T 80: Axions/ALPs II

Time: Thursday 16:15–17:45 Location: KH 02.019

T 80.1 Thu 16:15 KH 02.019

The IAXO-D1 Demonstrator for the BabyIAXO Intermediate Step — •Jorge Porrón Lafuente — University of Zaragoza — Centro de Astropartículas y Física de Altas Energías (CAPA)

The International AXion Observatory (IAXO) is a large-scale helioscope searching for solar axions and axion-like particles via the Primakoff effect. BabyIAXO, its prototype at DESY, serves both as a testbed for IAXO technologies and a functional helioscope, requiring high efficiency in the 1-10keV range and ultra-low background (<10*-7 counts/keV/cm2/s).

The IAXO-D1 Micromegas X-ray detector in Zaragoza characterizes cosmic background at surface level. It features 20cm lead shielding, a 4π muon veto, and radiopure materials to reduce intrinsic background. Cosmogenic neutrons, which can mimic axion signals, are tagged using the REST-for-Physics framework. Previous detectors achieved 8.6*10-7 counts/keV/cm2/s at surface and approx. 2*10-7 counts/keV/cm2/s underground. Simulations indicate cosmic neutrons produce secondary signals in the veto, enabling identification.

Initial IAXO-D1 measurements without the veto reached 2*10-6 counts/keV/cm2/s. Ongoing improvements in veto design, shielding, and analysis aim to meet the <10*-7 counts/keV/cm2/s goal, enhancing BabyIAXO*s sensitivity and informing the design of the full-scale IAXO experiment.

T 80.2 Thu 16:30 KH 02.019

Towards a low background SDD for IAXO — •Lucinda Schönfeld[1], Christian Buck[1], Susanne Mertens[1], Christoph Wiesinger[1], Michael Willers[2], and Juan Pablo Ulloa Beteta[1] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, DE — [2]Technische Universität München, Garching, DE

Axions are hypothetical particles that solve the strong CP problem and are candidates for dark matter. The International Axion Observatory (IAXO) is aiming to find these elusive particles by converting solar axions to X-rays. Detecting this rare signal requires highly efficient ultra-low background X-ray detectors, for which Silicon Drift Detectors (SDDs) are well suited. I will present the current status of the TRISTAN SDD for IAXO (TAXO) project, which is developing such an SDD. A particular focus will be the latest results of background measurements, as well as simulations to find an optimal shielding setup.

T 80.3 Thu 16:45 KH 02.019

Axion search with RADES — •Elisa Gabbrielli for the RADES MPP-Collaboration — Max Planck für Physik, Munich

RADES (Relic Axion Detection Exploratory Setup) is a haloscope experiment designed to search for axions originating from the local dark matter galactic halo in the μeV mass range, under the assumption that dark matter is entirely composed of axions. The detection technique relies on a resonant cavity placed inside a strong magnetic field, which enhances the conversion of axions into detectable photons. The collaboration has achieved significant progress regarding the development of new cavity geometries, leading to two physics results at axion masses around 30 μeV.

An innovative RADES setup incorporating transmon qubits is currently being developed within the collaboration. This talk focuses on the activities at the Max Planck Institut für Physik in Garching. To maximise the signal-to-noise ratio, the experiment operates at cryogenic temperatures using a dilution refrigerator that can reach approximately 10 mK. At these extremely low temperatures, superconducting devices such as transmon qubits can be employed as single-photon detectors to further improve signal sensitivity.

T 80.4 Thu 17:00 KH 02.019

First measurements with a MADMAX 8 disk prototype booster system for the search of dark matter — •Umashi Fernando for the MADMAX-Collaboration — Max-Planck-Institut für Physik, Boltzmannstr. 8, 85748 Garching

The main aim of the MADMAX experiment (Magnetised Disc and Mirror Axion Experiment) is to search for the hypothetical particle that solves the strong CP problem and is also an excellent cold dark matter candidate: the axion. The electric field oscillations due to axion conversion to photons in the presence of a strong magnetic field can be detected, but the signal is very weak. Thus, a configuration with dielectric disks in front of a mirror is used to resonantly enhance the signal over a controllable frequency range.

In this talk, measurements taken with an 8-disk closed prototype booster system CB200 will be discussed. Some details of the used receiver chain and data acquisition system will be given.

T 80.5 Thu 17:15 KH 02.019

MADMAX analysis procedures and preliminary results of CB100 cold experiment — •Haotian Wang for the MADMAX-Collaboration — III. Physikalisches Institut A, RWTH Aachen University, Aachen

MADMAX is a dielectric haloscope experiment that searches for QCD axion dark matter in the mass range of a few tens to a few hundred micro-eV by exploiting axion-photon conversion in a strong magnetic field enhanced by a dielectric booster. In this contribution, we present the general MADMAX data analysis procedures, developed for the treatment of large sets of power spectra, including background modeling, the combination of multiple measurements, and the statistical inference of exclusion limits. These methods are then applied to data from the CB100 closed-booster prototype operated in a magnetic field at cryogenic temperatures, and preliminary exclusion limits are shown.

T 80.6 Thu 17:30 KH 02.019

Determining the MADMAX boost factor using the bead pull method — •Lea Stankewitz for the MADMAX-Collaboration — Institut für Experimentalphysik, Universität Hamburg

The MAgnetised Disk and Mirror Axion eXperiment is a dielectric haloscope which aims to search for dark matter axions between 40 μeV and 400 μeV. It converts axions into photons using a strong magnetic field. The conversion probability is enhanced by arranging multiple dielectric disks in a resonant configuration, the so called booster. The boost factor, that quantifies how much the axion signal power is amplified relative to a simple dish-antenna configuration, can be determined from the electric field strength in between the disks. To measure the electric field the bead pull method is used, where a small dielectric object is moved through the setup to measure the electric field at different positions. For the next axion search, which will measure multiple frequency ranges, calibration of multiple disc configurations is required. The bead pull measurements inside the cryostat will have a limited range, therefore good reference measurements are required. In this talk I present the results of the boost factor determination for the open booster setup with a three disks configuration using a high-precision bead pull setup. These measurements will be used to calibrate the system for the first cryogenic axion search with MADMAX in the MORPURGO magnet at CERN.