T 106: Search for new particles 7

Time: Friday 9:00–10:15 Location: Geb. 20.30: 2.058

T 106.1 Fri 9:00 Geb. 20.30: 2.058

The Lohengrin Experiment at the ELSA Accelerator — •Matthias Hamer for the Lohengrin-Collaboration — Physikalisches Institut der Universität Bonn, Nussallee 12, 53115 Bonn

The particle nature of dark matter remains one of the great mysteries in elementary particle physics. The dark matter relic density constrains the masses of weakly interacting massive particles (WIMPs) to values larger than a few GeV (Lee-Weinberg bound). With the negative results from collider and direct searches for WIMPs, so-called dark sector models with significantly lighter dark matter candidates have received increasing interest in the past years.
In some minimal models, the dark sector contains a new vector boson that mediates a new U(1) gauge interaction. This new vector boson couples to the dark matter particles, which are either scalars or fermions. In addition, it can mix with the SM electroweak gauge bosons, enabling a very weak coupling to electrically charged particles. The new mass eigenstate is called dark photon and it can, if the mixing is strong enough, be produced through a SM bremsstrahlung like process, e.g. by scattering electrons off a nuclear target.
In this talk I will present the layout and potential physics reach of a new experiment that we propose to set up at the ELSA accelerator in Bonn - the Lohengrin experiment. The discovery reach of the Lohengrin experiment will cover dark photon masses of up to 50 MeV and couplings that can fully explain the relic density for scalar and fermionic dark matter particles, exceeding current limits and projections for other experiments.

T 106.2 Fri 9:15 Geb. 20.30: 2.058

Tracking with `Acts` for Lohengrin - A fixed target dark photon search experiment — •Jan-Eric Heinrichs for the Lohengrin-Collaboration — Universität Bonn

The true nature of dark matter (DM) has long been of interest for scientists worldwide. Previous searches have so far been unsuccessful in finding proposed DM particles. A promising and not well explored family of DM models contains dark matter particles with masses below ≈1 GeV connected through a portal interaction to the standard model (SM). This portal can be realized via a new vector boson mediating a U(1) gauge interaction, the dark photon. One possible search strategy is looking for the production of dark photons in a process similar to SM bremsstrahlung in a fixed target experiment.

This talk highlights some aspects of Lohengrin, a proposed fixed target experiment at the ELSA accelerator in Bonn. One of the key factors for the discovery potential of the experiment is the precise tracking of low momentum electrons. Electrons mainly loose energy via bremsstrahlung, which is notoriously difficult to correctly parametrize in tracking algorithms due to its non-gaussian nature. I will show first results of using `Acts` (A Common Tracking Software) to tackle this problem. `Acts` is a generalized tracking framework currently under development in international collaboration. The key element to enhance electron tracking is a gaussian sum filter. I will show necessary steps to adapt the framework to telescope like detector geometries. First preliminary results for the implementation and performance will be shown.

T 106.3 Fri 9:30 Geb. 20.30: 2.058

Search for single Vector-Like Quarks with the Run 2 data of the CMS experiment — •Di Wang — Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, D-22607 Hamburg

As an extension of the standard model, Vector Like Quarks provide a possible solution to various unsolved issues, such as the hierarchy problem. This analysis focuses on the single production of the vector-like top quark T', in the decay channel $T' \to tH$ ($H \to WW$), in the final state with two opposite sign leptons. The analysis is based on data collected by CMS Run 2, corresponding to an integrated luminosity of 137 fb^{-1}. The di-lepton final state includes the di-electron channel, the di-muon channel, and the electron-muon channel. A cut-based event selection strategy was designed, followed by a mass reconstruction method based on the χ^2 sorting algorithm and neutrino kinematic approximations. A preliminary data-MC comparison and limits based on MC data will be presented.

T 106.4 Fri 9:45 Geb. 20.30: 2.058

Dark Showers with the Herwig Generator — Suchita Kulkarni[1], Simon Plätzer[1], and •Dominic Stafford[2] — [1]University of Graz, Graz, Austria — [2]DESY, Hamburg, Germany

Most dark matter searches at the LHC focus on models where dark matter is a single stable particle, leading to traditional "MET+X" type searches. However recent years have shown a growing interest in "dark sector" which have a more complex internal structure. One such model is "dark showers", in which the particles in the dark sector interact with each other via a strong force similar to QCD in the Standard Model, which leads to the formation of "dark hadrons", some of which are stable DM candidates, and others of which decay to SM particles. This can give rise to unconventional experimental signatures, such as semi-visible and emerging jets.

Accurately simulating these dark showers is challenging since the hadronisation step is non-perturbative, and described by semi-empirical models, which require tuning to Standard Model data. However so far no extensive studies have been performed to determine the impact of hadronisation uncertainties on these types of models. In this talk I will describe the implementation of this dark shower model into the Herwig 7 Monte Carlo generator, where this can improve on the predictions in the existing Pythia hadronisation model, and how one can use variations of the Herwig hadronisation parameters to obtain an estimate of the hadronisation uncertainties for these dark shower models.

T 106.5 Fri 10:00 Geb. 20.30: 2.058

Validating Sherpa for New Physics Simulations in Diboson Processes — •Maren Bühring[1], Frank Siegert[2], Lisa Marie Lehmann[3], Diana Mareen Hoppe[4], and Erik Bachmann[5] — [1]IKTP Dresden — [2]IKTP Dresden — [3]IKTP Dresden — [4]IKTP Dresden — [5]IKTP Dresden

The Monte Carlo event generator Sherpa enables the simulation of high-energy particle collisions, like the ones recorded by the ATLAS detector at the Large Hadron Collider. One of Sherpa's features is its compatibility with models formulated in the Universal FeynRules Output (UFO) format. These UFO models make simulations based on physics beyond the Standard Model possible. Presented here are the results of validation tests performed using two seperate UFO models: Sherpa's use of the SMEFTsim model was tested in the context of a Vector Boson Scattering process, and the inclusion of the HHVBF_UFO model was tested using a process involving a triple Higgs coupling. The tests are based on consistency within Sherpa, as well as comparisons with events generated with the MadGraph5_aMC@NLO event generator.