

**T 18: Top Quark (Theorie) 1**

Convenor: M. Worek, S. Westhoff

Zeit: Montag 16:45–18:30

Raum: VSH 05

T 18.1 Mo 16:45 VSH 05

**Multi-TeV top-quark pair production at the LHC** — •DAVID HEYMES — University of Cambridge, Cavendish Laboratory (HEP), Cambridge, United Kingdom

Measurements including the top quark have evolved from its discovery at Tevatron to precision physics at the LHC. Especially, top-quark pair production is measured to high accuracy inclusively and differentially.

Precision predictions for top-quark pair production at the LHC are therefore indispensable in order to understand top-quark properties to the accuracy reached at experiments. I will summarize recent developments in next-to-next-to-leading order computations for top-quark pair production and show differential results in a wide kinematic regime.

T 18.2 Mo 17:00 VSH 05

**Polarised amplitudes for top quark pair production at NNLO** — •RENE PONCELET and MICHAL CZAKON — RWTH Aachen University Institute for Theoretical Particle Physics and Cosmology, Aachen, Germany

More than 20 years after its discovery, the investigation of the top-quark and its properties is in a high-precision phase. The LHC plays a central role in this investigation since it provides a large number of  $t\bar{t}$ -pairs. Precise top-quark measurements are an excellent tool for precision measurements of the Standard Model and searches for new physics. An important ingredient for this kind of measurements are precise theory predictions. Meanwhile, NNLO QCD predictions for  $t\bar{t}$ -pair production at the LHC became available for comparison to data. Inclusive or differential, these predictions have in common that they assume stable top-quarks and use spin-summed matrix-elements. The information about spin-correlations with decay products is therefore lost. I present here the first calculation of amplitudes for production of polarized on-shell  $t\bar{t}$ -pairs at NNLO QCD which is a necessary ingredient to incorporate spin-correlated top-decays in Narrow-Width-Approximation. The full calculation including higher order corrections to the decays can be used to extract the top-quark mass parameter more precisely from the examination of differential distributions of decay products.

T 18.3 Mo 17:15 VSH 05

**Top-quark pair production at next-to-next-to-leading order QCD in electron positron collisions** — •LONG CHEN — Institut f. Theoretische Teilchenphysik u. Kosmologie, RWTH Aachen

We set up a formalism, within the antenna subtraction framework, for computing the production of a massive quark-antiquark pair in electron positron collisions at next-to-next-to-leading order in the coupling  $\alpha_s$  of quantum chromodynamics at the differential level. Our formalism applies to the calculation of any infrared-safe observable. We apply this set-up to the production of top-quark top antiquark pairs in the continuum. We compute the production cross section and several distributions. We determine, in particular, the top-quark forward-backward asymmetry at order  $\alpha_s^2$ . Our result agrees with previous computations of this observable.

T 18.4 Mo 17:30 VSH 05

**QCD Korrekturen zur Produktion einzelner Top-Quarks in Assoziation mit einem Higgs-Boson** — •SASCHA PEITZSCH — Humboldt-Universität zu Berlin, Institut für Physik, Newtonstraße 15, 12489 Berlin

Die hadronische Produktion einzelner Top-Quarks in Assoziation mit einem Higgs-Bosons erlaubt das Studium der Top-Quark Kopplung an das Higgs-Boson und ermöglicht präzise Tests des Standardmodells. Da Vorhersagen in Bornapproximation oft große theoretische Unsicher-

heiten aufweisen, wurden für eine verlässliche Vorhersage die QCD Korrekturen berechnet. Der Vortrag gibt einen Überblick über die für die QCD Korrekturen relevanten virtuellen und reellen Korrekturen. Da die hier präsentierten Ergebnisse Anwendung in der Matrixelementmethode in nächstführender Ordnung finden sollen, wurde zur Kürzung der Infrarot-Singularitäten die sogenannte “Phase-Space-Slicing” Methode verwendet. Es werden Ergebnisse für den inklusiven Wirkungsquerschnitt für den LHC bei einer Schwerpunktenergie  $\sqrt{s} = 13\text{ TeV}$  vorgestellt. Darüber hinaus werden auch Resultate für differentielle Verteilungen für verschiedene Observablen präsentiert. Schließlich werden die theoretischen Unsicherheiten auf Grund der Skalenvariation behandelt.

T 18.5 Mo 17:45 VSH 05

**Measuring the Top Yukawa Coupling at 100 TeV** — MICHELANGELO MANGANO<sup>2</sup>, TILMAN PLEHN<sup>1</sup>, •PETER REIMITZ<sup>1</sup>, TORBEN SCHELL<sup>1</sup>, and HUA-SHENG SHAO<sup>2</sup> — <sup>1</sup>Institut für Theoretische Physik, Universität Heidelberg, Germany — <sup>2</sup>Cern, PH-TH, 1211 Geneva 23, Switzerland

We propose a measurement of the top Yukawa coupling at a 100 TeV hadron collider, based on boosted Higgs and top decays. We find that the top Yukawa coupling can be measured to 1%, with excellent handles for reducing systematic and theoretical uncertainties, both from side bands and from  $t\bar{t}H/t\bar{t}Z$  ratios.

T 18.6 Mo 18:00 VSH 05

**Heavy Higgs boson production and decay into top quarks at the LHC** — WERNER BERNREUTHER<sup>1</sup>, •PETER GALLER<sup>2</sup>, CLEMENS MELLEIN<sup>1</sup>, ZONG-GUO SI<sup>3</sup>, and PETER UWER<sup>2</sup> — <sup>1</sup>Institut für Theoretische Teilchenphysik und Kosmologie, RWTH Aachen University, 52056 Aachen, Germany — <sup>2</sup>Institut für Physik, Humboldt-Universität zu Berlin, 12489 Berlin, Germany — <sup>3</sup>School of Physics, Shandong University, Jinan, Shandong 250100, China

We investigate the impact of heavy, neutral Higgs bosons on top-quark pair production at the LHC. For definiteness we consider the type-II two-Higgs-doublet model with two heavy, neutral Higgs bosons with masses larger than twice the top-quark mass. These heavy Higgs bosons can appear as resonances in the  $t\bar{t}$  decay channel. We calculate the resonant production of heavy Higgs bosons and their decay into top-quark pairs including the interference with the standard model (SM) background at next-to-leading order (NLO) QCD. The non-resonant SM contribution to  $t\bar{t}$  production is also taken into account at NLO QCD including weak corrections. Using representative CP-conserving as well as CP-violating parameter scenarios we study different observables and compare their sensitivity to heavy Higgs bosons in the  $t\bar{t}$  channel. In particular, we study spin dependent observables and show that they can enhance the sensitivity significantly.

T 18.7 Mo 18:15 VSH 05

**Monte Carlo tuning for  $t\bar{t}b\bar{a}$  production with Herwig 7** — •LUDOVIC SCYBOZ — Max-Planck-Institut für Physik

With ever-increasing integrated luminosity at LHC, the comparison of high-accuracy  $t\bar{t}b\bar{a}$  measurements from ATLAS with Monte Carlo generator predictions requires improved tunes of the generator parameters. The current study towards defining a new tune for  $t\bar{t}b\bar{a}$  production is based on the new Herwig7 generator. Samples generated with Herwig7 are compared with recent differential measurements using 8 and 13 TeV data recorded with the ATLAS experiment. The comparisons are performed using the Rivet and the Professor framework. In this talk, first results with the Herwig7 generator are presented and compared to the tunes currently used by the ATLAS experiment.