T 33: Search for new particles II

Time: Tuesday 17:00–18:30   Location: H-HS XVI

T 33.1   Tue 17:00   H-HS XVI

Searching for the single production of vector-like quarks in the Wb final state with the ATLAS detector at 13 TeV — ●Ferdinand Schenck[1], Anjishnu Bandyopadhyay[2], Heiko Lacker[1], Janet Dietrich[1], Maxx Rahman[2], Michel Smola[1], and Ian Brock[2] — [1]Humboldt-Universität zu Berlin — [2]Rheinische Friedrich-Wilhelms-Universität Bonn

Vector-Like quarks are hypothetical particles which are consistent with several BSM models, and are promising cadidates for a window into new physics.

This talk will cover the results from an ATLAS search for the single production vector-like $T^{2/3}$ or $Y^{-4/3}$ quarks decaying to a Wb final state using 139 fb^{-1} of proton-proton data collected at 13 TeV by the ATLAS experiment.

Previous searches focused exclusively on the 1-lepton channel, while the new search improves on this by combing the results with a 0-lepton channel for added sensitivity, as well as by the addition of Machine Learning based discriminants and taggers.

T 33.2   Tue 17:15   H-HS XVI

Search for third generation scalar and vector leptoquarks in the context of a stop search at LHC — Ferdinand Krieter, ●Kyeong Ro Lee, and Alexander Mann — Ludwig-Maximilians-Universität München

Leptoquarks (LQs) are hypothetical bosons coupling both to quarks and leptons. Leptoquarks are interesting since they might provide an explanation for similarities between the quark and lepton sector and lepton-universality violation observed in B-anomalies. Assuming there exist leptoquarks coupling to third-generation fermions (i.e. top and bottom quarks, tau leptons and neutrinos), the direct decay products of LQ pairs produced in pp collisions will be similar to final states of stop (SUSY partner of top quark) pairs. Thus a similar strategy applies to the LQ search and the stop search with corresponding optimizations. Currently, there are open possiblities for both scalar ($s = 0$) and vector ($s = 1$) LQs, so an additional goal is to extend the LQ search to vector LQ.

T 33.3   Tue 17:30   H-HS XVI

Search for a singly-produced vector-like quark in the lepton+jets final state with the CMS experiment — ●Anna Benecke, Andreas Hinzmann, Roman Kogler, and Arne Reimers — Universität Hamburg

Many models of physics beyond the Standard Model predict new heavy top partners, the vector-like quarks (T). Considering decay modes $T \to tH, TZ$ and Wb, vector-like quarks are excluded up to a mass of around 1.3 TeV by pair production searches. If other decays are considered, for example to new scalar degrees of freedom, this bound is considerably weaker. The analysis presented here targets the $T \to tH$ decay mode in the lepton+jets final state. The $H \to b\bar{b}$ and $t \to Wb \to l\nu b$ result in a final state with three b jets, which are used to increase the sensitivity of the search. Special emphasis is given to T masses between 600 and 700 GeV, where an analysis in the all-hadronic final state reported an excess above the background expectation of about three standard deviations. Results using pp collision data collected by the CMS experiment in the years 2016 – 2018 at $\sqrt{s} = 13$ TeV, corresponding to an integrated luminosity of 137 fb^{-1}, are presented.

T 33.4   Tue 17:45   H-HS XVI

Search for pair-produced leptoquarks decaying into quarks of the third and leptons of the first or second generation with the ATLAS experiment at $\sqrt{s} = 13$ TeV — ●Volker Austrup and Frank Ellinghaus — Bergische Universität Wuppertal

Motivated by similarities between the quark and lepton sectors in the Standard Model, leptoquarks (LQs) are hypothetical bosons that are assumed to couple to quarks and leptons at the same time. First proposed in the 1980s, the initial model includes couplings only within one generation. However, hints at flavor anomalies recently observed by various experiments such as LHCb, BaBar, and Belle have sparked interest in extended models with LQs coupling to quarks and leptons of different generations.

In this talk, a search for up- ($q = 2/3\,\mathrm{e}$) and down-type ($q = -1/3\,\mathrm{e}$) LQs decaying into quarks of the third and leptons of the first or second generation is presented. The focus of this analysis is on final states with exactly one lepton and large amounts of missing transverse energy. Neural networks (NNs) are applied to ensure good separation between signal and background processes over a wide range of the parameter space. The NN output is subsequently used as the discriminating variable in a profile-likelihood fit in control and signal regions. Expected upper limits on the signal mass are obtained from the fit results as a function of the LQ branching ratio into charged and uncharged leptons. The analysis shown is based on pp-collision data at a centre-of-mass energy of $\sqrt{s} = 13$ TeV measured by the ATLAS experiment at the LHC between 2015 and 2018.

T 33.5   Tue 18:00   H-HS XVI

Leptoquark single production in a τ charm final state at the ATLAS detector — ●Patrick Bauer for the ATLAS-Collaboration — Physikalisches Institut Bonn

At B-factories, anomalies were observed in decays of the B-hadrons into $D^{(*)}$ and $K^{(*)}$, which are consistent with the hypothesis of contributions from Leptoquarks in the high GeV to low TeV range. Therefore, the direct search for leptoquarks (LQ) got once again in focus at high energy collider experiments. So far most searches aimed at the pair-production via strong interaction, as it is enables a almost model independent approach and is for LQ-masses below 1 TeV expected to be dominating.

However for LQ masses well above 1 TeV the single production mode becomes more relevant. The analysis presented this talk, offers the most direct approach for a search of LQ signature related to the $B \to D^{(*)}\tau\nu$ anomaly, as it incorporates essentially the same couplings. Furthermore the process to be investigated could be mediated by a U_1-vector LQ, which is presently widely discussed among theorists, as preferred solution to B-anomalies.It could explain the two observed anomalies within one model. The talk will motivate the analysis and present first monte-carlo studies.

T 33.6   Tue 18:15   H-HS XVI

Suche nach vektorartigen Top-Quarks in Endzuständen mit einem Lepton, Jets und fehlendem transversalem Impuls am ATLAS Experiment — Frank Ellinghaus und ●Jens Roggel — Bergische Universität Wuppertal

Verschiedene Modelle für Physik jenseits des Standardmodells sagen vektorartige Top-Quarks voraus, d.h. schwere Partnerteilchen des Top-Quarks, deren rechts- und links-händige Komponenten gleichartig unter der schwachen Wechselwirkung transformieren.

Die Analyse fokussiert sich auf die Suche nach vektorartigen Top-Quarks aus Paarproduktion mit einem Zerfall in Top-Quark und Z-Boson, wobei das Z-Boson in Neutrinos zerfällt. Die betrachteten Ereignisse werden durch ein Lepton, Jets und einen hohen fehlenden transversalen Impuls im Endzustand gekennzeichnet. Weiter führen die hohen Massen der vektorartigen Top-Quarks zu einem starken Boost der Zerfallsprodukte, was zu einer kollimierten Zerfallstopologie führt. Die Strategie und der Status der Analyse der ATLAS pp Daten bei $\sqrt{s} = 13$ TeV werden präsentiert.