

## T 44: Searches/BSM III (Long-lived, Misc.)

Time: Wednesday 16:15–18:15

Location: ZHG010

T 44.1 Wed 16:15 ZHG010

**Probing Delayed Jets with Dedicated Long-Lived-Particle Triggers at ATLAS** — ●TOBIAS STEPHAN HEINTZ<sup>1,2</sup>, GARETH BIRD<sup>2</sup>, OLEG BRANDT<sup>2</sup>, and CHRISTOPHER LESTER<sup>2</sup> — <sup>1</sup>Kirchhoff Institute for Physics, Heidelberg, Germany — <sup>2</sup>Cavendish Laboratory, Cambridge, United Kingdom

Delayed energy deposits are a compelling signature in searches for long-lived particles (LLPs) at the LHC. This talk will present an analysis strategy to search jets that arrive at the ATLAS calorimeter with a significant time delay of up to 35 ns.

These delayed signals can serve as benchmarks for exploring a hidden sector beyond the Standard Model. For instance, long-lived dark matter particles may travel slowly due to a mass hierarchy in the production mechanism  $pp \rightarrow \text{scalar particle} \rightarrow \text{LLPs}$ , leading to delayed signals in the ATLAS detector. In extreme cases, LLPs with velocities below  $\beta \sim 0.1$  could reach the calorimeter even in the subsequent bunch crossing (BC).

Conventional triggers are inefficient for such events, but ATLAS has implemented a dedicated LLP trigger at the hardware level. This trigger specifically examines two consecutive BCs for signatures of missing transverse energy in BC  $N-1$  followed by a delayed jet in BC  $N$ . This talk will discuss the motivation, implementation, and potential of this trigger in uncovering new physics at the LHC in Run-3.

T 44.2 Wed 16:30 ZHG010

**Search for long-lived supersymmetric decays in CMS** — ●SOUMYAA VASHISHTHA<sup>1,2</sup> and ISABELLE MELZER-PELLMANN<sup>1</sup> — <sup>1</sup>Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, D-22607 Hamburg — <sup>2</sup>Universität zu Köln, Albertus-Magnus-Platz, 50923 Köln

The standard model is an effective theory but a low-energy approximation to a more complete theory. Supersymmetry (SUSY) extends the Standard Model but is expected to be broken and mediated to the visible sector via mechanisms like gravity or gauge mediation. In the search for beyond the standard model processes, we present an ongoing analysis based on simplified models to study the pair production and semileptonic decay of the hypothetical SUSY partner of the tau lepton, known as the stau ( $\tilde{\tau}$ ) within the CMS experiment at the CERN Large Hadron Collider (LHC). In gauge-mediated SUSY-breaking scenarios, the stau has macroscopic lifetime, and decays via  $\tilde{\tau} \rightarrow \tau \tilde{\chi}_0^-$ . This study focuses on events where one tau lepton decays to a muon, and the other decays hadronically, forming a jet. Using a dedicated machine learning algorithm for displaced tau tagging, we reconstruct the stau.

T 44.3 Wed 16:45 ZHG010

**Search for long-lived axion-like particles produced in Higgs boson decays at the ATLAS Experiment** — ●LUKAS BAUCKHAGE<sup>1,2</sup> and FEDERICO MELONI<sup>1</sup> — <sup>1</sup>Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — <sup>2</sup>Physikalisches Institut, Universität Bonn, Bonn, Germany

Exotic Higgs decays to long-lived particles are featured in theories beyond the standard model related to hidden sectors, while (long-lived) axion-like particles are not only a prime candidate to dark matter but also part of hidden and dark sector theories. Preliminary results of an ATLAS Run 3 search for long-lived axion-like particles produced in a Higgs decay in association with a Z boson and decaying into a pair of photons are presented. The ALP decay's displacement challenges the standard photon reconstruction and calls for new techniques, such as machine learning and a new tagger utilising shower shape information. Detailed studies of the performance of these algorithms will be presented.

T 44.4 Wed 17:00 ZHG010

**Search for Semivisible Jets with CMS Run 2 Scouting Data** — ●MARCEL GAISDÖRFER<sup>1</sup>, BENEDIKT MAIER<sup>3</sup>, BRENDAN REGNER<sup>1</sup>, MARKUS KLUTE<sup>1</sup>, JONAS JANIK<sup>1</sup>, KEVIN PEDRO<sup>4</sup>, ROBERTO SEIDITA<sup>2</sup>, CESARE TIZIANO CAZZANIGA<sup>2</sup>, ANNA PAOLA DE COSA<sup>2</sup>, AIMAR AGUADO BERASALUCE<sup>2</sup>, REBECCA NATALIA HAMP<sup>2</sup>, and CELESTE HOLM<sup>2</sup> — <sup>1</sup>Karlsruher Institut für Technologie (KIT)

— <sup>2</sup>ETH Zürich — <sup>3</sup>Imperial College London — <sup>4</sup>Fermilab (FNAL)

Semivisible jets are large area jets containing missing transverse momentum. These jets could be caused by a QCD-like dark sector, coupled to the SM via an additional  $Z'$  boson. The dark sector contains dark quarks, which while hadronizing form both stable and unstable dark hadrons. This hadronization process leads to large jets containing both SM particles and invisible DM particles.

This search uses data scouting, a technique that utilizes HLT reconstruction to access otherwise lost events below the typical trigger thresholds, to expand the parameter space of the existing s-channel search for a resonant  $Z'$  decaying into two semivisible jets.

This talk will present the search strategy, status and expected limits for the search for semivisible jets using scouting data collected by the CMS experiment during Run 2 of the LHC.

T 44.5 Wed 17:15 ZHG010

**Search for high-mass resonances in dilepton final states with associated b-jets at the ATLAS experiment** — FRANK ELLINGHAUS and ●ANNA BINGHAM — Bergische Universität Wuppertal

An overview of a search for a  $Z'$  boson in high-mass dilepton ( $ee, \mu\mu$ ) final states with associated  $b$ -jets is presented. The considered  $Z'$  model is a candidate explanation for potential anomalies in  $B$  hadron decays and couples to  $b$  and  $s$  quarks in the production. The search is carried out using the dataset collected by the ATLAS detector in Run-2 of the LHC corresponding to an integrated luminosity of  $140 \text{ fb}^{-1}$ . Backgrounds are estimated from MC and also by data-driven methods. Control, signal and validation regions are defined, and these regions are fitted in a profile-likelihood fit. Exclusion limits on the  $Z'$  mass are obtained based on the results of the fit.

T 44.6 Wed 17:30 ZHG010

**Impact of polarized beams for Higgs, Electroweak and Dark Matter Physics** — ●GUDRID MOORTGAT-PICK — University of Hamburg, Hamburg, Germany — Wackerweg 1

Future Electron-Positron Linear Collider Designs (ILC, CLIC, HALHF) offer high-energy, polarized beams and high-precision measurements. In the talk we discuss the impact of polarized beams for the detection of the Higgs couplings, CP-violation effects and Dark Matter candidates with respect to the model distinction in different Beyond the Standard Models (MSSM, 2HDMS, inflation models). The current experimental bounds have been taken into account and involved parameter scans have been performed.

T 44.7 Wed 17:45 ZHG010

**The Principle of Global Relativity** — ●JOCHUM VAN DER BIJ — Albert-Ludwigs Universität Freiburg, Deutschland

I present a new principle of relativity in physics. It is an alternative away from naturalness towards a new paradigm. It allows for an a priori derivation of the gauge structure of nature. In particular it can explain why there are precisely three generations of fermions. A specific form of dark matter is preferred. The standard model can only be extended in a minimalistic way.

T 44.8 Wed 18:00 ZHG010

**Einstein's Basement: A new sector for hypothetical particles** — ●FRITZ RIEHLE and SEBASTIAN ULBRICHT — Physikalisches Technische Bundesanstalt Braunschweig

The extremely fruitful concept of an avoided crossing in mechanical, optical, electrical science and in quantum mechanics of molecules, quantum chemistry and others rises the question for a supplement of the relativistic physics of particles. In this new sector - dubbed as Einstein's basement - new quasi particles with novel kinematic properties occur [1]. The new particles cannot be treated as a sector of the standard model of particles. We calculate the kinematics between the new particles and regular particles under Newtonian gravity which under special conditions can lead to repulsion of the basement particles and a modified interaction with regular matter.

[1] Fritz Riehle and Sebastian Ulbricht arXiv:2402.13679 [gr-qc]