Contribution ID: **118** Type: **not specified**

Constraints on non-universal gaugino mass scenario using the latest LHC data

Tuesday 12 July 2016 16:15 (20 minutes)

In our work, we investigate exclusion limits on the parameter space of the Non-Universal Gaugino Mass (NUGM) scenario
where a natural SUSY spectrum is achieved due to a relatively heavy wino mass parameter. We calculated the bound on the mass of top squark, which is almost right-handed and then it can decay into both $t\tilde{\chi}^0_{1,2}$ and $b\tilde{\chi}^\pm_1$. The top squark mass is roughly controlled by the bino mass parameter since the RG contributions from the gluino and the wino mass parameters are canceled each other in the light higgsino region. Thus the top squark searches at the LHC Run I and Run II can constrain
parameter region with the small bino mass parameter and the large gluino mass parameter. The top squark lighter than 700 GeV is excluded at $\mu \leq 150$ GeV, and lighter than 600 GeV is excluded at $\mu \leq 300$ GeV according to the result of the search for $bb + E_T^{\rm miss}$ at the LHC Run II. This limit already exceeds the one from the LHC Run 1 data. This lower bound corresponds to $M_1 \geq 6.0$ TeV for $\mu \sim 150$ GeV and $M_1 \geq 5.0$ TeV for $\mu \sim 300$ GeV. Note that there is no bound from the top squark search when $\mu \geq 300$ GeV. Gluino search is also good probes to the NUGM scenario due to the large production cross section.
According to the LHC results, the parameter space with the small gluino mass and the large bino mass can be covered in our scenario. Note that the top squark is tachyonic in the parameter region where both bino and gluino masses are small.
The gluino mass less than 1.55 TeV is excluded by the ATLAS result at the LHC Run II when μ satisfies $\mu \leq 500$ GeV. We can conclude that the parameter region with $M_3 < 650$ GeV and $\mu \leq 500$ GeV is already excluded.
Bottom squark mass can be same or lighter than top squark mass
if $\tan\beta$ is so large that the bottom Yukawa coupling becomes sizable. Since the behavior of bottom squark at the collider experiment is quite similar to the one of top squark,
the top squark search discussed above is also sensitive to the events generated by the bottom squarks. The wider region is prohibited theoretically compared with the small $\tan\beta$ case, in order to avoid the tachyonic bottom squarks or the tau slepton. The exclusion limit on the bino mass parameter reaches to $M_1 \simeq 12$ TeV for $M_3 \simeq 800$ GeV,
and it reduces to 6.0 TeV as M_3 increases.

Summary

We investigate exclusion limits on the the non-universal gaugino mass scenario
in the Minimal Supersymmetric Standard Model (MSSM), according the the latest results of the super-particle search at the LHC8 and the LHC13. In this scenario, suitable ratios of wino to gluino mass can realize the observed value of the Higgs boson mass, while keeping a small μ parameter.
Such a small μ parameter corresponds to the mass of higgsino, so that
lightest neutralino and chargino are higgsino-like and their masses are almost degenerate.
Besides, we find that the right-handed top squark tends to be lighter than other sfermions
and then the top squark search, where the top squark decays to a quark and higgsino, is relevant to our model.
In our analysis, the exclusion limits are derived using the data of the top squark searches

in the $bb + E_T^{\rm miss}$ and $tb + E_T^{\rm miss}$ channels.
Furthermore, the exclusion limit on gluino mass, which is crucial to our scenario, is investigated as well.
The analysis of the gluino is based on the data of the analysis with large missing energy and at least three b-tagged jets at the ATLAS experiment.
This work is based on PTEP 2013 (2013) 013B02, JHEP 1508 (2015) 089 and PRD 93 (2016) no.5, 055019.

Primary author: KAWAMURA, Junichiro (Waseda University)

Co-author: Dr OMURA, Yuji (Nagoya University)

Presenter: KAWAMURA, Junichiro (Waseda University)

Session Classification: Parallel II

Track Classification: Physics at Colliders