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# Phenomenological and experimental searches for compressed stau-neutralino production at the LHC

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We present an experimental search of Supersymmetry motivated by electrowikinos production in the electroweak sector using the CMS experiment at $\sqrt{s} = 13$ TeV. Data comes from proton-proton (pp) collisions corresponding to 35.9 and 41.3 $fb^{-1}$ collected during 2016 and 2017 respectively. We focus in final states containing a hadronic tau ($\tau_h$) of low transverse momentum ($p_T$), an initial state radiation jet (ISR), and a large imbalance of missing transverse energy ($p_T^{miss}$). By selecting an ISR jet in the final states, the SUSY signal in a kinematic region called compress mass spectra scenarios is maximized, where the mass difference between the stau ($\tilde{\tau}$) and the lightest supersymmetric particle, the neutralino ($\tilde{\chi}_1^0$) is small. This search has a special scientific interest due to the direct connection between particle physics and cosmology, in which, to obtain the correct relic dark matter density measured by the cosmology ($\Omega_{DM}h^2 = 0.1186 \pm 0.002$) in thermal dark matter models, the mass between the $\tilde{\tau}$ and the $\tilde{\chi}_1^0$ must be small. The phase space for the compressed stau has been difficult to prove at the LHC, nevertheless, no data excess is observed over the standard model estimation. The exclusion limits at $95\%$ of confidence level were established for the democratic scenario where $m(\tilde{\tau}) = 0.5m(\tilde{\chi}_1^{\pm}) + 0.5m(\tilde{\chi}_1^0)$. For the total cumulative luminosity of 2016 and 2017 (77.2 $fb^{-1}$), chargino masses are excluded up to $m(\tilde{\chi}_1^{\pm}) < 290$ GeV, where the mass gap between the chargino and the neutralino is $m(\tilde{\chi}_1^{\pm}) - m(\tilde{\chi}_1^0) = 50$ GeV.

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