HK 7: Astroparticle Physics I

Time: Monday 16:45–18:15 Location: HBR 19: C 103

Group Report HK 7.1 Mon 16:45 HBR 19: C 103

Compact Particle Detectors for the Study of Cosmic Rays and of Earth's Radiation Belts — •Martin J. Losekamm[1], Liesa Eckert[1], Peter Hinderberger[1], Luise Meyer-Hetling[1], Stephan Paul[1], Thomas Pöschl[2], and Sebastian Rückerl[3] — [1]School of Natural Sciences, Technical University of Munich, Garching, Germany — [2]CERN, Geneva, Switzerland — [3]School of Engineering and Design, Technical University of Munich, Ottobrunn, Germany

We develop compact charged-particle detectors for space applications based on scintillating-plastic fibers and silicon photomultipliers. In this contribution, I will present recent advances in several projects of our group that currently are in various stages of development. I will particularly focus on the RadMap Telescope, a radiation-monitoring experiment that was deployed to the International Space Station in April 2023 and has successfully been collecting data since. The instrument comprises several sensors that are optimized for the detailed characterization of the radiation environment astronauts are exposed during their stay in space. I will also summarize our work towards a small-satellite mission that shall measure the flux of antiprotons trapped in Earth's Van Allen radiation belts to augment the data previously collected by the PAMELA instrument.

Group Report HK 7.2 Mon 17:15 HBR 19: C 103

BDF/SHiP @CERN: Search for Hidden Particles at a Future Beam Dump Facility — •Annika Hollnagel for the SHiP-Collaboration — JGU Mainz (DE)

In conjunction with the CERN North Area Consolidation, an upgrade of the existing ECN3 experimental hall will enable a diverse physics program at the CERN SPS, complementing research at the energy frontier. At a dedicated Beam Dump Facility (BDF), the Search for Hidden Particles (SHiP) experiment has been proposed to exploit the full potential of the 400 GeV proton beam, covering a wide range of the Hidden Sector while also offering a rich neutrino physics program.

In line with the European Strategy for Particle Physics, BDF/SHiP has been identified as a frontrunner proposal by the CERN Physics Beyond Colliders (PBC) initiative. With the final CERN Research Board decision being imminent, this is the ideal time for new groups to join the project.

This talk will give an overview of the detector technologies and physics capabilities of the proposed experiment.

HK 7.3 Mon 17:45 HBR 19: C 103

Active Transverse Energy Filter Development for KATRIN — •Sonja Schneidewind, Kevin Gauda, Kyrill Blümer, Christian Gönner, Volker Hannen, Hans-Werner Ortjohann, Sebastian Wein, and Christian Weinheimer for the KATRIN-Collaboration — Institute for Nuclear Physics, University of Münster

The KATRIN experiment aims to measure the neutrino mass via tritium β-decay spectroscopy. Despite implementation of efficient countermeasures, we still observe an elevated experimental background (150 mcps instead of 10 mcps), which needs to be reduced to reach the targeted sensitivity of 0.2 eV/c^2. Radioactive decays in the stainless steel vessel of the main spectrometer produce highly-excited Rydberg or autoionizing atomic states in the volume. These release low-energetic electrons, which are energetically indistinguishable from β-electrons at the detector. Their angular distribution, however, is significantly sharper. The "active Transverse Energy Filter" (aTEF) concept was invented to reduce this background by discrimination of electrons in a large magnetic field based on their pitch angle (EPJ-C 82, 922 (2022)). This talk will introduce the "Si-aTEF" as a concept based on Si-PIN diodes. The fabrication process and prototype performance will be presented. The implementation of the Si-aTEF in KATRIN - success supposed - and the expected sensitivity improvement will be shown. This work is supported by the Helmholtz Association, by BMBF (grant numbers 05A23PMA, 05A23PX2, 05A23VK2 and 05A23WO6) and DFG (Research Training Group GRK 2149) in Germany.

HK 7.4 Mon 18:00 HBR 19: C 103

Progress of the Neutron Decay Facility PERC and its Silicon Detector — •Manuel Lebert for the PERC-Collaboration — Physik-Department, Technische Universität München, Germany — Forschungs-Neutronenquelle Heinz Maier-Leibnitz, Garching, Germany

The PERC facility is currently under construction at the FRM II in Garching, Germany. It will serve as an intense and clean source of electrons and protons from neutron beta decay for precision studies. It aims to improve the measurements of the properties of weak interaction by one order of magnitude and to search for new physics via new effective couplings.

PERC's central component is a 12 m long superconducting magnet system. It hosts an 8 m long decay region with a uniform field. To minimize systematic uncertainties, an additional high-field region selects the phase space of electrons and protons that can reach the main detector.

The main detector and two backscattering detectors will initially be scintillation detectors with a (silicon) photomultiplier readout. In a later upgrade, the downstream detector will be replaced by a pixelated silicon PIN-detector with a thickness of 2mm. In this talk, I present the status of the ongoing installation of PERC and its infrastructure, which is expected to be ready for neutrons by the end of 2024, as well as first results of the characterization of the silicon detector.