

DÉFENSE PUBLIQUE DE LA DISSERTATION DE DOCTORAT
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titulaire d'une Licence en sciences physiques ainsi que d'un DEA en sciences,
orientation physique

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Réunion du jury pour statuer sur la recevabilité de la dissertation

Jeudi 19 novembre 2015, à 15h, salle des Conseils, Grands Amphithéâtres

Date et lieu de la défense publique

Vendredi 4 décembre 2015, à 15h, salle Vésale 030

Titre de la dissertation

Search for top s-quarks in bottom s-quark production in R-parity violating supersymmetric models with the CMS detector

Résumé de la dissertation

The discovery of the Higgs boson in 2012 at the CERN's Large Hadron Collider (LHC) by both the ATLAS and the CMS experiments completes the last missing piece of the Standard Model of particle physics. Despite its success to describe the experimental observations in high energy physics, the Standard Model presents several theoretical and experimental issues; for example the problem of the “naturalness” – the introduction of a fine-tuning in the Higgs boson mass correction calculations. Therefore the Standard Model needs to be extended into a more general model. Among the most popular models, are the supersymmetric models, which introduce a symmetry between fermions and bosons.

In the present thesis, we search for a possible manifestation of the Supersymmetry. In particular, we study a model with the R-parity violation (RPV), which allows s-quarks to decay into a pair of the Standard Model quarks. In this model, the lightest top s-quark \tilde{t}_1 is the lightest supersymmetric particle (LSP) and the bottom s-quark \tilde{b}_1 is the next-to-lightest supersymmetric particle (NLSP), with their masses ranging from 150 GeV to 400 GeV, maintaining so the “naturalness” of the Supersymmetry. In this context, we study the process:

$$pp \rightarrow \tilde{b}_1 \bar{\tilde{b}}_1 \rightarrow \tilde{t}_1 W^- + \bar{\tilde{t}}_1 W^+ \rightarrow qq'l^- \bar{\nu} + qq'l^+ \nu.$$

The search is performed by analysing 19.6/fb of data collected during the proton-proton collisions at a centre-of-mass energy of 8 TeV by the CMS detector at the LHC in 2012. This search is optimized for small mass splitting between the \tilde{b}_1 and \tilde{t}_1 s-quarks (under 100 GeV), when the leptons in final state have low transverse momenta. The selected events contain two opposite-sign, isolated leptons (electrons or muons) and at least four reconstructed jets. The leptons are used further to discriminate the signal from the Standard Model background, while the jets are used to reconstruct the \tilde{t}_1 s-quark candidates.

The relevant Standard Model background sources in the data are carefully estimated using Monte-Carlo and data driven techniques. A statistical analysis, based on the CL_s method, is performed by comparing the reconstructed \tilde{t}_1 mass distribution obtained with data and simulations. We do not find any excess of events in the data, compared to the Standard Model expectations, and derive 95 % confidence level exclusion limits on the \tilde{b}_1 and \tilde{t}_1 s-quark masses for various configurations of the RPV coupling values.