Successful operation of the Large Hadron Collider has led to more than 1 $\text{fb}^{-1}$ of data recorded with both ATLAS and CMS detectors by summer of 2011. This large amount of data has allowed to perform numerous searches for rare processes beyond the Standard Model, many of which are competitive with previous searches performed with the CDF and D0 detectors at the Tevatron. In this talk the most recent searches at the hadron colliders are reviewed.

1. INTRODUCTION

Searches for exotic processes of New Physics beyond the Standard Model have been a major focus of analysis efforts in the last few years at the Tevatron. The successful operation of the Large Hadron Collider (LHC) in 2010 at a center-of-mass energy of $\sqrt{s} = 7$ TeV opened a new season in the exotic searches, providing a new opportunity to spot signatures of new physics. The cross section of rare processes profits greatly from the higher center of mass energy and hence the very first searches at the LHC with just 35 $\text{pb}^{-1}$ of accumulated data in 2010 could compete immediately with the results obtained with the CDF [1] and D0 [2] detectors at the Tevatron, operating at $\sqrt{s} = 1.96$ TeV. The performance of the LHC in 2011 by far exceeded even the more optimistic predictions and both ATLAS [3] and CMS [4] detectors recorded more than 1 $\text{fb}^{-1}$ of data before Summer. This thirty-fold increase in recorded luminosity combined with the excellent performance of the Tevatron in the same period led to more than 60 new results from the four collaborations involved in the exotic searches. Due to time and space constraints, this article cannot serve as a comprehensive review of all ongoing efforts but rather as a snapshot of the latest results using the largest available data samples at the LHC and Tevatron. A complete list of all public results from the four collaborations, together with additional supporting material not included in the papers or conference notes, is available on the web for ATLAS [5], CDF [6], CMS [7], and D0 [8]. Another challenge in reviewing such a large number of results is grouping them in coherent and related groups. A given experimental signature, e.g. di-lepton final state, is predicted by several theoretical models, including new symmetries requiring new heavy bosons and theories of extra dimensions. If final states with two, three, of four objects are considered, where each object can be a jet, lepton, photon, or missing transverse energy (MET), the number of final states is limited and well defined. Rather than using a signature-based approach, in this review searches are grouped in four topics of interest: heavy resonances, both leptonic and hadronic, large extra dimensions, long-lived particles, and 4th generation quarks. For searches with a top quark or $t\bar{t}$ in the final state see the proceedings of this conference [9]. For SUSY searches see the proceedings of this conference [10].

2. HEAVY RESONANCES

Many models of new physics predict the existence of narrow resonances, possibly at the TeV mass scale, that decay to a pair of charged leptons. Some of the more popular models used as benchmark reference include the Sequential Standard Model $Z'_{\text{SSM}}$ with standard-model-like couplings, the $Z'_0$ predicted by grand unified theories [11], and Kaluza–Klein graviton excitations arising in the Randall–Sundrum (RS) model of extra dimensions [12, 13].

The results of searches for narrow $Z' \rightarrow l^+l^-$ and $G_{KK} \rightarrow l^+l^-$ resonances in $p\bar{p}$ collisions at the Tevatron with over 5 $\text{fb}^{-1}$ of integrated luminosity at centre-of-mass energy of 1.96 TeV have previously been published [14, 15, 16, 17]. The most recent unpublished spectrum from the CDF collaboration at Fermilab in the di-electron channel [18] has three events above 600 GeV, the highest at 960 GeV, with an integrated luminosity of 5.7$\text{fb}^{-1}$.

Both ATLAS and CMS collaborations have searched for such narrow resonances in, respectively, 1.2$\text{fb}^{-1}$ and 1.1$\text{fb}^{-1}$ of data collected at the LHC until the summer of 2011 in dilepton (both electrons and muons) [19, 20] and diphoton [21, 22] final states. The observed invariant mass spectra agree with expectations based on standard model processes. Therefore
limits are set on the mass of a narrow heavy resonance. Summary of the observed limits is reported for dileptons in Table I and for diphoton final state in Table II.

Searches have been conducted also for resonances in the dijet final states. No excess of events has been observed beyond the expected background from the Standard Model and limits have been set on the mass on such heavy resonances for a variety of reference models. The most stringent limits today are those obtained by the ATLAS [23] and CMS [24] and are summarized in table III for a few reference models.

Heavy W-like resonances are also predicted by several extensions of the Standard Model. In one such benchmark model [22], the W' boson is considered a heavy analogue of the SM W boson with the same left-handed fermionic couplings. Interactions of the W' boson with the SM gauge bosons and other heavy gauge bosons such as the Z' are excluded. However, in some models coupling to the leptons is suppressed, leading to a relative enhancement in the triple gauge bosons couplings that could lead to a WZ final state [35]. Searches for heavy W' bosons have been performed at the Tevatron [21] for many years and started at the LHC since 2010 using leptonic final states. The most stringent lower limit on the W' mass is about 2.3 TeV and has been obtained at ATLAS [25] and CMS [26]. In the WZ final state masses below 784 GeV have been excluded [37], assuming the extended gauge model for the coupling of W' to WZ.

The search in the WZ final state is also interpreted in the context of Technicolor (TC), a strongly interacting gauge theory which allows for the dynamical breakdown of electroweak symmetry [12, 13]. The lightest $\rho_{TC}$ and $\omega_{TC}$ are expected to have masses below $\sim 700$ GeV, and their decay channels (e.g. $\rho_{TC} \rightarrow WZ$) have distinctive signatures with narrow resonant peaks. A $\rho_{TC}$ with a mass below 382 GeV in the parameter space $M(\pi_{TC}) = 3M(\rho_{TC}) - 25$ GeV has been excluded, as well as $\rho_{TC}$s with masses below 436 GeV in the parameter space $M(\rho_{TC}) < M(\pi_{TC}) + M_W$ [36]. These are the strongest limits to date in this channel.

Recently the CDF collaboration reported an excess in the dijet mass spectrum at 145 GeV [35] in events with two jets produced in association with a W boson. An updated search with $7.3fb^{-1}$ at CDF confirms this excess which however is not confirmed by the D0 collaboration with $5.4fb^{-1}$ of data [40]. A similar search by the ATLAS collaboration at the LHC also does not observe any excess of events beyond the Standard Model background [41].

Finally, searches have been conducted by the ATLAS [45] and CMS [46] collaborations in the $lljj$ final state sensitive to the existence of a heavy neutrino and a right-handed W-like boson as predicted in left-right (LR) symmetric extensions to the Standard Model model [42, 43, 44], which naturally explain the parity violation seen in weak interactions as a result of spontaneously broken parity. No excess of events is observed beyond the expected Standard Model background and exclusion limits are set as a function of the heavy-neutrino and right-handed $W_R$ masses. For a heavy neutrino with masses up to 1 TeV, the exclusion contour extends to $W_R$ masses of up to 1.6 TeV in both electron and muons channels.

### 3. EXTRA DIMENSIONS

The existence of extra spatial dimensions is an intriguing scenario that may solve the hierarchy problem [47] of the Standard Model. The original proposal to use extra dimensions (ED) to solve the hierarchy problem was presented by Arkani-Hamed, Dimopoulos, and Dvali (ADD) [48, 49, 50]. They posited a scenario wherein the SM is constrained to the common 3+1 space-time dimensions (brane), while gravity is free to propagate through the entire multidimensional space (bulk). Thus, the gravitational flux in 3+1 dimensions is effectively diluted by virtue of the multidimensional Gauss’s Law. The fundamental Planck scale $M_D$ is therefore related to the apparent scale.
$M_{Pl}$ according to the formula $M_{Pl}^{n_{ED}+2} = M_{Pl}^{2}/r^{n_{ED}}$ where $r$ and $n_{ED}$ are the size and number of the EDs, respectively. The coupling of the Kaluza-Klein modes to the SM energy-momentum tensor results in an effective theory with virtual graviton exchange at leading order in the perturbation theory. A phenomenological consequence is a non-resonant enhancement of expected dilepton and diphoton events at high invariant masses. The CMS collaboration has searched for such an excess of events in the invariant mass region $> 0.8$ TeV in the diphoton final state \[22\] and $> 1.1$ TeV in the dimuon final state \[51\]. No events in excess of the expected SM background, dominated respectively by QCD and Drell-Yan, are found and exclusion limits are set in the parameter space of the model for $n_{ED} = 2, 3, 4, 5, 6, 7$.

Other direct signatures of ADD include the direct production of gravitons in association with one energetic jet or photon. The gravitons are very weakly coupled and their presence is inferred from the missing transverse energy $E_{T}^{miss}$. The primary SM backgrounds in these channels are the $W/Z+jets$ events with the $Z$ decaying in the invisible channel $\nu\bar{\nu}$ and the $W$ decaying leptonically. In searches for these signature by the ATLAS and CMS collaborations \[52, 53, 54\] the data are found to be in agreement with the expected contributions from SM processes and exclusion limits are set on $M_{D}$ for different values of $n_{ED}$ which significantly improve the previous limits for this model from previous searches at LEP, Tevatron, and LHC.

4. LONG-LIVED PARTICLES

Many extensions of the standard model predict the existence of new Heavy stable or quasi-Stable Charged Particles \[55\] (HSCP). Such particles are present in some supersymmetric models \[56, 57, 58\], and are also a hallmark of split supersymmetry \[59\], where the gluino ($\tilde{g}$) decay is suppressed due to the large gluinosquark mass splitting, from which the theory gets its name. If long-lived gluinos (stops) are produced at the Tevatron, and LHC, there have been many searches for a possible new generation of fermions. Those searches have not found evidence of new fermions beyond the standard model (SM). However, from a theoretical point of view, the number of generations of fermions is not limited to three. The extension of the generations of fermions may have a significant effect on neutrino physics, flavor physics and Higgs physics. With a fourth generation, indirect bounds on the Higgs boson mass can be relaxed \[66, 67\], and an additional generation of quarks may possess enough intrinsic matter and anti-matter asymmetry to be relevant for the baryon asymmetry of the Universe \[68\]. Therefore, there is continued theoretical and experimental interest in such a fourth generation \[69\]. Direct searches restrict the masses of quarks in the fourth generation, $t'$ and $b'$, to be greater than $350 \text{ GeV}/c^2$ \[70, 71\], and the indirect search from LEP excludes a fourth type of light neutrino \[72\]. At the LHC, the QCD production cross section of $t'\bar{t}'$ is expected to be significantly larger than that at the Tevatron \[73\]. This brings us a great opportunity to explore the possibility of new physics with an extended generation of fermions. Several searches at both Tevatron and LHC are presented here which exploit the rich number of final states available following the $t'\bar{t}'$ production. The main background for these searches is due to the Standard Model.

5. 4th GENERATION

Since the discovery of the top quark at the Tevatron, there have been many searches for a possible new generation of fermions. Those searches have not found evidence of new fermions beyond the standard model (SM). However, from a theoretical point of view, the number of generations of fermions is not limited to three. The extension of the generations of fermions may have a significant effect on neutrino physics, flavor physics and Higgs physics. With a fourth generation, indirect bounds on the Higgs boson mass can be relaxed \[66, 67\], and an additional generation of quarks may possess enough intrinsic matter and anti-matter asymmetry to be relevant for the baryon asymmetry of the Universe \[68\]. Therefore, there is continued theoretical and experimental interest in such a fourth generation \[69\]. Direct searches restrict the masses of quarks in the fourth generation, $t'$ and $b'$, to be greater than $350 \text{ GeV}/c^2$ \[70, 71\], and the indirect search from LEP excludes a fourth type of light neutrino \[72\]. At the LHC, the QCD production cross section of $t'\bar{t}'$ is expected to be significantly larger than that at the Tevatron \[73\]. This brings us a great opportunity to explore the possibility of new physics with an extended generation of fermions. Several searches at both Tevatron and LHC are presented here which exploit the rich number of final states available following the $t'\bar{t}'$ production. The main background for these searches is due to the Standard Model.
Table IV Summary of exclusion limits for a fourth generation quark.

| Decay | Exp. | Method | Excluded mass (GeV) | Lum. (fb$^{-1}$) |
|-------|------|--------|--------------------|------------------|
| $b' \rightarrow t + W$ | CMS [74] | lep+jets | 495 | 1.1 |
| $b' \rightarrow t + W$ | CDF [75] | lep+jets | 371 | 4.8 |
| $Q_4 \rightarrow q + W$ | ATLAS [76] | lep+jets | 270 | 0.035 |
| $t' \rightarrow b + W$ | CMS [77] | dilepton | 422 | 1.1 |
| $t' \rightarrow b + W$ | CMS [78] | lep+jets | 450 | 1.1 |
| $t' \rightarrow b + W$ | CDF [79] | lep+jets | 358 | 5.6 |
| $t' \rightarrow b + W$ | D0 [80] | lep+jets | 285 | 5.3 |
| $t' \rightarrow t + A_0$ | CMS [81] | lep+jets | 417 | 0.2 |
| $t' \rightarrow t + A_0$ | ATLAS [82] | dilepton | 290 | 0.034 |
| $t' \rightarrow t + X$ | CDF [83] | hadronic | 400 | 5.7 |
| $t' \rightarrow t + X$ | CDF [84] | lep+jets | 360 | 4.8 |

$t\bar{t}$ and $W/Z$+jets events which could emulate the signal. However, requirements on the total visible transverse energy and the missing transverse energy are typically sufficient to achieve good background rejection and define signal regions with good $S/B$ ratio. The typical decay chain considered in these searches is given by $t'/b' \rightarrow t/b + X$ where $X$ can be either a $W/Z$ boson or a new particle $X$ escaping detection. Therefore the specific final states can vary from all hadronic, when both the top and the $W/Z$ decay hadronically to leptonically only, when only the leptons are used. In all these searches, using different amount of data, no excess is observed beyond the expected Standard Model background and lower limits are set on the mass of the fourth generation fermion. These limits are summarized in Table IV.

6. CONCLUSIONS

The outstanding performance of the LHC and the ATLAS and CMS detectors led to more than 1 fb$^{-1}$ of accumulated data by summer of 2011 exceeding the expectations. This large amount of data has allowed a multitude of searches to be conducted in the first year of LHC operation, with results are are competitive, and in many cases improving the existing limits from the Tevatron. In particular the data acquisition and the computing infrastructure for data delivery worked according to the design specifications enabling thousands of users around the globe to have timely access to the flow of data delivered by the LHC. The detector performance also exceeded the expectations, with the missing transverse energy and the $b$-flavor tagging techniques playing a crucial role in many of the searches presented here. Unfortunately no excess of events has been observed and the measurements are in good agreement with the Standard Model expectations.

References

[1] D. Acosta et al. (The CDF Collaboration), Phys. Rev. D 71, 032001 (2005).
[2] V.M. Abazov et al. (D0 Collaboration), Nucl. Instrum. Methods Phys. Res., Sect. A 565, 463 (2006).
[3] ATLAS Collaboration, JINST 3, S08003 (2008).
[4] CMS Collaboration, “The CMS experiment at the CERN LHC”, JINST 3 (2008) S08004. doi:10.1088/1748-0221/3/08/S08004.
[5] https://twiki.cern.ch/twiki/bin/view/AtlasPublic/ExoticsPublicResults
[6] http://www-cdf.fnal.gov/physics/physics.html
[7] https://twiki.cern.ch/twiki/bin/view/CMSPublic/PhysicsResultsEXO
[8] http://www-d0.fnal.gov/Run2Physics/WWW/results.htm
[9] Francesco Spano, “Top quark production at LHC”, arXiv:1112.3906v1
[10] Xavier Portell Bueso, “Supersymmetry Searches at the Tevatron and the LHC Collider Experiments”, arXiv:1112.1723v1
[11] A. Leike, “The phenomenology of extra neutral gauge bosons”, Phys. Rept. 317 (1999) 143, arXiv:hep-ph/9805494 doi:10.1016/S0370-1573(98)00133-1.
[12] L. Randall and R. Sundrum, “An alternative to compactification”, Phys. Rev. Lett. 83 (1999) 4690, arXiv:hep-th/9906064 doi:10.1103/PhysRevLett.83.4690.
[13] L. Randall and R. Sundrum, “A large mass hierarchy from a small extra dimension”, Phys. Rev. Lett. 83 (1999) 3370, arXiv:hep-ph/9905221 doi:10.1103/PhysRevLett.83.3370.
[14] D0 Collaboration, “Search for Randall-Sundrum gravitons in the dielectron and diphoton final states with 5.4 fb$^{-1}$ of data from $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV, Phys. Rev. Lett. 104 (2010) 241802, arXiv:1004.1826 doi:10.1103/PhysRevLett.104.241802.
[15] D0 Collaboration, “Search for a heavy neutral gauge boson in the dielectron channel with 5.4 fb$^{-1}$ of $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV, Phys. Lett. B 695 (2011) 088, arXiv:1008.2023 doi:10.1016/j.physletb.2010.10.059.
[16] CDF Collaboration, “A search for high-mass resonances decaying to dimuons at CDF, Phys. Rev. Lett. 102 (2009) 091805, arXiv:0811.0053 doi:10.1103/PhysRevLett.102.091805.
[17] CDF Collaboration, “Search for High-Mass $e^+e^-$ Resonances in $p\bar{p}$ Collisions...
23. Exotic (non SUSY) Searches S. Rahatlou (U Roma)

at $\sqrt{s} = 1.96$ TeV, *Phys. Rev. Lett.* 102 (2009) 031801, arXiv:0810.2059

[18] CDF Collaboration, “Search for New DiElectron Resonances and Randall-Sundrum Gravitons at the Collider Detector at Fermilab,” (2011).

[19] ATLAS Collaboration, “Search for dilepton resonances in pp collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector”, arXiv:1108.1682.

[20] CMS Collaboration, “Search for Resonances in the Dilepton Mass Distribution in pp Collisions at $\sqrt{s} = 7$ TeV”, *CMS PAS EXO-11-019* (2011).

[21] ATLAS Collaboration, “A Search for High Mass Diphoton Resonances in the Context of the Randall-Sundrum Model in $\sqrt{s} = 7$ TeV pp Collisions”, *ATLAS-CONF-2011-044* (2011).

[22] CMS Collaboration, “Search for Extra Dimensions in the Diphoton Final State at the Large Hadron Collider”, *CMS PAS EXO-11-038* (2011).

[23] ATLAS Collaboration, “Search for New Physics in the Dijet Mass Distribution using $fb^{-1}$ of pp Collision Data at $\sqrt{s} = 7$ TeV collected by the ATLAS Detector”, arXiv:1108.6311v1.

[24] CMS Collaboration, “Search for Resonances in the Dijet Mass Spectrum from 7 TeV pp Collisions at CMS”, arXiv:1107.4771v1.

[25] U. Baur, I. Hinchliffe, and D. Zeppenfeld, “Excited Quark Production at Hadron Colliders”, *Int. J. Mod. Phys. A* 2 (1987) 1285. doi:10.1142/S0217751X87000661.

[26] U. Baur, M. Spira, and P. M. Zerwas, “Excited Quark and Lepton Production at Hadron Colliders, *Phys. Rev. D* 42 (1990) 815. doi:10.1103/PhysRevD.42.815.

[27] P. H. Frampton and S. L. Glashow, “Chiral color: An alternative to the standard model, *Phys. Lett. B* 190 (1987) 157. doi:10.1016/0370-2693(87)90859-8.

[28] E. H. Simmons, “Coloron phenomenology, *Phys. Rev. D* 55 (1997) 1678. doi:10.1103/PhysRevD.55.1678.

[29] J. Bagger, C. Schmidt, and S. King, “Axigluon production in hadronic collisions”, *Phys. Rev. D* 37 (1988) 1188. doi:10.1103/PhysRevD.37.1188.

[30] L. A. Anchordoqui et al., “Jet signals for low mass strings at the Large Hadron Collider”, *Phys. Rev. Lett.* 101 (2008) 241803. doi:10.1103/PhysRevLett.101.171603.

[31] S. Cullen, M. Perelstein, and M. E. Peskin, “TeV strings and collider probes of large extra dimensions”, *Phys. Rev. D* 62 (2000) 055012. doi:10.1103/PhysRevD.62.055012.

[32] G. Altarelli, B. Mele, and M. Ruiz-Altaba, “Searching for New Heavy Vector Bosons in $p\bar{p}$ Colliders”, *Z. Phys. C45* (1989) 109.

[33] M. Chen, B. Dobrescu, K. Nakamura et al., “The Review of Particle Physics: W'-Boson Searches”, *J. Phys. G* 37 (2010) 075021. doi:10.1088/0954-3899/37/7A/075021.

[34] D0 Collaboration, “Search for resonant WW and WZ production in ppbar collisions at $\sqrt{s} = 1.96$ TeV”, *Phys. Rev. Lett.* 107 (2011) 011801. doi:10.1103/PhysRevLett.107.011801.

[35] ATLAS Collaboration, “Search for a heavy gauge boson decaying to a charged lepton and a neutrino in $fb^{-1}$ of pp collisions at $\sqrt{s} = 7$ TeV using the ATLAS detector”, arXiv:1108.1316.

[36] CMS Collaboration, “Search for W in the leptonic channels in pp Collisions at $\sqrt{s} = 7$ TeV”, *CMS PAS EXO-11-024*.

[37] CMS Collaboration, “Search for W (or techni-lepton) to WZ”, *CMS PAS EXO-11-041*.

[38] T. Aaltonen et al. (CDF Collaboration), *Phys. Rev. Lett.* 106, 171801 (2011).

[39] http://www-cdf.fnal.gov/physics/ewk/2011/wwj/73.html.

[40] D0 Collaboration, “Bounds on an Anomalous Dijet Resonance in W+jets Production in pp Collisions at $\sqrt{s} = 1.96$ TeV”, doi:10.1103/PhysRevLett.107.011804.

[41] ATLAS Collaboration, “Invariant mass distribution of jet pairs produced in association with a leptonically decaying W boson using 1.02 fb of ATLAS data”, *ATLAS-CONF-2011-097*.

[42] J. C. Pati and A. Salam, *Phys. Rev. D* 10 (1974) 275.

[43] R. N. Mohapatra and J. C. Pati, *Phys. Rev. D* 11 (1975) 366.

[44] G. Senjanovic and R. N. Mohapatra, *Phys. Rev. D* 12 (1975) 1502.

[45] ATLAS Collaboration, “Search for heavy Majorana neutrino and $W_R$ in dijet plus jets events with the ATLAS detector in pp collisions at $\sqrt{s} = 7$ TeV”, *ATLAS-CONF-2011-115*.

[46] CMS Collaboration, “Search for a heavy neutrino and right-handed W of the left-right symmetric model in pp collisions at $\sqrt{s} = 7$ TeV”, *CMS PAS EXO-11-002*.

[47] E. Witten, “Mass Hierarchies in Supersymmetric Theories”, *Phys. Lett. B* 105 (1981) 267. doi:10.1016/0370-2693(81)90885-6.

[48] N. Arkani-Hamed, S. Dimopoulos, and G. Dvali, “The hierarchy problem and new dimensions at a millimeter”, *Phys. Lett. B* 429 (1998) 263. doi:10.1016/S0370-2693(98)00466-3.

[49] G. Giudice, R. Rattazzi, and J. Wells, “Quantum gravity and extra dimensions at high-energy colliders”, *Nucl. Phys. B* 544 (1999) 3. doi:10.1016/S0550-3213(99)00044-9.

[50] T. Han, J. Lykken, and R.-J. Zhang, “On Kaluza-Klein states from large extra dimensions”, *Phys. Rev. D* 59 (1999) 105006.
CMS PAS EXO-11-058.

[55] M. Fairbairn et al., “Stable massive particles at colliders”, Phys. Rept. 438 (2007) 163. doi:10.1016/j.physrep.2006.10.002.

[56] S. Dimopoulos, M. Dine, S. Raby et al., “Experimental Signatures of Low Energy Gauge Mediated Supersymmetry Breaking”, Phys. Rev. Lett. 76 (1996) 34943497. doi:10.1103/PhysRevLett.76.3494.

[57] H. Baer, K.-m. Cheung, and J. F. Gunion, “A Heavy gluino as the lightest supersymmetric particle”, Phys. Rev. D50 (1999) 075002. doi:10.1103/PhysRevD.59.07500.

[58] T. Jittoh, J. Sato, T. Shimomura et al., “Long life stau”, Phys. Rept. D73 (2006) 055009. arXiv:hep-ph/0512197.

[59] N. Arkani-Hamed and S. Dimopoulos, “Supersymmetric unification without low energy supersymmetry and signatures for fine-tuning at the LHC”, JHEP 06 (2005) 073, arXiv:hep-th/0405159.

[60] A. Arvanitaki, S. Dimopoulos, A. Pierce et al., “Stopping gluinos”, Phys. Rev. D76 (2007) 055007. arXiv:hep-ph/0506242.

[61] CMS Collaboration, “Search for Stopped Heavy Stable Charged Particles in pp collisions at $\sqrt{s} = 7$ TeV”, CMS PAS EXO-11-020.

[62] CMS Collaboration, “Search for Heavy Stable Charged Particles in $\sqrt{s} = 7$ TeV”, CMS PAS EXO-11-022.

[63] ATLAS Collaboration, “Search for stable hadronising squarks and gluinos with the ATLAS experiment at the LHC”, Phys. Lett. B 701 (2011) 1-19. doi:10.1016/j.physletb.2011.05.010.

[64] CMS Collaboration, “Search for Heavy Stable Charged Particles in pp collisions at sqrt(s)=7 TeV”, JHEP 3 (2011) 24. doi:10.1007/JHEP03(2011)024.

[65] D0 Collaboration, “A search for charged massive long-lived particles”, arXiv:1110.3302v1.

[66] P. Q. Hung and M. Sher, “Experimental constraints on fourth generation quark masses”, Phys. Rev. D 77 (Feb, 2008) 037302. doi:10.1103/PhysRevD.77.037302.

[67] G. D. Kribs, T. Plehn, M. Spannowsky et al., “Four generations and Higgs physics”, Phys. Rev. D 76 (Oct, 2007) 075016. doi:10.1103/PhysRevD.76.075016.

[68] W.-S. Hou, “CP Violation and Baryogenesis from New Heavy Quarks”, Chin. J. Phys. 47 (2009) 134. arXiv:0803.1234.

[69] B. Holdom et al., “Four Statements about the Fourth Generation”, PMC Phys. A3 (2009) 4. arXiv:0904.4698.

[70] CDF Collaboration, “Search for Heavy Top $t' \to Wq$ in Lepton Plus Jets Events in 4.6 fb$^{-1}$”, CDF public conference note CDF/PUB/TOP/PUBLIC/10110 (unpublished) (2010).

[71] CDF Collaboration, “Search for heavy bottomlike quarks decaying to an electron or a muon and jets in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV”, Phys. Rev. Lett. 106 (2011) 141803. doi:10.1103/PhysRevLett.106.141803.

[72] D. Decamp et al., “Determination of the number of light neutrino species”, Phys. Lett. B 231 (1989) 519.

[73] E. L. Berger and Q.-H. Cao, “Next-to-Leading Order Cross Sections for New Heavy Fermion Production at Hadron Colliders”, Phys. Rev. DS1 (2010) 035006. arXiv:0909.3555.

[74] CMS Collaboration, “Search for a Heavy Bottomlike Quark in 1.14 fb$^{-1}$ of pp Collisions at $\sqrt{s} = 7$ TeV”, CMS PAS EXO-11-036.

[75] CDF Collaboration, “Search for heavy bottomlike quarks decaying to an electron or muon and jets in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV”, Phys. Rev. Lett. 106 (2011) 141803. doi:10.1103/PhysRevLett.106.141803.

[76] ATLAS Collaboration, “Search for Fourth Generation Quarks Decaying to $Wq\bar{q}$ in pp collisions at $\sqrt{s} = 7$ TeV with the ATLAS Detector”, ATLAS-CONF-2011-022.

[77] CMS Collaboration, “Search for a Heavy Top-like Quark in the Dilepton Final State in pp Collisions at $\sqrt{s} = 7$ TeV”, CMS PAS EXO-11-050.

[78] CMS Collaboration, “Search for pair production of a fourth-generation $t'$ quark in the lepton-plus-jets channel with the CMS experiment”, CMS PAS EXO-11-051.

[79] CDF Collaboration, “Search for Heavy Top $t' \to Wq$ in Lepton Plus Jets Events in 5.6 fb$^{-1}$”, CDF Conference Note 10395 unpublished.

[80] D0 Collaboration, “Search for a Fourth Generation $t'$ Quark in $p\bar{p}$ Collisions at $\sqrt{s} = 1.96$ TeV”, Phys. Rev. Lett. 107 (2011) 082001. doi:10.1103/PhysRevLett.107.082001.
[81] CMS Collaboration, “Search for a Top-like Quark Decaying To A Top Quark And a Z boson in pp Collisions at $\sqrt{s} = 7$ TeV”, CMS PAS EXO-11-005.

[82] ATLAS Collaboration, “Inclusive search for same-sign dilepton signatures in pp collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector”, JHEP 10 (2011) 107. doi:10.1007/JHEP10(2011)107.

[83] CDF Collaboration, “Search for new physics in $tt + MET \rightarrow bbqqq + MET$ final state in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV”, arXiv:1107.3574v1.

[84] CDF Collaboration, “Search for Production of Heavy Particles Decaying to Top Quarks and Invisible Particles in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV”, Phys. Rev. Lett. 106 (2011) 191801. doi:10.1103/PhysRevLett.106.191801.

23. Exotic (non SUSY) Searches S. Rahatlou (U Roma)