T 60: Theory BMS

Time: Wednesday 15:50–17:05 Location: HSZ/0201

T 60.1 Wed 15:50 HSZ/0201

Domain walls in the 2HDM and their interactions with standard model fermions — •Mohamed Younes Sassi and Gudrid Moortgat-Pick — II. Institut für Theoretische Physik, Hamburg, Germany

Extended Higgs models such as the 2HDM can induce topological defects after spontaneous symmetry breaking. In this talk, I will discuss the formation of domain walls arising after the breaking of the discrete Z2 symmetry present in the 2HDM. I will, in particular, discuss the property of localized CP and charge violation inside the domain walls and finish with describing how standard model fermions interact with such types of domain walls.

T 60.2 Wed 16:05 HSZ/0201

Dark Matter Phenomenology in Z'2 broken Two Higgs Doublet Model with Complex Singlet Extension — •Julia Ziegler, Juhi Dutta, Cheng Li, Gudrid Moortgat-Pick, and Tabira Farah Sheikh — Universitaet Hamburg, Germany

Although the Standard Model is very successful, there are still open problems which it cannot explain, one of it being dark matter (DM). This has led to various Beyond Standard Model theories, of which Two Higgs Doublet models are very popular, as they are one of the simplest extensions and lead to a rich phenomenology. Further extensions with a complex singlet lead to a natural DM candidate.

The aim of this work is the exploration of the dark sector in a Two Higgs Doublet Model extended by a complex scalar singlet, where the imaginary component of the singlet gives rise to a pseudo-scalar DM candidate. Both, the doublets, and the singlet, obtain a vacuum expectation value (vev), where the singlet vev leads to additional mixing of the doublet and the singlet scalar sector. We examine the influence of the Higgs sector parameters on DM relic density and direct detection scattering cross sections. The results are then compared with constraints from experiments.

T 60.3 Wed 16:20 HSZ/0201

Leading Logarithmic 3-loop Corrections to $(g-2)_\mu$ in the Two-Higgs-Doublet Model — •Kilian Möhling — TU Dresden, Germany

The persistent deviation of the measured value of the anomalous magnetic moment of the muon $(g-2)_\mu$ from the prediction in the Standard Model provides us with one of the currently most tantalizing hints at physics beyond the Standard Model. In the near future, increased statistics and improved theoretical calculations will further reduce the uncertainty of this result which in turn puts stronger constraints on new physics models and motivates more precise calculations of the additional corrections.

In this talk I will focus on the Two-Higgs-Doublet Model as one of the promising explanations of the deviation. Here, the dominant contribution to the magnetic moment arises through two-loop Barr-Zee diagrams with large Yukawa couplings to heavy fermion loops. These diagrams bring with them a large uncertainty from QCD corrections at 3-loop order. I will discuss how this uncertainty can be reduced by including large logarithmic 3-loop contributions resummed in the renormalization group equation of an appropriate effective field theory.

T 60.4 Wed 16:35 HSZ/0201

Scalar Potential in SU(6) Gauge-Higgs Grand Unification — Andreas Bally, Florian Goertz, •Maya Hager, and Aika Marie Tada — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

Composite Grand Unified Theories unify the Standard-Model gauge symmetries and their breaking in a single structure while at the same time offering a solution to the hierarchy problem. In these scenarios, the corrections to the Higgs mass are expected to be at the order of the compositeness scale around a few TeV, significantly decreasing the necessary level of fine-tuning. In the recently proposed SU(6) Gauge-Higgs GUT (GHGUT) by Angelescu et al., the Higgs emerges as a pseudo Nambu-Goldstone boson of the coset SU(6)/SU(5) along with a scalar leptoquark and a scalar singlet. The scalar potential is generated radiatively through explicit symmetry breaking induced by the coupling to elementary fields. To describe the dynamics of the SU(6) GHGUT we work in a 4-dimensional framework using the AdS/CFT correspondence and we employ the Callan-Coleman-Wess-Zumino (CCWZ) mechanism to find the zero temperature potential. The 4D method enables a better analytical understanding of the scalar potential than the numerical study in five dimensions done previously. In addition, it can shed light on open problems such as baryogenesis, for which we include the finite temperature potential. A small hierarchy remains between the scales and we look at the fine tuning needed to achieve a realistic Higgs mass and vev. Furthermore, phenomenological aspects are investigated, such as the modification of couplings with respect to the SM, or the bounds on the lightest composite resonances.

T 60.5 Wed 16:50 HSZ/0201

Constraining BSM scalars with neural networks — Thomas Flacke[1], Jeong Han Kim[2], •Manuel Kunkel[3], Jun Seung Pi[2], Werner Porod[3], and Leonard Schwarze[3] — [1]Center for AI and Natural Sciences, KIAS, Seoul, Republic of Korea — [2]Department of Physics, Chungbuk National University, Chungbuk, Republic of Korea — [3]Institut für Theoretische Physik und Astrophysik, Julius-Maximilians-Universität Würzburg, Germany

We study a simple extension of the Standard Model motivated by composite Higgs models, in which a doubly charged scalar decays to $W^+t\bar{b}$, resulting in a $4t$-like signature from pair production. We train a neural network to differentiate this BSM signal from the dominant SM backgrounds using jet images and kinematic data. We derive the discovery reach and expected exclusion limit at the LHC. A comparison with recasts of Run-2 analyses shows a significant improvement over cut-based analyses.