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Relic density determination at the LHC

The neutralino is the lightest supersymmetric particle in many SUSY models. Thus in R parity conserving models it provides a perfect dark matter candidate by being electromagnetically neutral, weakly interacting and stable. Following cosmological models, at the freeze-out time most neutralinos should have been transformed into standard model particles by annihilation. The annihilation cross section is inversely proportional to the observed dark matter density and thus precisely known.
In case SUSY will be discovered at the LHC, it is not a proof that the neutralino is the dark matter existing in the universe. But to get a hint one can try to determine the neutralino annihilation cross section from LHC data and see if it is consistent with the annihihilation cross section corresponding to the relic density, as discussed above.
It is shown that in a large region of parameter space this cross section is dominated by pseudoscalar Higgs exchange and the correct value can only be obtained for values of tanβ around 50. This would lead o a large cross section for pseudoscalar Higgs production, which is proportional to tanβ squared.
This cross section or the width of the pseudoscalar Higgs can be exploited to determine tanβ and thus determine the annihilation cross section in the regions without co-annihilation or very light squarks and sleptons. In the latter case the t-channel would dominate, but this region is already excluded by the Higgs limits and other electroweak constraints.

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