

Search for an invisible scalar in $t\bar{t}$ final states at the LHC (12'+3')

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We present a phenomenological study where an invisible scalar mediator is produced in association with a top-quark pair at the Large Hadron Collider (LHC). Using a $t\bar{t}$ experimental-like analysis, we search for light scalar particles that could be hidden in the $t\bar{t}$ final state. The signal process $pp \rightarrow t\bar{t}Y_0$ is generated within a simplified dark matter (DM) model implemented in MadGraph5_aMC@NLO, where the scalar mediator Y_0 couples to both Standard Model (SM) and DM particles. Scenarios with CP-even and CP-odd couplings of Y_0 to the top quarks are investigated for different mediator masses, ranging from very light scalars (~ 0 GeV) up to values close to the Higgs boson mass (125 GeV). The analysis focuses on the dileptonic decay channel of the $t\bar{t}$ system, reconstructed through a kinematic fit without reconstructing the mediator. CP angular observables were used to probe the CP-nature of the mediator-top coupling, which allowed to set confidence level (CL) limits on the corresponding Yukawa couplings as a function of the mediator mass.

Presenter: CAPUCHA, Rodrigo (Centro de Física Teórica e Computacional, FCUL)

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