# HK 72: Astroparticle Physics II

Time: Thursday 15:45–17:00 Location: SCH/A252

HK 72.1 Thu 15:45 SCH/A252

**Measurement of Pion-Carbon Interactions with NA61/SHINE** — •Johannes Bennemann for the NA61/SHINE-Collaboration — Karlsruhe Institute of Technology, Institute for Astroparticle Physics, Karlsruhe, Germany

For the measurement of ultrahigh-energy cosmic-rays it is crucial to understand the evolution of air showers in the atmosphere. Air showers initiated by cosmic ray particle consist mostly of pions, thus studying the interaction between pions and air molecules is of utmost importance. Fixed target experiments with pions from accelerators like the SPS at CERN are suitable for pion interaction studies. As a proxy for nitrogen, the dominant component of air, carbon is used as a target material. The produced particles and their spectra are measured by the NA61/SHINE detector at the CERN North Area. The detector consists of multiple time projection chambers which allow momentum measurements and particle classification.

In this talk we will present the analysis of a new pion-carbon dataset, including meson spectra and resonance cross sections. Furthermore predictions of hadron interaction models used for air shower simulations are compared with the new data.

HK 72.2 Thu 16:00 SCH/A252

**krypton level measurement in XENONnT and beyond** — •ying-ting lin, steffen form, matteo guida, robert hammann, hardy simgen, and jonas westermann for the XENON-Collaboration — Max-Planck Institut fur Kernphysik, Heidelberg, Germany

The XENONnT experiment is in search of dark matter and other rare physical phenomena via a ton-scale liquid-xenon detector. To reach its target sensitivity, competing background has to be suppressed to unprecedented level. One main internal background is the pure beta-emitter, $^{85}$Kr. With dedicated purification system in XENONnT, the krypton concentration over xenon can be reduced down to 100 ppq (parts per quadrillion $10^{-15}$). Precisely quantifying the $^{85}$Kr remnant in this ultra pure xenon detector is therefore an important and challenging task. The rare gas mass spectrometer (RGMS) at MPIK Heidelberg is capable of performing such measurement by a two stage process: applying a gas-chromatographic separation of krypton from xenon and tracing the amount of Kr gas using a mass spectrometer. For future low-background liquid-xenon detectors, a fully automatic rare gas mass spectrometer (AutoRGMS) is under development. The AutoRGMS will be a major improvement in reducing the complexity and duration of its operations, and thus allow frequent krypton monitoring. The highlight will cover both the results from RGMS and the progress toward AutoRGMS.

HK 72.3 Thu 16:15 SCH/A252

**Experiments with the MuonPi Cosmic Particle Detector** — Simon Glennemeier-Marke[1], •Kai-Thomas Brinkmann[1], Hans-Georg Zaunick[1], Lara Dippel[1], Marvin Peter[1], Lukas Nies[2], and Katharina Dort[1] — [1]Justus-Liebig-University — [2]EP Department, CERN

The MuonPi project is an open-community research project dedicated to the investigation of cosmic particle showers. Its goal is to establish a wide-spanning network of detector units for measuring muons originating from shower cascades. Nanosecond time synchronization for all stations is achieved using navigation satellites. By aggregating the individual detections and analyzing their timestamps, the shower geometry and energy can be reconstructed. However a single detector unit can already be used for some interesting experiments, enabling students, teachers, makers and otherwise interested individuals to study the field of high energy physics. In this presentation we will showcase some of these experiments as well as the results of a stratospheric balloon launch. *supported by ELJEN Technology

HK 72.4 Thu 16:30 SCH/A252

**Photon identification and their uncertainties for the displaced production vertices in search for ALPs with ATLAS** — Peter Krämer, Kristof Schmieden, Matthias Schott, and •Olivera Vujinović for the ATLAS-Collaboration — Johannes Gutenberg University, Mainz, Germany

Some puzzling questions in particle physics, such as the strong CP problem or the discrepancy of the muon magnetic moment could be solved by introducing light scalar or pseudo-scalar axion-like particles (ALPs). Theoretical models allow a wide range of ALP-masses and couplings to SM particles such as photons and the Higgs boson. Therefore, parts of the ALP parameter space could be investigated with collider experiments like the ATLAS experiment at the LHC.

In this analysis, we search for the SM Higgs boson decaying into a pair of ALPs further decaying into two photons each. Depending on ALP properties such as mass and their coupling to photons, the signal is expected to form different final states, ranging from 2 to 4 photons, with a special focus on the photons originating from displaced vertices. This resulted in developing a dedicated approach in estimating the systematic uncertainties for this case. In this talk, the preliminary analysis results will be presented.

HK 72.5 Thu 16:45 SCH/A252

**Neural network based identification of collimated photon pair signatures in a search for axions in SM Higgs boson decays with the ATLAS detector** — •Peter Krämer, Kristof Schmieden, Matthias Schott, and Olivera Vujinović for the ATLAS-Collaboration — Johannes Gutenberg University, Mainz, Germany

Some puzzling questions in particle physics, such as the strong CP problem or the discrepancy of the muon magnetic moment could be solved by introducing light scalar or pseudo-scalar axion-like particles (ALPs). Theoretical models allow a wide range of ALP-masses and couplings to SM particles such as photons and the Higgs boson. Therefore, parts of the ALP parameter space could be investigated with collider experiments like the ATLAS experiment at the LHC.

In the ongoing analysis, we search for the SM Higgs boson decaying into a pair of ALPs further decaying into two photons each. For low mass ALPs, the decay photons can appear strongly collimated. These collimated photon pairs are reconstructed as a single photon only differing in the shape of the electromagnetic shower. In this talk it will be discussed how these collimated photon pair signatures can be identified using neural networks and how the corresponding uncertainties can be estimated.