T 13: Elektroschwache Physik (Theorie)

Convenor: Gudrun Heinrich

Zeit: Montag 16:45–18:40 Raum: 30.23: 6-1

T 13.1 Mo 16:45 30.23: 6-1

Weak Radiative Corrections to Dijet Production at the LHC — Oliver Brein, Stefan Dittmaier, and •Alexander Huss — Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

The unpreceded energy regime that is now accessible at the LHC allows for the investigation of the laws of physics at the smallest distances. The production of two jets constitutes a scattering reaction between two partons at leading order and allows for a detailed study of QCD at these high energies. Furthermore, several extensions beyond the Standard Model predict new heavy particles which can lead to dijet signatures in the detector. Although suppressed by the small value of the coupling constant α, the electroweak corrections can become sizable in the high-energy domain due to the appearance of Sudakov logarithms. In this talk we present the full calculation (i.e. beyond the logarithmic level) of the purely weak radiative corrections at the order $\alpha_S^2\alpha$ to dijet production at the LHC. The photonic corrections are not subject to these Sudakov enhancements and are omitted in a gauge-invariant manner. We find that, although negligible in the total cross section, the weak radiative corrections have a strong impact on the high-energy tail of kinematic distributions.

T 13.2 Mo 17:00 30.23: 6-1

Higgs boson production in association with a photon via weak boson fusion — •Ken Arnold[1], Terrance Figy[2], Barbara Jäger[3], and Dieter Zeppenfeld[1] — [1]IThP, Karlsruhe Institute of Technology — [2]CERN Theory Division — [3]THEP, Universität Mainz

Higgs boson production in association with a hard central photon and two forward tagging jets is expected to provide valuable information on Higgs boson couplings in a range where it is difficult to disentangle weak-boson fusion processes from large QCD backgrounds. Next-to-leading order QCD corrections to Higgs production in association with a photon via weak-boson fusion at a hadron collider are presented in the form of a flexible parton-level Monte Carlo program.

T 13.3 Mo 17:15 30.23: 6-1

Central Jet Veto for processes with W and Z bosons — •Matthias Kerner and Dieter Zeppenfeld — IThP, Karlsruhe Institute of Technology, 76128 Karlsruhe, Germany

Vector boson fusion processes will be used to probe the mechanism of electroweak symmetry breaking at the LHC. Large backgrounds will arise from QCD induced processes, where instead of electroweak bosons a gluon is exchanged between the initial state partons. Because of the additional t-channel color exchange, angular distributions of additional jets, beyond the two tagging jets, are expected to differ in the QCD backgrounds.

We have implemented the leading order gluon induced process $pp \to WZjjj$, with leptonic decay of the weak bosons, into a flexible parton level Monte Carlo program, VBFNLO. In this talk we will present the results of these calculations and quantify to what extent a central jet veto can be used to reduce QCD backgrounds to weak boson scattering.

T 13.4 Mo 17:30 30.23: 6-1

Spin-2 Resonances in Vector Boson Fusion at the LHC — •Jessica Frank, Michael Rauch, and Dieter Zeppenfeld — IThP, Karlsruhe Institute of Technology, 76128 Karlsruhe, Germany

In this talk we present the production of spin-2 resonances in vector-boson fusion at the LHC. We start from an effective Lagrangian of the interaction of a spin-2 particle with electroweak gauge bosons and derive the corresponding Feynman rules. Thereby we consider two different scenarios: heavy spin-2 resonances which decay into two gauge bosons, leading to a four-lepton final state, and light Higgs-like resonances producing two photons. These processes have been implemented into the Monte Carlo program VBFNLO.

Our analysis focuses on angular correlations, as they are known as a powerful tool to study the spin of a resonance. We investigate how we can use them to establish, or disprove, the spin-2 nature of such states, and distinguish these from Higgs bosons.

T 13.5 Mo 17:45 30.23: 6-1

Electroweak symmetry breaking with nonlocal Higgs-Boson actions — Martin Beneke, •Philipp Knechtges, and Alexander Mück — Institut für Theoretische Teilchenphysik und Kosmologie, RWTH Aachen, Germany

We investigate a nonlocal Higgs sector as it was recently suggested in the context of unparticle physics. The Higgs fields are coupled in a gauge invariant way to the gauge bosons via a Wilson line or by a generalization of minimal coupling. We analyze spontaneous symmetry breaking in the nonlocal model and consider its phenomenological consequences, e.g. for the ρ parameter and the $W^{\pm}$-mass which receive corrections already at the tree-level. Moreover, we study the tree-level unitarity in gauge-boson scattering involving the exchange of the nonlocal Higgs boson. As in the Standard Model, all terms in the amplitude growing with energy are shown to cancel. Tree-level unitarity is subsequently employed to constrain the parameter space of the model.

Gruppenbericht T 13.6 Mo 18:00 30.23: 6-1

Electroweak precision data and the fourth family — •Otto Eberhardt[1], Heiko Lacker[2], Alexander Lenz[3], Andreas Menzel[2], and Jürgen Rohrwild[4] — [1]Karlsruher Institut für Technologie — [2]Humboldt-Universität zu Berlin — [3]Universität Regensburg — [4]RWTH Aachen

The easiest extension of the Standard Model is a sequential generation of (heavy) fermions. Referring to the electroweak oblique parameters, the particle data group excludes a mass degenerated fourth fermion generation at the 6 σ level.

We want to show that these arguments against the existence of a fourth family can be relaxed if we take into account quark mixing. This is the result of fits in the parameter space of the standard model with four families, which were generated using the CKMfitter software. Moreover, we will discuss the correlation of the fourth family and the Higgs mass.

Gruppenbericht T 13.7 Mo 18:20 30.23: 6-1

"Constraints auf Leptonen und Quarks einer 4. Familie aus elektroschwachen Präzisionsmessungen und Flavourphysik" — Otto Eberhardt[1], Heiko Lacker[2], Alexander Lenz[3], •Andreas Menzel[2], Jürgen Rohrwild[4] und Martin Wiebusch[4] — [1]TPP/KIT Karlsruhe — [2]HU Berlin — [3]TU Dortmund — [4]RWTH Aachen

Bei Anwesenheit einer 4. Familie von Fermionen liefert die bisherige Bestimmung der Fermi-Konstanten G_F aus der Myonlebensdauer nur eine Untergrenze des tatsächlichen Wertes, weil nicht mehr von der Unitarität der 3×3-Untermatrix der PMNS-Matrix, welche die Mischung der drei leichten Neutrinoflavours beschreibt, ausgegangen werden kann. G_F kann jedoch in einem Fit bestimmt werden, in dem man die Myonlebensdauer, leptonische Tauonzerfälle, leptonische Pionzerfälle, semileptionische Kaonzerfälle sowie radiative (flavourändernde) Zerfälle von Myonen und Tauonen kombiniert. Dabei erhält man einen etwas größeren Wert von G_F mit einem ca. 230mal größeren Fehler. Gleichzeitig werden diejenigen PMNS-Matrixelemente, die die Mischung mit dem Neutrino ν_4 der 4. Familie beschreiben, eingeschränkt. Als Folge müssen Tree-Level-Messungen von CKM-Matrixelementen teils neu interpretiert werden, um der Nichtunitarität der Mischungsmatrix der leichten Neutrinoflavours Rechnung zu tragen. Durch die schlechtere Einschränkung von G_F erhält das hochpräzise bestimmte Matrixelement $|V_{ud}|$ etwas größere Fehler. Die Analyse der 4×4-CKM-Matrix wird weiter mit schleifeninduzierten Observablen aus dem Bereich der Flavourphysik kombiniert.