T 38: Neutrinos, Dark Matter V

Time: Tuesday 17:00–18:30 Location: POT/0361

T 38.1 Tue 17:00 POT/0361

Understanding the RF response of the MADMAX experiment — •Juan Pablo Arcila Maldonado for the MADMAX-Collaboration — Max Planck Institute for Physics/ University of Bonn

The MADMAX collaboration aims to probe the parameter space of the QCD axion around the well-motivated range of 40-400 μeV, which is out of reach for conventional cavities, using a novel technique referred to as dielectric haloscope. This concept relies on the power enhancement by constructive interference of axion-induced microwave signals from multiple dielectric boundaries. A prototype to verify the sensitivity of this approach was built, which helped to understand the underlying physics and the dependency from parameters on the axion-generated signal power. This talk presents the first results and discusses the next steps toward a possible final MADMAX setup.

T 38.2 Tue 17:15 POT/0361

Fitting the reflectivity of the MADMAX booster — •David Leppla-Weber for the MADMAX-Collaboration — Institut für Experimentalphysik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg — Now at Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

The **MA**gnetized **D**isk and **M**irror **A**xion e**X**periment is a dielectric haloscope aiming to detect axions from the galactic halo by resonant conversion to photons in a strong magnetic field. It uses a stack of dielectric disks, called booster, to amplify the axion-photon conversion probability over a significant mass range dependent on the position of the adjustable disks. In the planned prototype, depending on the axion mass, amplifications of a factor of $\sim 10^4$ can be achieved. To calibrate the system, an optimization fitting measurements to simulation is needed. The main physical quantity of the booster that can be measured is its complex reflectivity. It is shown how the simulation parameters are optimized in a way to reproduce the measured reflectivity. Previously, instead of the reflectivity, the group delay was used. The new method improves the match between simulation and measurement by one order of magnitude.

T 38.3 Tue 17:30 POT/0361

In-place optimization of a dielectric haloscope for axion dark matter detection, MADMAX — •Dominik Bergermann for the MADMAX-Collaboration — RWTH Aachen University, Physics Institute III A

The axion is a promising candidate to explain cold dark matter and the absence of CP violation in strong interaction. The **MA**gnetized **D**isc and **M**irror **A**xion e**X**periment is a planned experiment which intends to probe axion dark matter in a mass range of 40 to 400 μeV. It is a dielectric microwave haloscope utilizing the axion photon conversion, consisting of multiple, consecutive and movable dielectric discs.

Covering this range with a single experimental setup, while simultaneously being able to finetune the resonance on potential signals, necessitates repositioning the experimental hardware continuously and automatically. In simulations the parameter-space (disc positions) can be optimized to produce desired signals. Prominent optimizers are Nelder-Mead or Quasi-Newtonian algorithms.

This talk focuses on the attempt of optimizing a physical, scaled-down MADMAX-like setup in-place based on it's electrical microwave responses. Challenges are the reduced set of information, the time requirement of the motor movement and the reliability of the algorithm.

T 38.4 Tue 17:45 POT/0361

Axion-Photon Coupling Distributions for Non-Minimal DFSZ-type Axion Models — •Johannes Diehl and Emmanouil Koutsangelas — Max Planck Institute for Physics, Munich, Germany

We systematically calculate anomaly ratios and thus axion-photon couplings for non-minimal DFSZ models. This allows us to classify every model and study the resulting distributions to make predictions for axion experiments like haloscopes, helioscopes or light-shining-through-a-wall experiments. Doing so we confirm the experimental importance of the values dictated by the minimal DFSZ models, while also extending the viable axion parameter space. We map this space by introducing a theoretical prior probability distribution for DFSZ-type axions under the assumption of equally probable numbers of Higgs doublets $n_D \leq 9$ and give 68% and 95% lower bounds on the axion-photon coupling. In contrast to the minimal DFSZ models, there is a large number of non-minimal DFSZ models with domain wall number of unity, thus avoiding the domain wall problem. We find a significantly enhanced axion-photon coupling compared to the minimal DFSZ models, adding to the experimental relevance of this subset.

T 38.5 Tue 18:00 POT/0361

Search for the DSNB in JUNO: Development of new Methods for Background Event Identification — •Matthias Mayer[1], Lothar Oberauer[1], Raphael Stock[1], Hans Steiger[2], Konstantin Schweizer[1], Ulrike Fahrendholz[1], David Dörflinger[1], Simon Appel[1], Carsten Dittrich[1], Korbinian Stangler[1], Simon Csakli[1], and Florian Kübelbäck[1] — [1]Technische Universität München, München, Germany — [2]Institute of Physics and EC PRISMA$^+$, Johannes Gutenberg Universität Mainz, Mainz, Germany

The diffuse supernova neutrino background (DSNB) describes the constant flux of neutrinos from past core-collapse supernovae over the entire visible universe. The Jiangmen Underground Neutrino Observatory (JUNO), a 20 kton liquid scintillator detector, plans to detect the DSNB in the inverse beta decay (IBD) detection channel. While other electron anti-neutrino sources will cause irreducible IBD background, non-IBD backgrounds such as neutron-induced events and NC interactions of atmospheric neutrinos can be reduced by careful pulse-shape discrimination (PSD). In this talk, I compare the performance of different PSD techniques with the prospect of increasing the fiducial volume available for the DSNB search. Additionally, I discuss the influence of possible quenching of non-IBD pulseshapes on the available discrimination performance in the DSNB energy region of interest. This work is supported by the DFG research unit "JUNO", the DFG collaborative research centre 1258 "NDM", and the DFG Cluster of Excellence "Origins".

T 38.6 Tue 18:15 POT/0361

Characterisation measurements of LAPPDs for ν-detectors — •Benedict Kaiser, Lukas Bieger, Marc Breisch, Jessica Eck, Tobias Heinz, Tobias Lachenmaier, and Tobias Sterr — Universität Tübingen, Physikalisches Institut, Auf der Morgenstelle 14, 72076 Tübingen

Designed for use in future neutrino experiments, Large Area Picosecond Photodetectors (LAPPDs) are novel Microchannel Plate (MCP) based photodetectors. With a uniform gain of 10^6 to 10^7 over a large active area of more than 370 cm, an LAPPD is capable of single photon detection. It features a position resolution of better than 3 mm and an unprecedented time resolution of better than 70 ps. This performance is achieved by using a compact, evacuated glass case containing a multi-alkali photocathode, a chevron pair of MCPs for electron multiplication, and 28 individual anode strips for signal detection. Currently, we are analysing the performance of an LAPPD using a self-developed test setup. This talk will outline the working principle and characteristics of an LAPPD and the first measurement results will be discussed.