HK 51: Fundamental Symmetries III

Time: Wednesday 17:30–19:15 Location: SCH/A252

Group Report HK 51.1 Wed 17:30 SCH/A252

Recent results of NA64 for Dark Matter searches at CERN — •Michael Hösgen and Bernhard Ketzer for the NA64-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

We report on the recent activity of the NA64 experiment at the SPS of CERN. The NA64 experiment uses an active beam-dump setup to conduct missing energy searches with high-intensity lepton beams (e or mu).

Since 2016 several dedicated searches for new mediators between standard model and dark sector were performed, most notably a light vector boson A' and a short-lived neutral boson X(17). The A' was proposed as a possible explanation for magnetic-moment anomalies of muons. At NA64 it could be created in electron-on-target reactions $e^-Z \to e^-ZA'$ and supposedly decay invisibly into lighter dark-sector particles ($A' \to \chi\bar{\chi}$). The X is motivated by an excess of e^+e^--pairs in $^8Be^*$ excited state nuclear transitions. At NA64 it could be produced in bremsstrahlung interactions $e^-Z \to e^-ZX$ and decay into standard model leptons ($X \to e^+e^-$).

Starting in 2021, the search for a dark portal was expanded with a dedicated setup using a muon beam at the M2 beamline at the SPS of CERN. In 2022, a pilot run using an e^+ beam for resonant A' production in our active target was performed.

We present an overview over the experimental setups and analysis strategies, as well as the updated results until 2022.

Group Report HK 51.2 Wed 18:00 SCH/A252

The P2 experiment — Sebastian Baunack[1], Maarten Boonekamp[4], Boris Gläser[1], Rahima Krini[1], Frank Maas[1,2,3], Tobias Rimke[1], David Rodriguez Pineiro[2], and •Malte Wilfert[1] for the P2-Collaboration — [1]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz — [2]Helmholtz-Institut Mainz, Johannes Gutenberg-Universität Mainz — [3]PRISMA+ Cluster of Excellence, Johannes Gutenberg-Universität Mainz — [4]IRFU, CEA, Université Paris-Saclay, Gif-sur-Yvette, France

The weak mixing angle $\sin^2\theta_W$ can be measured in parity violating elastic electron-proton scattering. The aim of the P2 experiment is a very precise measurement of the weak mixing angle with an accuracy of 0.15% at a low four-momentum transfer of $Q^2 = 4.5 \cdot 10^{-3}\,\mathrm{GeV}^2$. In combination with existing measurements at the Z pole with comparable accuracy, this comprises a test of the standard model with a sensitivity towards new physics up to a mass scale of 50 TeV. The experiment will be built at the future MESA accelerator in Mainz. In this talk, the motivation and challenges for this measurement will be discussed together with ideas for measurements at lower beam energies, which will be available at the start of MESA.

Group Report HK 51.3 Wed 18:30 SCH/A252

Light Dark Matter Searches at DarkMESA — •Maik Biroth for the MAGIX-Collaboration — Institute of Nuclear Physics, Johannes Gutenberg University, Mainz, Germany

The DarkMESA beam dump experiment will search for light dark matter particles. It will be placed behind the P2 experiment at the future MESA electron accelerator, where an unprecedented amount of electrons-on-target can result in the radiative production of dark photons. In various models, such a dark photon decays predominantly into a pair of dark matter particles in the sub-GeV range. These will be detected by a sophisticated setup based on a solid and reliable detection technology.

In this talk, the development status of the detector system and the estimated exclusion limits will be presented.

HK 51.4 Wed 19:00 SCH/A252

Search for axion-like particles from Higgs boson decays in the 4 electron final state using the ATLAS detector — •Georgios Lamprinoudis, Matthias Schott, and Kristof Schmeiden for the ATLAS-Collaboration — Johannes Gutenberg Universitat Mainz

Axion-like particles (ALPs) are motivated by numerous theoretical models, including the two-Higgs-doublet model (2HDM). ALPs can also couple to the Higgs boson and may decay to leptons. The coupling of ALPs to leptons defines their life-time and hence might lead to displaced decay vertices in the detector. While previous analyses assumed a negligible axion lifetime, a finite lifetime with displaced vertex signatures is studied in the present analysis of the h->aa->4e channel. The analysis covers a mass range of the axions from 0.5 GeV to 60 GeV. In the case that no signal is observed, the analysis will establish upper limits on the axion-Higgs coupling.