T 47: Higgs-Boson (Eigenschaften) (theo.+exp.)

Zeit: Dienstag 16:45–19:00 Raum: VMP5 HS B1

T 47.1 Di 16:45 VMP5 HS B1

QFT justification of the κ-framework using the electroweak chiral Lagrangian — Gerhard Buchalla, Oscar Catà, Alejandro Celis, and •Claudius Krause — Ludwig-Maximilians-Universität München, Fakultät für Physik, Arnold Sommerfeld Center for Theoretical Physics, D-80333 München, Germany

We consider the electroweak chiral Lagrangian as effective field theory (EFT) for the Standard Model at the electroweak scale v. This EFT describes the phenomenology of the Standard Model with generalized Higgs couplings in a consistent way. This is motivated by (but not restricted to) a new, strongly-coupled sector responsible for electroweak symmetry breaking.

After a brief discussion of the systematics of the effective expansion, I will present its application to current LHC Higgs data. I will show how the leading effects are related to the κ-framework that is currently used by the experiments at the LHC. The κ-framework was introduced as a pure phenomenological signal-strength parametrization and is criticized as being inconsistent with quantum field theory. I will show that the latter is not the case and present a justification of the κ-framework using the leading order analysis of the electroweak chiral Lagrangian. It is therefore well defined and can straightforwardly be extended to higher orders within the EFT. I will also present a fit of the chiral Lagrangian to the LHC Higgs data.

T 47.2 Di 17:00 VMP5 HS B1

Suche nach Lepton-Flavour verletzenden Higgszerfällen mit dem CMS-Experiment — Peter Schleper, Daniel Tröndle und •Annika Vanhoefer — Universität Hamburg

Nach der Entdeckung eines Higgsbosons mit einer Masse von 125 GeV durch die ATLAS- und CMS-Kollaboration ist es eine wichtige Aufgabe, dessen Eigenschaften zu untersuchen. Lepton-Flavour verletzende (LFV) Zerfälle des Higgsbosons wären ein Anzeichen für Physik jenseits des Standardmodells der Teilchenphysik, die in vielen Modellen auftreten können, wie zum Beispiel in Modellen mit zwei Higgsdoublets. In diesem Vortrag wird auf die Suche nach LFV Higgszerfällen in ein Elektron und ein Tau-Lepton eingegangen. Mit den Daten des CMS-Experiments, welche bei einer Schwerpunktsenergie von 8 TeV aufgezeichnet wurden, konnten die Ausschlussgrenzen des Verzweigungsverhältnises des Higgsbosons in ein Elektron und ein Tau-Lepton verbessert werden und liegen in der Größenordnung von 1%. Weiterhin wird ein Ausblick auf die Analyse der Daten gegeben, welche bei einer Schwerpunktsenergie von 13 TeV aufgezeichnet wurden.

T 47.3 Di 17:15 VMP5 HS B1

Messung der HZZ Tensorstruktur in $pp \to H \to ZZ^* \to 4\ell$-Zerfällen mit dem ATLAS-Detektor — •Katharina Ecker, Sandra Kortner, Hubert Kroha, Oliver Kortner und Verena Walbrecht — Max-Planck-Institut für Physik, München

Ein wichtiger Zerfallskanal für die Messungen der Eigenschaften des im Jahr 2012 entdeckten Higgs-Bosons am LHC, ist der Zerfall in zwei Z-Bosonen, $H \to ZZ^* \to 4\ell$. Der Endzustand mit vier Leptonen aus Z-Bosonen Zerfällen kann vollständig rekonstruiert werden. Messungen mit Daten aus den Jahren 2011 und 2012 haben bereits gezeigt, dass die vom Standardmodell vorhergesagte Hypothese eines Teilchens mit Spin-0 und positiver CP-Quantenzahl gegenüber anderen Hypothesen bevorzugt ist. Unter der Annahme eines Spin-0 Teilchens wurde nach anomalen und CP-verletzenden Kopplungen des Higgs-Bosons an Z-Bosonen gesucht, die auf Physik jenseits des Standardmodells zurückzuführen sind.

Der Vortrag behandelt die Untersuchung der Kopplungseingenschaften des Higgs-Bosons an Z-Bosonen mit Daten des ATLAS-Experiments von Run-II des LHC. Um die große Anzahl von Kopplungsparametern gleichzeitig korreliert messen zu können, wurde die sogenannte analytische Morphing Methode zur Erstellung des Signalmodells entwickelt. Im Vortrag wird diese Methode im Zerfallskanal $H \to ZZ^* \to 4\ell$ angewendet und es werden sogenannte optimale Observablen vorgestellt, die mit Hilfe der Matrixelementmethode berechnet und zur Messung der HZZ-Kopplungsstruktur verwendet werden.

T 47.4 Di 17:30 VMP5 HS B1

Development of the morphing method for signal modelling and parameter extraction from ATLAS data, using effective operators in the $H \to W^+W^- \to \ell^+\nu\ell^-\bar{\nu}$ process — •Carsten Burgard and Karsten Köneke — Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

Given the parameter space of all physically conceivable Lagrange operators connected to physics beyond the Standard Model in the Higgs-boson sector, it seems unfeasible to conduct dedicated analyses for every new scenario. Instead, a fast, continuous, and analytical method of signal modelling would not only help to conduct hypothesis tests more efficiently, but would also allow to directly measure and derive limits on the coefficients of the individual terms in the matrix element. Similar approaches, such as Matrix-Element-Reweighting can not only be outperformed significantly by the morphing technique for some applications, but also be used complementarily and in conjunction with this new approach. This talk explores the applications in the context of effective Lagrangians for analyses of Higgs bosons decaying into two vector bosons for leptonic final states.

T 47.5 Di 17:45 VMP5 HS B1

Gluon Fusion Higgs Production in the CP Violating MSSM — •Shruti Patel[1], Stefan Liebler[2], and Georg Weiglein[3] — [1]DESY, Hamburg, Germany — [2]DESY, Hamburg, Germany — [3]DESY, Hamburg, Germany

The MSSM with complex parameters has emerged as an attractive SUSY candidate providing new sources of CP-violation, which are well motivated in the context of the observed imbalance between matter and antimatter in the universe. In order to study the effects of the complex parameters, which enter via loop contributions, an accurate prediction for the Higgs production cross-section is required. In this talk, we present a study of these effects carried out with an implementation in the program SusHi linked to FeynHiggs.

T 47.6 Di 18:00 VMP5 HS B1

Probing CP Properties of the discovered bosonic resonance with Higgs signal rates from Tevatron and LHC data — •Tobias Klingl[1], Philip Bechtle[1], Tim Stefaniak[2], and Klaus Desch[1] — [1]Universität Bonn — [2]University of California, Santa Cruz

In July 2012, the ATLAS and CMS collaborations reported the discovery of a single, narrow bosonic resonance ϕ with mass of 125 GeV. Although a pure CP-odd state can be excluded by the current data, it is still possible that the CP properties of this resonance deviate from the expectations for a pure CP-even Standard Model (SM) Higgs boson. In general it can be an admixture of a CP-even Higgs-like scalar h and a CP-odd pseudoscalar A described by the general parametrization $\phi = \cos\alpha\, h + \sin\alpha\, A$. We investigate the scope of possible discrepancies between the CP properties and the couplings of the discovered resonance and the properties of a SM Higgs boson. To this end, we consider a Higgs coupling scale factor benchmark scenario with scalar and pseudoscalar scale factors for the Higgs couplings to fermions and one scalar scale factor for the SU(2) gauge bosons. The latter coupling is assumed to be ≤ 1, as predicted in many models such as SUSY or the 2HDM. Additionally, we allow for non-SM Higgs boson decays into invisible final states. We perform χ^2 fits to the available data from the Tevatron and LHC experiments using the Computer Code HiggsSignals, which takes into account signal efficiencies and major correlations of experimental and theoretical uncertainties. We obtain constraints on the mixing angle α and the scalar and pseudoscalar couplings of the field ϕ.

T 47.7 Di 18:15 VMP5 HS B1

Testing CP-Invariance in Higgs VBF production with ATLAS using the Optimal Observable method and di-tau decays — •Coniavitis Elias, Schillo Christian, and Schumacher Markus — Albert-Ludwigs-Universität, Freiburg, Germany

CP-invariance in Higgs boson production via vector boson fusion is tested using the method of the optimal observable. In the present analysis the di-tau channel is utilised. A description of the method and analysis strategy is given, and the results of the ATLAS analysis using 20.3 fb^{-1} of proton-proton collision data at $\sqrt{s} = 8$ TeV are presented, along with a performance comparison to the signed $\Delta\phi$ variable previously proposed for this study.

T 47.8 Di 18:30 VMP5 HS B1

Study of the Higgs CP properties in the $\tau\tau$ decay channel with the CMS experiment — Vladimir Cherepanov, Günter Flügge, Bastian Kargoll, Wolfgang Lohmann, Alexander Nehrkorn, Ian M. Nugent, •Claudia Pistone, Achim Stahl, and Alexander Zotz — III. Physikalisches Institut B, RWTH Aachen University, D-52056 Aachen

In 2012 the discovery of a Higgs boson with mass of 125 GeV was announced by the ATLAS and CMS collaborations. Since then, efforts were focused on the measurement of its properties and thus the complete determination of the nature of this particle. We study the CP quantum numbers of the Higgs boson in its decay into tau lepton pairs. Our approach uses the distribution of the signed angle φ^*_{CP} between the decay planes of the tau leptons, which is sensitive to the Higgs CP properties. At the generator level we observe the expected discrimination power between CP-even and CP-odd states, and the results are presented. The sensitivity of our observable is also being investigated at the reconstruction level, and results are presented as well.

T 47.9 Di 18:45 VMP5 HS B1

Probing triple-Higgs productions via $4b2\gamma$ at a 100 TeV hadron collider — Chien-Yi Chen[1,2,3], Qi-Shu Yan[4,5,6], Xiaoran Zhao[4], •Zhijie Zhao[7], and Yiming Zhong[8] — [1]Department of Physics, Brookhaven National Laboratory, Upton, New York 11973, USA — [2]Department of Physics and Astronomy, University of Victoria, Victoria, BC V8P 5C2, Canada — [3]Perimeter Institute for Theoretical Physics, Waterloo, ON N2J 2W9, Canada — [4]School of Physical Sciences, University of Chinese Academy of Sciences, Beijing 100049, P. R. China — [5]Center for High-Energy Physics, Peking University, Beijing 100871, P. R. China — [6]Center for future high energy physics, CAS, P. R. China — [7]Department of Physics, University of Siegen, 57068 Siegen, Germany — [8]C. N. Yang Institute for Theoretical Physics, Stony Brook University, Stony Brook, New York 11794, USA

The quartic self-coupling of the Standard Model Higgs boson can only be measured by observing the triple-Higgs production process, but it is challenging for the LHC Run 2 or ILC at a few TeV because of its extremely small production rate. In this talk, we present a detailed MC simulation study of the triple-Higgs production through gluon fusion at a 100 TeV hadron collider and explore the feasibility of observing this production mode. We focus on the decay channel $HHH \to b\bar{b}b\bar{b}\gamma\gamma$, investigating detector effects and optimizing the kinematic cuts to discriminate the signal from the backgrounds. We also explore the dependence of the cross section upon the trilinear (λ_3) and quartic (λ_4) self-couplings of the Higgs.