T 78: Suche nach neuen Teilchen 4

Zeit: Mittwoch 16:45–19:05 Raum: JUR 2

Gruppenbericht T 78.1 Mi 16:45 JUR 2

Search for hidden particles with the SHiP experiment — •Daniel Bick, Caren Hagner, Stefan Bieschke, Joachim Ebert, and Walter Schmidt-Parzefall — Universität Hamburg, Institut für Experimentalphysik, Luruper Chaussee 149, 22761 Hamburg

SHIP is a new general purpose fixed target facility, currently in the design phase at CERN. In its initial phase, the 400 GeV proton beam extracted from the SPS will be dumped on a heavy target with the aim of integrating 2×10^{20} pot in 5 years. A dedicated detector, based on a long vacuum tank followed by a spectrometer and particle identification detectors, will allow probing a variety of models with light long-lived exotic particles and masses below $\mathcal{O}(10)\,\mathrm{GeV}/c^2$. The main focus will be the physics of the so-called Hidden Portals, i.e. search for Dark Photons, Light scalars and pseudo-scalars, and Heavy Neutrinos. Another dedicated detector will allow the study of neutrino cross-sections and angular distributions. ν_τ deep inelastic scattering cross sections will be measured with a statistics 1000 times larger than currently available, with the extraction of the F_4 and F_5 structure functions, never measured so far and allow for new tests of lepton non-universality with sensitivity to BSM physics.

T 78.2 Mi 17:05 JUR 2

Search for hidden particles at SHiP: impact of the vertex reconstruction — Maximilian Ehlert, Sandra Gerlach, •Ievgen Korol, Heiko Lacker, Paul Rosenau, and Plamenna Venkova — Humboldt University, Berlin, Germany

A new general-purpose fixed-target facility, SHiP, is proposed at the CERN SPS 400 GeV accelerator complex. It aims to search for "hidden particles", such as Heavy Neutral Leptons (HNL), dark photons, axion-like particles etc. The principal background to the hidden-particle decay signals originates from neutrino- and muon-induced interactions, from muon combinatorial background, and from cosmic muons. The talk explains the offline reconstructin of signal events and the vertex and impact-parameter reconstruction, which plays an important role in the rejection of background events.

T 78.3 Mi 17:20 JUR 2

The role of the Surround Background Tagger for the SHiP experiment — Maximilian Ehlert, Sandra Gerlach, Ievgen Korol, Heiko Lacker, Paul Rosenau, and •Plamenna Venkova — Humboldt University, Berlin, Germany

SHiP, a new general-purpose fixed-target facility is proposed to be constructed at the CERN SPS accelerator complex. The goal is to dump 2×10^{20} protons of 400 GeV momentum on a molybdenum-tungsten target over a time of five years and to search for very weakly interacting long-lived particles with masses below O(10 GeV), such as Heavy Neutral Leptons (HNLs). After stopping hadrons and filtering out muons, the HNLs can decay inside a 50 m long decay vessel, which is enclosed by a surround background tagger (SBT). The decay products of the HNLs are detected in a subsequent spectrometer. The talk discusses the role of the SBT to suppress background in the offline analysis.

T 78.4 Mi 17:35 JUR 2

Searches for New Physics with the Mu3e Experiment — •Ann-Kathrin Perrevoort for the Mu3e-Collaboration — Physikalisches Institut, Universität Heidelberg

The upcoming Mu3e experiment searches for physics beyond the Standard Model in the lepton-flavour violating decay $\mu^+ \to e^+e^+e^-$ with a final sensitivity of one signal decay in 10^{16} muon decays. For this purpose, the detector is designed to measure electron and positron tracks of low momenta with excellent precision while operating at very high muon stopping rates in the order of $10^8 \frac{\mu}{s}$ up to $10^9 \frac{\mu}{s}$.
The high number of observed muon decays combined with the excellent detector resolution opens up a window for New Physics searches beyond the $\mu \to eee$ decay. Currently, two classes of such processes are under study. These are processes of the type $\mu^+ \to e^+X^0$ with X^0 being a neutral light boson, as well as $\mu^+ \to e^+A\bar{\nu_\mu}\nu_e$, where the A can either decay to an e^+e^- pair or leave the detector unseen. An example of A could be a dark photon.
Simulation studies estimating the sensitivity of the Mu3e experiment to these processes will be presented.

T 78.5 Mi 17:50 JUR 2

Search for magnetic monopoles, utilizing luminescence light, with the IceCube detector* — •Frederik Lauber for the IceCube-Collaboration — Bergische Universität Wuppertal

Magnetic monopoles are hypothetical particles predicted by many Beyond the Standard Model theories. They are carriers of single elementary magnetic charge. This work considers Intermediate Mass Monopoles which have been created shortly after the Big Bang. No recent search exists for the low relativistic range $(0.1 - 0.5\,c)$ because of the predominant usage of Cherenkov light as a detection mechanism in current experiments. No Cherenkov light is produced in the considered velocity range. Still, highly ionizing particles such as magnetic monopoles produce luminescence light in water and ice. To detect luminescence light, a high effective detection volume, as provided by the IceCube detector, with a high sensitivity to light is needed.

An ongoing search in the low relativistic range, utilizing luminescence light for the first time as a detection method with the IceCube detector, is outlined. Signal simulation will be shown as well as a first comparison between data, taken with the new monopole filter of the IceCube detector, and background simulation. The first separating variables used in the search will be presented.

** Gefördert durch die BMBF-Verbundforschung Astroteilchenphysik*

T 78.6 Mi 18:05 JUR 2

Search for heavy Majorana neutrinos in rare semileptonic B meson decays at the LHCb experiment — •Meriem Boubdir, Arno Heister, Christoph Langenbruch, and Stefan Schael — I. Physikalisches Institut B, RWTH Aachen

It is an open question of particles physics whether Neutrinos are Dirac or Majorana fermions. Neutrinos of Majorana-type (meaning they are their own antiparticles) would induce lepton number violating (LNV) processes. An example would be B meson decays with two same-sign leptons in the final state.
The LHCb experiment is an ideal environment for the search for these striking signatures due to the large $b\bar{b}$ production cross section. This talk presents an ongoing search for the LNV decay $B^+ \to \mu^+\mu^+\pi^-$ using data collected by the LHCb experiment during the LHC Run 1 and 2. The analysis is extended by a search for the related decay $B_c^+ \to \mu^+\mu^+\pi^-$, which allows to probe Neutrino masses of up to $\sim 6\,GeV$. The selection of the signal modes and the suppression of possible backgrounds will be discussed. In addition, the expected limit on the branching fractions of the signal decays will be presented.

T 78.7 Mi 18:20 JUR 2

Analysis of high mass lepton flavour violating processes with CMS — •Aaron Hornschild, Sören Erdweg, Thomas Hebbeker, Arnd Meyer, and Swagata Mukherjee — III. Physikalisches Institut A, RWTH Aachen University

Lepton flavour violating processes are common in several models of physics beyond the Standard Model. Some models predict objects at the TeV mass scale that can decay into two standard model leptons of different flavour: electron + muon, muon + tau, or electron + tau.

The challenges in a search for such phenomena are to achieve a high mass resolution, good rejection of standard model backgrounds, and an efficient lepton identification at the same time.

The selection part of the analysis is presented, which is based on the 2016 CMS dataset corresponding to an integrated luminosity of 36 fb^{-1} at a center of mass energy of 13 TeV.

T 78.8 Mi 18:35 JUR 2

Search for massive particles with flavour violating decays with CMS - interpretation of the results — •Sören Erdweg, Thomas Hebbeker, Aaron Hornschild, Arnd Meyer, and Swagata Mukherjee — III. Physikalisches Institut A, RWTH Aachen University

Many models of physics beyond the standard model predict charged lepton flavour violation at scales within LHC reach: Quantum gravity at the TeV scale can lead to the production of quantum black holes (QBH). Also, new heavy Z' bosons can be produced via quark-quark interaction. Finally, allowing R-parity violation can permit resonant sneutrino production in SUSY scenarios.

In all these models, a resonance-like excess of events at high elec-

tron + muon invariant masses can appear, thus leading to a striking signature with low standard model background.

The interpretation part of the analysis is presented, which is based on the 2016 CMS dataset corresponding to an integrated luminosity of $36\,\mathrm{fb}^{-1}$ at a center of mass energy of 13 TeV.

T 78.9 Mi 18:50 JUR 2

Search for disappearing tracks with the CMS experiment at 13 TeV — Paul Asmuss, Tobias Kramer, •Viktor Kutzner, Peter Schleper, and Benedikt Vormwald — Institut für Experimentalphysik, Universität Hamburg

The status of the search for long-lived charged BSM particles, which decay in the CMS detector and produce disappearing track signatures, is presented. A disappearing track signature is characterized by missing hits in the outer layers of the tracker with little or no energy deposited in the calorimeter. The findings are interpreted in the anomaly-mediated supersymmetry breaking model, which predicts a small mass splitting between the two lightest SUSY particles, giving rise to non-reconstructed soft leptons or hadrons. The search is further extended to consider pairs of tracks yielding a kinked track signature. First results of this extended search are presented using proton-proton collision data with $\sqrt{s} = 13$ TeV collected by the CMS experiment in 2016.