T 85: Beyond the Standard Model (Theory) 2 and QFT and Lattice Gauge Theory 1

Time: Thursday 16:15–18:30 Location: T-H16

T 85.1 Thu 16:15 T-H16

Four-top final states as a probe of Two-Higgs-Doublet models — •Steven Paasch and Henning Bahl — Deutsches Elektronen-Synchrotron DESY

Using a CMS measurement of four top ($t\bar{t}t\bar{t}$) production in proton-proton collisions we constrain the parameter space of BSM scalar models. We study these effects for models with a generic scalar X with couplings to W-bosons and to top-quarks. We use Monte-Carlo simulators and fast detector simulations to recast the CMS analysis in order to obtain upper limits on the cross section times branching fraction for the production modes $pp \to (t\bar{t}, tW, t) + X$ with $X \to t\bar{t}$, where X is a new heavy Higgs H, a pseudoscalar A or mixed CP-state. Furthermore we study the impact on Two-Higgs-Doublet models where four top production places constraints on the low tanβ region which is of special interest for Baryogenesis.

T 85.2 Thu 16:30 T-H16

Flavour and LHC constraints in the 2HDM — Oliver Atkinson[1], •Matthew Black[2], Christoph Englert[1], Alexander Lenz[2], Aleksey Rusov[2], and James Wynne[3] — [1]SUPA, School of Physics and Astronomy, University of Glasgow, Glasgow, UK — [2]Physik Department, Universität Siegen, Walter-Flex-Str. 3, Siegen, Germany — [3]IPPP, Department of Physics, University of Durham, UK

We present comprehensive studies of the Two Higgs Doublet Model with Type I and Type II Yukawa couplings. To find bounds on the mass spectrum of these models, contributions to flavour, Higgs, and electroweak observables from the new scalars and couplings are considered, using theoretical constraints to inform these fits. We compare the results of these fits to those from direct searches at the LHC, finding regions of parameter space allowed by both flavour and collider. In addition, we test the consequences of our results on electroweak baryogenesis and the possibility of generating a strong first order phase transition in the 2HDM.

T 85.3 Thu 16:45 T-H16

Benchmarking Di-Higgs Production in Various Extended Higgs Sector Models — •Duarte Azevedo[5,6], Hamza Abouabid[1], Abdesslam Arhrib[1], Jaouad El Falaki[3], Pedro M. Ferreira[2,4], Margarete Mühlleitner[5], and Rui Santos[2,4] — [1]AbdelMalek Essaadi University, Faculty of Sciences and Techniques B.P 416, Tangier, Morocco — [2]ISEL - Instituto Superior de Engenharia de Lisboa, Instituto Politécnico de Lisboa 1959-007 Lisboa, Portugal — [3]EPTHE, Physics Department, Faculty of Science, Ibn Zohr University, Faculty of Sciences Agadir, Morocco — [4]Centro de Física Teórica e Computacional, Faculdade de Ciências, Universidade de Lisboa, Campo Grande, Edifício C8 1749-016 Lisboa, Portugal — [5]Institute for Theoretical Physics, Karlsruhe Institute of Technology, 76128 Karlsruhe, Germany — [6]Institute for Astroparticle Physics, Karlsruhe Institute of Technology, 76344 Karlsruhe, Germany

We study di-Higgs production in various extended Higgs sector models such as the real and complex 2HDM, the 2HDM with a real singlet and the next-to-Minimal Sypersymmetric Standard Model. We study the process $pp\to h_ih_j$ with $h_i=h_j$ the 125 GeV scalar and the case where h_i and/or h_j are new scalars predicted by the models. When performing the parameter scan, we consider all relevant constraints. The di-Higgs production cross section in these models can exceed the Standard Model rate by more than one order of magnitude. Furthermore we presenting our results for extended Higgs sector considered and list benchmark scenarios which exhibit important di-Higgs production rates at the LHC.

T 85.4 Thu 17:00 T-H16

Phenomenology of unusual top partners in composite Higgs models — Giacomo Cacciapaglia[1], Thomas Flacke[2], •Manuel Kunkel[3], and Werner Porod[3] — [1]Université Lyon 1, Villeurbanne, France — [2]Center for AI and Natural Sciences (KIAS), Seoul, Korea — [3]Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Germany

We consider a particular composite Higgs model which contains SU(3) color octet top partners besides the usually considered triplet representations. Moreover, color singlet top partners are present as well which can in principle serve as dark matter candidates. We investigate the LHC phenomenology of these unusual top partners. Some of these states could be confused with gluinos predicted in supersymmetric models at first glance.

T 85.5 Thu 17:15 T-H16

HiggsTools: a toolbox for BSM scalar phenomenology — •Steven Paasch[1], Cheng Li[1], Jonas Wittbrodt[1], Thomas Biekoetter[1], Henning Bahl[1], Georg Weiglein[1], and Sven Heinemeyer[2] — [1]Deutsches Elektronen-Synchrotron DESY — [2]Instituto de Fisica Teorica (UAM/CSIC), Universidad Autonoma de Madrid

The codes HiggsBounds and HiggsSignals compare model predictions of BSM models with extended scalar sectors to searches for additional scalars and measurements to the 125GeV Higgs boson. We present a unification and extension of the functionalities provided by both codes into the new HiggsTools framework. The codes have been re-written in modern C++ with a native python interface for easy interactive use. We discuss the user interface for providing model predictions, now part of the new sub-library HiggsPredictions, which also provides access to many tabulated cross sections and BRs in reference models such as the SM. HiggsBounds now implements experimental limits purely through json data files and can better handle clusters of BSM particles of similar mass, even for complicated search topologies. In HiggsSignals, the treatment of different types of measurements has been unified, both in the $\chi 2$ computation and in the data file format used to implement experimental results.

T 85.6 Thu 17:30 T-H16

First-order strong-field QED processes including the damping of particle states — •Tobias Podszus and Antonino Di Piazza — Max Planck Institute for Nuclear Physics, Heidelberg, Germany

Strong field QED considers electrodynamic processes in the presence of an electromagnetic background field. Here 'strong' refers to the intensity of the background field, which is so high that the interactions of electrons and positrons with the background field have to be taken into account exactly in the calculations. This is done by implementing the background field in the quantization procedure of the fermion field. Exact solutions of the corresponding Dirac equation in the presence of an arbitrary plane wave field are the so called Volkov states. However, Volkov states, as well as free photon states, are not stable in the presence of the background plane-wave field but 'decay' as electrons/positrons can emit photons and photons can transform into electron-positron pairs. By using the solutions of the corresponding Schwinger-Dyson equations within the locally constant field approximation, we compute the probabilities of nonlinear single Compton scattering and nonlinear Breit-Wheeler pair production by including the effects of the decay of electron, positron, and photon states. As a result, we find that the probabilities of these processes can be expressed as the integral over the light-cone time of the known probabilities valid for stable states per unit of light-cone time times a light-cone time-dependent exponential damping function for each interacting particle.

T 85.7 Thu 17:45 T-H16

QCD equation of state via the complex Langevin method — •Felipe Attanasio[1], Benjamin Jäger[2], and Felix Ziegler[2,3] — [1]Institute for Theoretical Physics, Universität Heidelberg, Philosophenweg 16, D-69120, Germany — [2]CP3-Origins & Danish IAS, Department of Mathematics and Computer Science, University of Southern Denmark, Campusvej 55, 5230 Odense M, Denmark — [3]School of Physics and Astronomy, The University of Edinburgh, EH9 3FD Edinburgh, United Kingdom

The equation of state of hadronic matter is of high importance for many fields, ranging from heavy-ion collisions to neutron stars. Non-perturbative methods to simulate QCD encounter difficulties at finite chemical potential μ due to the so-called sign problem. We employ the complex Langevin method to circumvent this problem and carry out simulations at a variety of values for temperature and μ. We present results on the pressure, energy and entropy equations of state, as well as a numerical observation of the Silver Blaze phenomenon.

T 85.8 Thu 18:00 T-H16

High-energy diffractive processes without and with soft photon radiation and Low's theorem — •Piotr Lebiedowicz[1], Otto Nachtmann[2], and Antoni Szczurek[1] — [1]Institute of Nuclear Physics Polish Academy of Sciences, Krakow, Poland — [2]Institut für Theoretische Physik, Universität Heidelberg, Heidelberg, Germany

Exclusive high-energy reactions at small momentum transfer without and with soft photon radiation are discussed. The tensor-pomeron model describing such reactions involving hadrons is introduced. The tensor-pomeron model is for hadronic high-energy reactions and has its origin in general investigations of the soft, nonperturbative, pomeron in QCD. The emission of soft radiation provides a fundamental probe of the consistency of the underlying Quantum Field Theory. As an example pion-pion scattering without and with soft photon emission is considered. The "exact" model results are compared to soft photon approximations based on Low's theorem. The term of order (photon energy)^0 in the expansion of the photon emission amplitude needs to be changed compared to Low's result.

T 85.9 Thu 18:15 T-H16

Decay constants of B, B_s, and B_c mesons — •Matthew Black and Oliver Witzel — Physik Department, Universität Siegen, Walter-Flex-Str. 3, Siegen, Germany

We present the status of our ongoing work extracting B-meson decay constants f_B with $B = B_0, B^+, B_s, B_c$. Our calculation is based on $N_f = 2 + 1$ dynamical flavour gauge field ensembles generated by the RBC/UKQCD collaborations using domain wall fermions and the Iwasaki gauge action. Using domain wall light, strange, and charm quarks and relativistic b-quarks we obtain results at three different lattice spacings $a \approx 0.11, 0.08, 0.07$ fm and multiple valence quark masses. We perform a global fit to obtain phenomenologically relevant results in the continuum and at physical quark masses.