T 32: Methods in astroparticle physics 2

Time: Tuesday 16:00–18:00 Location: Geb. 20.30: 2.067

T 32.1 Tue 16:00 Geb. 20.30: 2.067

Preparation for the determination of the absolute X-ray detection efficiency of the TAXO SDD for IAXO — Joanna Bilicki, •Patrick Bongratz, Frank Edzards, Susanne Mertens, Lucinda Schönfeld, Juan Pablo Ulloa Beteta, Christoph Wiesinger, and Michael Willers — Physik-Department, Technische Universität München, Garching, DE

The International Axion Observatory (IAXO) aims to improve the search for solar axions by at least one order of magnitude with respect to previous helioscope experiments. In a helioscope experiment solar axions are back-converted to X-rays in a strong magnet pointed at the sun. Silicon drift detectors (SDDs) are particularly suited to detect this signal. Good noise performance enables sub-keV thresholds while maintaining high detection efficiency. In this talk, I will report on the TAXO SDD project and the preparations for a measurement of the absolute X-ray detection efficiency at the SOLEIL synchrotron facility. This project has received funding from the European Research Council (ERC) under the European Union Horizon 2020 research and innovation programme (grant agreement No. 852845).

T 32.2 Tue 16:15 Geb. 20.30: 2.067

TAXO, Towards a low background SDD for IAXO — Joanna Bilicki, Patrick Bongratz, Frank Edzards, Susanne Mertens, •Lucinda Schönfeld, Juan Pablo Ulloa Beteta, Christoph Wiesinger, and Michael Willers — Physik Department, Technische Universität München, Garching, DE

Axions are a dark matter candidate and could solve the strong CP problem. The International Axion Observatory (IAXO) is a next-generation experiment attempting to find these elusive particles by converting solar axions to X-rays. Silicon Drift Detectors (SDDs) are well suited to detect this rare axion signal. The TAXO project attempts to tackle the challenging IAXO background requirements with an SDD. I will present the current status of the TAXO project, in particular deep-underground and above-ground background measurements as well as simulation studies of cosmic-induced backgrounds. This project has received funding from the European Research Council (ERC) under the European Union Horizon 2020 research and innovation programme (grant agreement No. 852845). It has also been supported by the DFG through the Excellence Cluster ORIGINS.

T 32.3 Tue 16:30 Geb. 20.30: 2.067

Towards the complete calibration of the LNGS mobile neutron spectrometer — Melih Solmaz[1] and •Francesco Pompa[2,3] — [1]Karlsruhe Institute of Technology, Institute of Experimental Particle Physics — [2]University of L'Aquila, Department of Physics and Chemistry — [3]INFN-Laboratori Nazionali del Gran Sasso

Laboratori Nazionali del Gran Sasso (LNGS), located 1400 m below Gran Sasso mountains in Italy, hosts numerous rare event searches (e.g., dark matter direct detection and neutrinoless double beta decay experiments). Ambient neutrons produced at the cavern walls are a source of background for these elusive searches, potentially limiting the experimental sensitivity. Since both the neutron flux and spectrum vary with time and location, a mobile neutron counter would not only provide precise knowledge of this laboratory background for the hosted experiments but also resolve some inconsistencies between the past measurements.

In this talk, we present the design and the construction efforts of the portable neutron spectrometer for the LNGS underground laboratory as well as first test measurements. We also give an outlook towards the incoming detector calibration campaign and its final installation at LNGS.

This project is funded by the German Federal Ministry of Education and Research (BMBF) under the grant number 05A21VK1.

T 32.4 Tue 16:45 Geb. 20.30: 2.067

Development & Commissioning of bHiVE - Bite-sized High Voltage setup for Electrodes — •Simon Gentner — Karlsruhe Institute of Technology, Institute for Astroparticle Physics

Time projection chambers (TPCs) are used in various particle detectors including in dark matter and neutrino searches. To detect signals TPCs rely on a set of high-voltage electrodes to produce uniform electric fields. The high electric fields could lead to electron and photon emission from the electrode surface, and in worse cases may cause electrical breakdown. To study these effects and potential ways for mitigating them, this work aims to develop and commission a test setup for a variety of small electrode samples. In this way, the influence of various cleaning methods, treatments and coatings on the electron emission of electrodes in different gas environments and in vacuum could be examined and analyzed. The small sample size makes it possible to conduct detailed studies of the impact of defects, such as spikes, scratches or cuts on electrode performance and examine techniques for repairing them. These findings will be key for development of electrodes for the next generation of dark matter detectors such as DARWIN. In this talk I will present the recent status and progress of bHiVE.

T 32.5 Tue 17:00 Geb. 20.30: 2.067

Development of a spatial resolving scintillator readout system - "MIP-Cube" — •Philippe Bruder, Ralph Engel, Andreas Haungs, and Thomas Huber — Karlsruhe In- stitute of Technology, Institute for Experimental Physics, Karlsruhe, Germany

High-energy muons from extensive air-showers, originated in the interaction between cosmic rays and the Earth*s atmosphere, can propagate to Earth or even into low-noise facilities, like underground research laboratories and contribute to the noise level of experiments. By measuring the flux and spatial distribution of these muons, systematic background effects can be studied. For this purpose, a monitoring system based on a net of crossed 25 cm long and 5 cm wide plastic-scintillator bars is developed. The scintillator system presented here is readout by Hamamatsu 64-channel Silicon Photomultiplier (SiPM) arrays. The used fermilab scintillator bars and kururay fibers are based on detectors developed for the surface of the IceCube Neutrino Observatory and Auger Prime scintillator-based surface detector (SSD). The baseline design shows a mobile detector system, with an adequate power supply and signal where focus is given on a plug-and-play setup for variable measuring locations. The CAEN Co. Ltd Front-End unit DT5202 as SiPM array readout and trigger electronic is choosen. The DT5202 unit, in conjunction with a specifically crafted Python software, functions as a Data Acquisition System (DAQ). Through this combination, it is possible to reconstruct the direction of an incoming muon, and additionally, a heatmap of individual pixels is generated.

T 32.6 Tue 17:15 Geb. 20.30: 2.067

Drone-Based Calibration of Radio Antennas at the Pierre Auger Observatory. — Martin Erdmann, •Alex Reuzki, and Maximilian Straub — III. Physikalisches Institut A, RWTH Aachen University

Ultra-high-energy cosmic rays induce extensive air showers in the Earth's atmosphere. At the Pierre Auger Observatory, those air showers are measured using various detection techniques including Radio detection with Short Aperiodic Loaded Loop Antennas (SALLA) as part of the AugerPrime upgrade.

The SALLA's antenna pattern has been described using simulations and an absolute calibration has been performed utilizing the galactic radio background. Here we introduce a direction-dependent calibration procedure, which uses a well-defined biconical antenna mounted to a drone with active stabilization and precise position tracking. The drone setup allows us to precisely extract the antenna sensitivity from any direction and distance. With that, we performed calibration measurements on a SALLA. First results are presented.

T 32.7 Tue 17:30 Geb. 20.30: 2.067

Method and first results of the XY-Scanner Calibration of the Fluorescence Detector of the Pierre Auger Observatory — •Paul Filip and Christoph Schäfer for the Pierre-Auger-Collaboration — Hermann-von-Helmholtz-Platz 1 76344 Eggenstein-Leopoldshafen

The Pierre Auger Observatory is a hybrid instrument designed to detect extensive air showers stemming from ultra-high-energy cosmic rays impinging on the upper atmosphere of the earth. It uses two independent methods of detection. The Fluorescence Detector (FD) observes the evolution of the air shower in the atmosphere, and provides a model independent estimation of the energy of a cosmic ray primary particle. Additionally, data gathered from the FD is used to calibrate the energy

scale of the Surface Detector (SD) array, which measures the shower footprint on the ground.

In this talk, we present a novel method of calibration for the FD, which relies on a UV-light source mounted on a motorized XY-stage. The light source exposes the telescope camera sensor to light pulses of known intensity. The presented setup simplifies the calibration procedure drastically and is able to improve the systematic uncertainty of the FD calibration from $\sim 9\%$ to $\sim 4.4\%$. In addition, the short- and long term stability of the procedure is analyzed using data from the seven measurement campaigns.

T 32.8 Tue 17:45 Geb. 20.30: 2.067

Wavelength shifting fibers with high photon capture rate — Bastian Kessler, John Rack-Helleis, and •Sebastian Böser — JGU Mainz - Institut für Physik

Wavelength-shifting optical fibers are commonly used to collect light from large detector volumes and guide towards photosensors, which makes them particularly interesting for water Cherenkov or scintillator based detectors. However, one problem is their low photon capture rate, leading to a reduction in the energy resolution of fiber-based detectors.

Building on previous work, it was shown that the photon capture rate can be increased by appropriate design of the photon absorption zone. In this work, this concept was applied to wavelength shifting fiber, and the capture rate and absorption mechanism were studied in detail. It was found that initially the attenuation is mainly driven by self-absorption on the wavelength-shifting molecules themselves.

Here we present data from several measurement campaigns to quantify the self-absorbance together with an updated attenuation model.