T 100: Gamma astronomy II

Time: Friday 11:00–13:05 Location: H-HS XVI

Group Report T 100.1 Fri 11:00 H-HS XVI

Recent Highlights of MAGIC — •Razmik Mirzoyan for the MAGIC-Collaboration — Max-Planck-Institut für Physik (Werner-Heisenberg-Institut) — Föhringer Ring 6, 80805 München

MAGIC, consisting of two 17m diameter imaging atmospheric Cherenkov telescopes, is a pioneering instrument for doing astrophysics by means of very high energy gamma-rays in the energy range 30 GeV - 100 TeV. The telescopes are located at 2200m a.s.l. in the "Roque de los Muchachos" European Northern Observatory on the Canary island of La Palma. Since 2004 the MAGIC-I stand-alone telescope is taking scientific data. The sensitivity of the detector has been significantly improved by adding the MAGIC-II telescope and operating them in a coincidence (stereo) mode. For boosting the system sensitivity, we upgraded them in 2012. In recent 3-4 years we further boosted the sensitivity of MAGICs at the lowest energies, down to 20-30 GeV, by using the novel SUM-Trigger-2 system and at the very high energies of ~100 TeV, by using the very large zenith angle observation technique. In this report we are going to present the recent highlights of MAGIC, as for example, the gamma-ray observations of Geminga and Crab pulsars at energies above 20 GeV, of Crab Nebula in the range 30 GeV to 100 TeV, measurements of selected AGN, as well as observation of the recent gigantic signal from GRB 190114C, which made a major impact on understanding of the GRB physics.

T 100.2 Fri 11:20 H-HS XVI

FACT - Highlights from an Unbiased Monitoring Program — •Thomas Bretz[1] and Daniela Dorner[2] for the FACT-Collaboration — [1]RWTH Aachen, III. Physikalisches Institut A — [2]Universität Würzburg, Lehrstuhl für Astronomie

The First G-APD Cherenkov Telescope (FACT) has been monitoring bright sources at TeV energies for over eight years, collecting a total of more than 14000 hours of physics data. Using semi conductor photosensors, the duty cycle is maximized and gaps in the light curves minimized. Unbiased monitoring yields an unprecedented data sample and allows for systematic studies of source variability. In addition, a lot of multi-wavelength observations are triggered. One on Mrk 501 in 2014 allowed for a variability studies in gamma rays. In 2016, an unprecedented study of the intermittent extreme blazar 1ES 2344+51.4 was triggered. The long-term sample is studied for multi-wavelength correlations, e.g. a 5.5 year sample of Mrk 421, and periodic oscillations. Recent results from these studies will be presented.

T 100.3 Fri 11:35 H-HS XVI

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 meter diameter, the LST is optimized to detect gamma rays in the energy range between 20 and 200 GeV. The use of light weight materials to construct the telescope is crucial for very fast repositioning and follow-up of transients. In 2019, operations of the LST prototype in the Canary island of La Palma have started as part of the telescope commissioning. In this presentation, some results on the performance evaluation as well as some preliminary data on the Crab Nebula gamma-ray source will be presented.

T 100.4 Fri 11:50 H-HS XVI

First results from IceAct - SiPM based Imaging Air Cherenkov Telescopes for IceCube — •Merlin Schaufel[1], Jan Audehm[2], Thomas Bretz[2], Johannes Buscher[1], Giang Do[2], Adrianna García[2], Erik Ganster[1], Maurice Günder[1], Yuriy Popovych[1], Florian Rehbein[2], Martin Rongen[1], and Christopher Wiebusch[1] for the IceCube-Collaboration — [1]III. Physikalisches Institut 3B, RWTH Aachen, Deutschland — [2]III. Physikalisches Institut 3A, RWTH Aachen, Deutschland

The development of cost effective and compact Silicon Photomultipliers (SiPM) based Imaging Air Cherenkov Telescopes enables new measurements using a hybrid configuration with ground based detectors. IceAct is a proposed surface array of such telescopes above IceCube. During January 2019, two new versions of IceAct telescope demonstrators featuring 61 SiPM pixels and improved optics were installed in the center of the IceTop surface detector at the geographic South Pole. Combining information from these telescopes and IceCube, it is possible to test the performance in primary particle discrimination, energy calibration, and veto capabilities. We present the status of the project and first results from coincident and stereoscopic data taken during the antarctic winter 2019.

T 100.5 Fri 12:05 H-HS XVI

Performance analysis of the Imaging Air-Cherenkov Telescope HAWC's Eye based on Monte Carlo simulations — •Florian Rehbein[1], Jan Audehm[1], Thomas Bretz[1], Giang Do[1], Adrianna García[1], and Merlin Schaufel[2] — [1]Physics Institute III A, RWTH Aachen, Germany — [2]Physics Institute III B, RWTH Aachen, Germany

The compact imaging air Cherenkov telescope HAWC's Eye was developed to operate with the High-Altitude Water Cherenkov Gamma-Ray Observatory (HAWC), which is an extensive air shower array located in the state of Puebla, Mexico. Hybrid observations allow for improved energy and angular resolution. This approach is very promising not only for the HAWC observatory but also for future experiments such as the Southern Wide-field Gamma-ray Observatory, which will observe the Southern Hemisphere and is foreseen to begin operation by 2026. HAWC's Eye is based on a Fresnel lens focussing the light on a SiPM-based camera. Solid light guides increase the light collection area of the sensors. A full detector simulation has been set up, including the optical components as well as the electronics. Results on energy and angular resolution have been obtained.

T 100.6 Fri 12:20 H-HS XVI

Recent results from the MAGIC astroparticle and fundamental physics programme — •Moritz Hütten for the MAGIC-Collaboration — Max-Planck-Institut für Physik, Föhringer Ring 6, 80805 München

In this report, we present the latest results of searches for signs for new physics in extraterrestrial gamma rays with the MAGIC telescopes. MAGIC is a stereoscopic system of two imaging-atmospheric Cherenkov telescopes located on the Canary island of La Palma. We draw special attention to two recent efforts of the group: Firstly, we present a combined analysis of various dwarf galaxies for indirect gamma-ray signals from WIMP dark matter. Secondly, we show results on probing the Lorentz invariance using the MAGIC data from the first detection of TeV photons from a gamma-ray burst, namely, GRB190114C, and on Mrk421. We will conclude with an outlook on current activities of the group.

T 100.7 Fri 12:35 H-HS XVI

Towards intensity interferometry with Air Cherenkov Telescopes — •Andreas Zmija, Adrian Zink, Dmitry Malyshev, Stefan Funk, Gisela Anton, Naomi Vogel, and Thilo Michel — Friedrich-Alexander-Universität Erlangen-Nürnberg, ECAP

Astronomical intensity interferometry - recording correlated intensity fluctuations of starlight in two or more telescopes - is a promising tool of measuring the star's diameters and geometries, first performed by Hanbury Brown and Twiss in the late 1950s. The insensitivity to atmospheric fluctuations and the fact that the photon streams at the telescopes can be recorded independently of each other allows interferometry baselines of several kilometres even in the optical regime resulting in extremely high angular resolution. Therefore Cherenkov telescopes such as the future Cherenkov Telescope Array (CTA) with large baselines and detection areas provide excellent conditions for these measurements. We recall the physics of thermal light intensity correlations that set the conditions on optics and electronics. In this context we show the development of a setup for intensity interferometry with Cherenkov Telescopes and present results of laboratory tests which demonstrate the possibilities and challenges of the project.

T 100.8 Fri 12:50 H-HS XVI

Intensity interferometry setup characterization for possible measurements at the H.E.S.S. telescopes — •Naomi Vogel, Andreas Zmija, Gisela Anton, Stefan Funk, Dmitry Malyshev, Adrian Zink, and Thilo Michel — Friedrich-Alexander-Universität Erlangen-Nürnberg, ECAP

Intensity interferometry is a method which can be used to determine the angular diameter of a star by taking the measurements of at least two telescopes with varying baselines into account. An advantage of this technique is that only the measured intensities of a thermal source which are observed by the detectors each at a different position on Earth are of importance for the correlation. Intensity interferometry measurements can be performed at Cherenkov telescopes with additional detector systems, such as photomultiplier tubes (PMTs), which are able to record photon counts continuously. Provided that the collecting area of the Cherenkov telescopes is very large, the expected photon count rate is on the order of hundreds of MHz. In order to prove that our setup can handle such high photon count rates, we characterized the PMTs behaviour and measured intensity correlations at high photon rates in the laboratory. Furthermore, measurements were also carried out at the medium sized telescope prototype of the Cherenkov Telescope Array (CTA) in Berlin Adlershof. In this contribution we will present our laboratory setup and results as well as the results from the measurements at Adlershof. These tests serve as a preparation for measurements with H.E.S.S. Cherenkov telescopes in Namibia.