

# Search for Heavy (pseudo)Higgs boson A/H produced in association with a top-antitop quark pair leading to the final state with four top quarks in $pp$ collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector

*Tuesday, 13 July 2021 15:15 (15 minutes)*

Four top-quark production, a rare process in the Standard Model (SM) with a cross-section around 12 fb, is one of the heaviest final states produced at the LHC, and it is naturally sensitive to physics beyond the Standard Model (BSM). A data excess is observed with twice of the expectation. A follow-up analysis is the search for Heavy (pseudo)Higgs boson A/H produced in association with a top-antitop quark pair leading to the final state with four top quarks. The data analyzed correspond to an integrated luminosity of  $139 \text{ fb}^{-1}$  of proton-proton collision data at a centre-of-mass energy of 13 TeV collected by the ATLAS detector at the LHC. In this talk, the four top-quark decay final states containing either a pair of same-sign leptons or multi-lepton (SSML) are considered. To enhance the search sensitivity, a mass-parameterized BDT is introduced to discriminate the BSM signal against the irreducible SM four-top and other dominant SM backgrounds. Expected upper bounds on the production cross-section of A/H are derived in the mass range from 400 GeV to 1000 GeV.

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**Session Classification:** Beyond Standard Model

**Track Classification:** Beyond Standard Model Physics