G-APD Cherenkov Telescope (FACT) has continuously been monitoring a small sample of known TeV gamma-ray sources over the last seven years reaching up to 93% data taking efficiency.

Measurements of imaging air Cherenkov telescopes are dominated by charged cosmic rays. They hit the Earth with a remarkably stable rate. Therefore, they are a precise measurement of performance variations and changes of the atmosphere and can be used to quantify these variations.

The telescope has observed the Crab Nebula for more than 2000 hours. As the Crab Nebula is known as a standard candle in TeV astronomy, correlation studies of the cosmic ray rate with the photon flux of Crab allow for an efficiency correction. A long term understanding of the changes in the performance of the telescope is required for further analyses like periodicity studies. It also allows for a phenomenological correction of data taken under bad weather conditions.

T 87.9 Do 18:05 S14

Modelling of gamma-ray emission from galactic colliding wind binaries — •Ruslan Konno[1], Stefan Ohm[1], and Jim Hinton[2] — [1]DESY, D-15738 Zeuthen, Germany — [2]Max Planck Institut für Kernphysik, Heidelberg D-69029, Germany

Colliding wind binaries (CWBs) are binary stars with strong stellar winds that form shock regions and as it is known from the CWB Eta Carinae, these shocks can accelerate particles up to gamma-ray energies. This work aims to model CWBs as a gamma-ray source class with a radiative dynamical 3D code. Assuming two shocks and a hadronic interaction picture and by balancing acceleration and energy losses of particles, the model delivers flux predictions. Comparing predicted emission with the measurements made with the Large Area Telescope, the primary instrument on the Fermi Gamma-ray Space Telescope, likeliness of source detection will be tested and upper limits in case of non-detection will be placed. In this talk, the results will be presented and discussed.

T 87.10 Do 18:20 S14

Jet Kinematic Analysis of TeV Radio Galaxies using High-Resolution Radio Images — •Kevin Schmidt, Lena Linhoff, and Simone Mender — TU Dortmund, Experimentelle Physik Vb

In the last years, a new class of TeV emitters has been discovered, the so-called TeV radio galaxies. These are observed under larger viewing angles than blazars, which allows a direct view of their jet's morphologies. As they show features of both blazars and radio galaxies, the observed properties provide strong challenges for existing emission models. Expanding the group of TeV radio galaxies is essential to define their characteristics and learn about the acceleration mechanisms of active galactic nuclei (AGN) in general.

A central feature for the classification of AGN is their viewing angle relative to our line of sight. One opportunity to estimate the viewing angle is to study the jet characteristics using high-resolution radio images obtained by VLBI measurements. In this talk, a framework for jet kinematic analysis is presented using the example of 3C 264, the most recently discovered TeV radio galaxy.