# T 22: Poster

Zeit: Montag 16:00–18:30 Raum: C.A.R.L. Foyer 1. OG

T 22.1 Mo 16:00 C.A.R.L. Foyer 1. OG

**What is Dark Matter?** — •Albrecht Giese — Taxusweg 15, 22605 Hamburg

Dark matter is one of the great mysteries in today's physics.

There are fundamentally two solutions possible: (1) there may exist a type of presently undetected particles which provides the missing contribution to the gravitational field; (2) the theory of gravity of Newton and of Einstein which related gravitation to mass and energy may be erroneous.

For the second alternative there is a working ansatz. If one extends the Lorentzian interpretation of relativity to the area of general relativity, so to gravitation, there follows a different causality for gravity. Gravity is no longer caused by mass or energy but it is a side effect of other forces. So every elementary particle contributes to the field independently of its mass. And in this case photons and neutrinos are playing a particular role.

If the thoroughly investigated rotating galaxy NGC 3198 is taken as an example for this approach, it can be shown that the result for the amount of the field as well as its spatial distribution fits quite precisely to the measurement. And the recently detected galaxy NGC 1052-DF2, which emits dim light and has only a small amount of Dark Matter, is a good confirmation of this view.

On the other hand, the search for specific particles as an explanation of this phenomenon has up to now not yielded any hints for their existence.

Further Info: www.ag-physics.org/gravity

T 22.2 Mo 16:00 C.A.R.L. Foyer 1. OG

**High Resolution Neutron Detection by the (y)TPC method** — •Markus Köhli[1,2], Fabian Schmidt[2], Markus Gruber[2], Jochen Kaminski[2], and Klaus Desch[2] — [1]Physikalisches Institut, Universität Heidelberg,Heidelberg, Deutschland — [2]Physikalisches Institut, Universität Bonn, Bonn, Deutschland

The world of detectors used in thermal neutron scattering instrumentation has changed. By alerts on the future Helium-3 supply, critical to perspectives of the large-scale research infrastructures, the run on substitutional technologies started. Most of the solutions could be adapted from developments of particle physics and are comprised of one or more layers of boron-10. The Time Projection Method achieves a very high resolution by projecting ionization tracks onto a readout with dense spatial and time information. The University of Bonn is developing a novel system employing the Timepix - CMOS based chips with 55 micrometer sized pixels operated at clock speeds up to 80 MHz. Each matrix of 256 x 256 pixels is equipped with an InGrid - microstructured aluminum meshes 50 micrometer ontop of the pixels serving as a charge amplifier. In a first prototype with 8 Timepix chips, which are arranged in parallel to a boron layer, the track topology with this unrivaled high resolution has been studied. By reconstructing the origin of the conversion ions a time resolution of <50 ns and a spatial resolution of 100 micrometer has been achieved. As this setup now allows the full reconstruction of the conversion tracks down to the electron level we can address the question: what is realistically the resolution limit for boron-lined gas detectors?

T 22.3 Mo 16:00 C.A.R.L. Foyer 1. OG

**Eine neue Software zur 3d Simulation von Solid-State-Detektoren** — •Lukas Hauertmann, Martin Schuster, Oliver Schulz, Anna Zsigmond und Iris Abt für die LEGEND-Kollaboration — Max-Planck-Institut für Physik

Germanium- und Siliziumdetektoren kommen in einer Vielzahl von Experimenten weltweit zum Einsatz und haben einen festen Platz in zahlreichen Industriefeldern. In der GeDet (Germaniumdetektor Entwicklung) Gruppe am MPI für Physik werden Germaniumdetektoren genau studiert. Dies geschieht unter anderem durch den Vergleich von experimentell aufgenommenen mit simulierten Daten. Dazu wurde eine neue schnelle „Open Source“ Simulationssoftware „SolidStateDetectors.jl“ entwickelt, mit der das Verhalten aller auf Dioden basierenden Halbleiterdetektoren simuliert werden kann. Das Paket kann zur Berechnung der elektrischen Potentiale und Felder in Abhängigkeit von der angelegten Biasspannung verwendet werden. Es bietet die Möglichkeit der Pulsformsimulation basierend auf der Drift der Ladungsträger und die Möglichkeit, die Einflüsse der Elektronik zu berücksichtigen. Das Einlesen von GEANT4-generierten Ereignissen ist möglich. Die Software ist in der Programmiersprache Julia geschrieben und modular aufgebaut, sodass Benutzer auch leicht ihre eigenen Modelle, wie z.B. unterschiedliche Charge-Drift-Modelle, implementieren können.

T 22.4 Mo 16:00 C.A.R.L. Foyer 1. OG

**The tracking system of the TAIGA-IACT telescope** — •Dmitriy Zhurov[1,2], Oleg Gress[1], and Ralf Wischnewski[3] for the TAIGA-Collaboration — [1]Irkutsk State University — [2]Irkutsk National Research Technical University — [3]DESY Zeuthen

The TAIGA Observatory is designed for ground based gamma-ray astronomy in the energy range from a few TeV to several PeV, and is located in the Tunka valley (Siberia/Russia). The TAIGA-IACT telescopes are part of the TAIGA complex hybrid detector that is under deployment. Currently we have one IACT telescope in operation and two more telescopes under construction on the TAIGA site. Observation of a gamma-source with IACT telescopes requires long exposure time, accurate pointing and specific tracking modes that are used for this type of telescope. The telescope drive system is equipped with 17-bit shaft encoders and hybrid stepper motors. A CCD-camera located on the telescope dish is intended for telescope calibration and measurements of its absolute direction by the images. Telescope hardware are controlled with software developed using EPICS control system framework. In this report we overview TAIGA-IACT telescope pointing calibration and tracking control software. Also telescope pointing precision for the 2018-2019 observation season is presented.

T 22.5 Mo 16:00 C.A.R.L. Foyer 1. OG

**Analysis of the moon shadow in the IceCube detector and it's sensitivity dependence on the angular reconstruction method** — •Aakash Bhat, Thorsten Gluesenkamp, and Gisela Anton for the IceCube-Collaboration — Erlangen Centre for Astroparticle Physics, Friedrich-Alexander Universität Erlangen-Nürnberg

The moon shadow is an observed deficit in cosmic-ray muons from the direction of the moon compared to the average muon flux from the same declination. The observation of such a phenomenon by the IceCube detector can be used to confirm the angular resolution of the detector and the robustness of the reconstruction method used. Here we analyze IceCube data taken from detector runs in 2015 and investigate the effect of the angular reconstruction method and exact statistical analysis on the moon sensitivity.

T 22.6 Mo 16:00 C.A.R.L. Foyer 1. OG

**Measurement of Nuclear Fragmentation Cross Sections of Carbon on Proton to Boron with NA61/SHINE at the CERN SPS** — •Franziska Sutter for the NA61/SHINE-Collaboration — Karlsruher Institut of Technology

A precise knowledge of fragmentation cross sections of intermediate mass nuclei is very important for the understanding of the propagation of cosmic rays in our Galaxy. The main observable to constrain the average integrated mass density traversed by the cosmic rays is the ratio of secondary-to-primary cosmic rays, especially the boron to carbon ratio, B/C, which has been recently measured by AMS with a precision of several percent. On the other hand, the cross section for the most crucial production channel for boron, $\mathrm{C} + \mathrm{p} \rightarrow \mathrm{B} + \mathrm{X}$, has a cross section uncertainty of about $15 - 20\,\%$.

In this poster we will present new measurements of carbon fragmentation with the NA61/SHINE facility at the SPS at CERN. One week of data with a fragmented Pb-ion beam at $13 - 13.5$ AGeV/c was taken in December 2018. By using a carbon trigger as well as two different targets made of polyethylene and carbon the cross section measurement at isotope level was performed.

T 22.7 Mo 16:00 C.A.R.L. Foyer 1. OG

**Determination of analysis plane magnetic field in the KATRIN main spectrometer** — •Fabian Block[1] and Alexander Osipowicz[2] for the KATRIN-Collaboration — [1]Karlsruher Institut für Technologie, Deutschland — [2]Hochschule Fulda, Deutschland

The Karlsruhe Tritium Neutrino (KATRIN) experiment aims to measure the effective electron anti-neutrino mass with a sensitivity of 0.2 eV (90% C.L.) by investigating the endpoint region of the $\beta$ decay spectrum. The experimental setup of KATRIN consists of a tritium source, from which the decay electrons are magnetically guided through the transport section towards two Mac-E filters (pre- & main spectrometer). The spectrometers act as integrating high pass filters with an energy resolution defined by the magnetic field strength in the spectrometer's center and the Pinch magnet. Only electrons near the energetic endpoint of the decay spectrum are transmitted to the detector.

A precise magnetic field model is of high importance for the neutrino mass analysis, as slight magnetic field deviations can significantly influence the spectrometer's energy resolution. This poster presents a method to precisely determine the magnetic field inside of the main spectrometer based on field values measured outside of the vessel, with KATRIN's radial magnetic monitoring system. The systematic uncertainty of the model is analyzed as a function of the applied magnetic field setting. The results of the study are essential for deciding which magnetic field setting to use in the first neutrino mass measurements.

This work was supported by the GRK 1694, the YIG VH-NG-1055, BMBF (Ø05A17VK2) and the Helmholtz Association.

T 22.8 Mo 16:00 C.A.R.L. Foyer 1. OG

**Precision High Voltage at the KATRIN Experiment** — •Caroline Rodenbeck[1], Oliver Rest[1], and Thomas Thümmler[2] — [1]Institut für Kernphysik, WWU Münster — [2]Institut für Kernphysik, Karlsruher Institut für Technologie

The Karlsruhe Tritium Neutrino (KATRIN) experiment aims to determine the neutrino mass by measuring the tritium beta spectrum using an integrating spectrometer (MAC-E filter). The sensitivity goal of $0.2\,\mathrm{eV/c^2}$ (90% C.L.) requires the spectometer's energy scale to be stable up to 60 meV. This translates to a stability requirement of 3 ppm for the high voltage system that creates the retarding potential (18.6 kV) inside the spectrometer.

KATRIN's high voltage system meets these requirements with precision power supplies and a high precision monitoring using two custom-built high voltage dividers. The monitoring system is complemented by an independent comparision of the energy scale to a nuclear standard. This is achieved by spectroscopic measurements of mono-energetic conversion electrons from Kr-83m decays utilizing different source formats (implanted, condensed, gaseous).

The poster will give a detailled overview of KATRIN's high voltage system and its performance during recent commissioning measurements. This project is supportet by BMBF under contract number 05A17PM3.

T 22.9 Mo 16:00 C.A.R.L. Foyer 1. OG

**Characterization of Germanium crystals using PET** — •Lukas Rauscher, Büsra Cebeci, and Josef Jochum for the GERDA-Collaboration — Physikalisches Institut, Auf der Morgenstelle 14, Tübingen, Deutschland

To increase their sensitivity several neutrino experiments want to significantly reduce background contributions by active background-suppression techniques. One of these techniques is the pulse shape analysis of signals induced by the interaction of radiation with the detector. The pulse shapes do not only depend on the energy of the interacting particle, the geometry and the field configuration but also on the location of interaction within the crystal. One possibility to determine the waveform depending on the location of the interaction in the detector is the use of positron-emission-tomography (PET). The main goal of this work is to create a setup which can characterize a detector using a PET. The poster shows a proof of principle and also the ongoing work on the subject. This work is funded by the BMBF.

T 22.10 Mo 16:00 C.A.R.L. Foyer 1. OG

**Attenuation Measurements of Fast Neutrons in an Experimental Site at the Chooz Nuclear Power Plant for NU-CLEUS** — •Andreas Erhart, Angelina Kinast, Alexander Langenkämper, Elizabeth Mondragón, Tobias Ortmann, Luca Pattavina, Walter Potzel, Stefan Schönert, and Raimund Strauss for the NU-CLEUS-Collaboration — Physikdepartment E15 and Excellence Cluster Universe, Technische Universität München, D-85748 Garching

The NU-CLEUS experiment is aiming for the detection of coherent neutrino-nucleus scattering (CE$\nu$NS) using gram-scale cryogenic bolometric detectors with a demonstrated ultra-low energy threshold ($\mathcal{O}(\lesssim 10\,\mathrm{eV})$) and a time response fast enough to be operated in above ground conditions. Nuclear reactors are promising sources to explore this process at low energies since they deliver large fluxes of anti-neutrinos with energies below 10 MeV. For the NU-CLEUS experiment, a new experimental site at the Chooz nuclear power plant in France has been located. Fast neutrons represent a potentially dangerous background for the measurement of coherent neutrino-nucleus scattering as they interact with the detector-material via the same mechanism of nucleus scattering as CE$\nu$NS. Therefore, a detailed understanding of the neutron background rate is crucial. Attenuation measurements of fast neutrons in the experimental site at the Chooz nuclear power plant have been performed and first results are presented. This research was supported by the DFG cluster of excellence “Origin and Structure“ of the Universe and by the SFB1258.

T 22.11 Mo 16:00 C.A.R.L. Foyer 1. OG

**Towards Run Wise Simulations for the HAWC Observatory** — •Edna L. Ruiz-Velasco for the HAWC-Collaboration — Max Planck Institute for Nuclear Physics, Heidelberg, Germany

The High-Altitude Water Cherenkov (HAWC) is a wide-field of view gamma-ray observatory located in Sierra Negra, Mexico. It is dedicated to study astrophysical sources of very-high energy (VHE) gamma rays from  0.1 to 100 TeV. In the most conservative way (and the currently used one) simulations of air-shower detection is made with *idealised* detector conditions. Event reconstruction, gamma/hadron separation, and high-level data analysis rely on optimisation and checks on simulated events. Therefore, a proper description and well modelled detector becomes extremely important to better estimate systematic uncertainties and reliable results. Dedicated work for an improvement on the HAWCs simulation chain will be presented in this contribution. The importance of a well estimated efficiency of each detector unit is addressed by implementing a correction of the individual PMTs light level based on an analysis of muons detected by HAWC. On this we can include the possible efficiency evolution of the detector during the operation time of HAWC (already spanning for almost 4 years). A new method for emulating the HAWC low level data (trigger level) will be also presented. This introduces the possibility of comparing data and Monte Carlo simulations at the trigger level and can be used to better simulate the detector by including the information of the calibration methods used in data.

T 22.12 Mo 16:00 C.A.R.L. Foyer 1. OG

**Gamma-Hadron separation using Convolutional Neural Network for the HAWC observatory.** — •Edna L. Ruiz-Velasco for the HAWC-Collaboration — Max Planck Institute for Nuclear Physics, Heidelberg, Germany

The High-Altitude Water Cherenkov (HAWC) is a wide-field of view observatory located in Sierra Negra, México. It is dedicated to study astrophysical sources of very-high energy (VHE) gamma rays from ~0.1 to 100 TeV. The HAWC main array comprises 300 Water Cherenkov Detectors (WCDs) that collect the footprint information of atmospheric air showers at the ground level. The detection of gamma-ray induced air showers poses a big challenge when it comes to the separation from the highly hadronic-dominated background (gamma-hadron separation problem). The standard method for the rejection of hadronic showers in HAWC employs parameters inferred from the reconstruction of these showers and is mostly based on the identification of muon signals. In this contribution we explore the application of Convolutional Neural Networks (CNNs) as a gamma-hadron separation method for HAWC, using the pure topology of the air showers, obtaining with this a high degree of separation power.