ID de Contribution: **57**   Type: **Non spécifié**

Search for doubly resonant beyond the Standard Model process with one Higgs boson and one scalar resonance in the final state in the $b\bar{b}\gamma\gamma$ channel in the ATLAS experiment at the LHC

jeudi 28 novembre 2024 10:00 (30 minutes)

Physics at the Large Hadron Collider (LHC) at CERN (European Organization for Nuclear Research) is the high priority research field of the Particle Physics community worldwide. ATLAS is one of the two general purpose experiments installed at the LHC that discovered a Higgs boson in July 2012, key piece for the understanding of the fundamental interactions and the origin of elementary particle mass. Its physics program extends beyond Higgs property measurements to the search for signs of physics beyond the Standard Model (BSM) of particle physics.

Many theoretical BSM (Beyond the Standard Model) models predict the existence of new scalar particles in the Higgs sector, denoted as X and S, which could be produced in proton-proton collisions in association with a Higgs boson: $pp \rightarrow X \rightarrow SH$. Searches for such particles have been conducted by several analysis teams within the ATLAS and CMS experiments. Notably, one analysis reported a local (global) excess of 3.5σ (2.0σ) for $X = 575$ GeV and $S = 200$ GeV compared to the background-only hypothesis in the decay channel $X \rightarrow SH \rightarrow b\bar{b}\gamma\gamma$, using 140 fb^{-1} of ATLAS Run 2 data at $\sqrt{s} = 13$ TeV. While this excess is below the discovery threshold of 5σ, it may suggest a possible deviation from the Standard Model prediction.

A search is performed for a new scalar particles, X and S, using ATLAS Run 2 data $\sqrt{s} = 13$ TeV and partial Run 3 data $\sqrt{s} = 13.6$ TeV. That could either allow to confirm the existence of these particles with a higher significance ($> 5\sigma$) or refute their existence.

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Classification de Session: Beyond Standard Model