T 32: Di-Higgs, Higgs BSM

Time: Tuesday 17:00–18:30					Location: HSZ/0204

T 32.1 Tue 17:00 HSZ/0204
Employing Matrix Elements with Neural Networks to Search for Higgs Self-coupling — •Christoph Ames, Otmar Biebel, Lars Linden, and Celine Stauch — Ludwigs-Maximilians-Universität, München

The Higgs boson was discovered in 2012 as predicted by the Standard Model (SM), however, not all of its predicted couplings have been measured yet. One such coupling is the Higgs self-coupling, in which a Higgs boson decays into two further Higgs bosons. By integrating over all possible initial states and by using the details of the end state, the matrix element method evaluates the weight of an event for the specific production cross section. In this work, machine learning is combined with the matrix element method to search for $HH \rightarrow b\bar{b}\,W^+W^-$ using simulated data. A neural network is trained to calculate the matrix element weight of an event and to use this to determine whether the event contains a signal or a background decay.

T 32.2 Tue 17:15 HSZ/0204
Prospects for measuring di-Higgs production at the ILC — •Julie Torndal[1,2], Jenny List[1], and Yasser Radkhorrami[1,2] — [1]Deutsches Elektronen-Synchrotron DESY, Hamburg — [2]Universität Hamburg, Hamburg, Germany

The Higgs mechanism is a central part of the Standard Model (SM). However, at this point in time, it has not been established experimentally which can only be done by reconstructing the Higgs potential. In the SM, the shape of the potential is determined by the Higgs self-coupling, which can be measured directly and model-independently at future linear e+e- colliders through di-Higgs production.

The Interntional Linear Collider (ILC) offers a clean experimental environment and a physics programme with sufficient energies to produce di-Higgs events. The measurement suffers from small production cross sections and large jet multiplicity, imposing high standards on the reconstruction tools. Modern reconstruction tools have seen a large improvement since the di-Higgs analysis was last visited almost 10 years ago. These improvements are foreseen to improve the precision, and an analysis strategy is presented focusing on an accurate event reconstruction and Z/H separation. Other aspects such as the the centre-of-mass energy and BSM effects might also influence the reachable precision and will be considered.

T 32.3 Tue 17:30 HSZ/0204
Prospects for constraints on light-quark Yukawa couplings from differential distributions of Higgs boson production in the diphoton decay channel — Johannes Erdmann and •Jan Lukas Späh — III. Physikalisches Institut A, RWTH Aachen University

More than ten years after the discovery of the Higgs boson, various production and decay channels have been explored experimentally. However, the constraints on couplings to the light quarks up, down, and strange are comparatively weak as they are challenging to probe experimentally.

In this talk, studies to constrain these couplings based on the production mode of quark-antiquark annihilation in the diphoton decay channel are presented. The focus lies on the discrimination of this $q\bar{q} \rightarrow H + X$ component against the dominant Standard Model contribution from gluon-gluon fusion. For this, the transverse momentum and the rapidity of the Higgs boson play an important role.

Expected upper limits on the Yukawa couplings to the three light quark species are presented. The potential for this interpretation in light of the large statistical power of the datasets collected with the High-Luminosity Large Hadron Collider is highlighted.

T 32.4 Tue 17:45 HSZ/0204
Search for heavy Higgs bosons in the t$\bar{\text{t}}$Z final state at CMS — Matteo Bonanomi, Yannick Fischer, Johannes Haller, •Daniel Hundhausen, and Matthias Schröder — Institut für Experimentalphysik, Universität Hamburg

All measurements of the properties of the Higgs boson at 125 GeV are compatible with a standard model-like behaviour. However, the observed resonance might well be part of an extended Higgs sector, which is predicted in various scenarios of new physics beyond the standard model. Two Higgs Doublet Models (2HDM) provide a generic description of the phenomenology arising in models with a second Higgs doublet. In this talk, we will present a search for a hypothetical CP odd heavy Higgs boson A decaying into a CP even heavy Higgs boson H and a Z boson, with the H decaying further into a pair of top quarks. This decay channel is particularly relevant in the high mass and low $\tan(\beta)$ regime. We will present the strategy and status of the analysis of data collected with the CMS experiment at a centre of mass energy of 13 TeV, targeting the fully hadronic t$\bar{\text{t}}$ decay.

T 32.5 Tue 18:00 HSZ/0204
Exotic Higgs Decays: ATLAS Search for Higgs Decays to Two Light Scalars — •Judith Höfer, Claudia Seitz, and Beate Heinemann — DESY, Hamburg, Germany

Extensions of the SM Higgs sector featuring one or several singlet scalar fields are realised in many BMS models. While several searches have been performed targeting decays of the SM Higgs boson to two light spin-zero particles of the same mass, the decay to two new scalars of different mass is largely unexplored. The successive decays of these particles can give rise to spectacular high-multiplicity collider signatures, including so-called cascade decays, where the heavier of the scalars decays into the lighter one. The talk discusses an analysis searching for scalar decays to multi-b final states with the ATLAS experiment at the Large Hadron Collider, CERN. The analysis focuses on the ZH production mode and the channel where the scalars decay to b-quarks, resulting in a challenging low-pT jet final state. Particular focus is put on the cascade decays that result in a 6b final state. The signatures motivate the use of novel reconstruction techniques, such as a newly developed low-pT X→bb tagger or the reconstruction of soft secondary vertices.

T 32.6 Tue 18:15 HSZ/0204
Domain walls in the N2HDM — Gudrid Moortgat-Pick, Mohamed Younes Sassi, and •Muriel Kaya Blenck — II. Institut für Theoretische Physik Luruper Chaussee 149 22761 Hamburg

In the next-to-two Higgs doublet model, the Higgs sector is extended by a second doublet as well as a singlet real scalar. These extra degress of freedom lead to the possibility of extending the symmetry group of the theory with additional discrete symmetries. In this talk, I will discuss the domain walls arising in this model due to the breaking of a discrete symmetry imposed on the singlet scalar and also discuss how to avoid the domain wall problem in such a model by allowing for soft breaking of this discrete symmetry.