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

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We propose an experimental search for physics beyond the standard model at the Compact Muon Solenoid (CMS) experiment, using as benchmark a supersymmetric model in the electroweak sector. We focus in final states containing a hadronic tau, a jet from initial state radiation and a large imbalance of energy in the transverse plane of the detector. The search focuses in compressed mass spectra scenarios, where the mass difference between the stau ($\widetilde{\tau}$) and the lightest supersymmetric particle, the neutralino ($\widetilde{\chi}_0$), is small. The proposed analysis is of special scientific interest, since, it is motivated by a direct connection between particle physics and cosmology. To obtain the correct relic dark matter density predicted by cosmology, in thermal dark matter models, the mass gap between the $\widetilde{\tau}$ and the $\widetilde{\chi}_0$ must be small. The phase space at LHC for compressed $\widetilde{\tau}'s$ is very difficult to prove. A phenomenological study has been performed for the proposed final state, showing good sensitivity to search for new physics in this difficult region, which yet remains as uncharted territory at the LHC.

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