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Search and Constraints on NLSP Gluino Models

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We investigate the collider phenomenology of gluino-bino co-annihilation scenario at the 7 TeV LHC. This scenario can be realized in a class of realistic supersymmetric models with non-universal gaugino masses and t - b - τ Yukawa unification. The NLSP gluino and LSP bino should be nearly degenerate in mass, so that the typical gluino search channels involving leptons or hard jets are not available. Consequently, the gluino can be lighter than various bounds on its mass from direct searches. We propose a new search for NLSP gluino involving multi- b final states, arising from the three-body decay $\tilde{g} \rightarrow b\bar{b}\tilde{\chi}_1^0$.

The ATLAS experiment has recently presented its search results for final states containing jets and/or b -jet(s) and missing transverse momentum, corresponding to an integrated luminosity of 165 pb^{-1} . We employ this data to constrain a class of supersymmetric $SU(4)_c \times SU(2)_L \times SU(2)_R$ models with t - b - τ Yukawa unification, in which the gluino is NLSP. We find that NLSP gluino masses below $\sim 300 \text{ GeV}$ are excluded by the ATLAS data. For LSP neutralino mass ~ 200 - 300 GeV and $\mu > 0$, where μ is the coefficient of the MSSM Higgs bilinear term, the LHC constraints in some cases on the spin-dependent (spin-independent) neutralino-nucleon cross section are significantly more stringent than the expected bounds from IceCube DeepCore (Xenon 1T/SuperCDMS). For $\mu < 0$, this also holds for the spin-dependent cross sections.

Primary authors: Mr AJAIB, Adeel (University of Delaware); Dr WANG, Kai (Zhejiang University); Prof. SHAFI, Qaisar (University of Delaware); Dr LI, Tong (University of Delaware)

Presenter: Dr LI, Tong (University of Delaware)

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