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Measurement of Higgs boson production in association with a ttbar pair in the diphoton decay channel using 139 fb^{-1} of LHC data collected at $\sqrt{s}$ = 13 TeV by the ATLAS experiment

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A measurement of the ttH production in the diphoton decay channel is performed using 139 fb^{-1} of pp collision data with a center-of-mass energy √s = 13 TeV recorded by the ATLAS experiment at the LHC. Two regions are defined to target either the fully hadronic or semi-leptonic decay of the top quark. In each, a boosted decision tree (BDT) is trained to create ttH enhanced categories. The measurement is then performed with a simultaneous fit to the diphoton mass in these BDT-based categories.

The ttH production is observed in the diphoton decay mode with a significance of 4.9 standard deviations, compared to an expected significance of 4.2 standard deviations. The ttH cross section times $H \rightarrow\gamma\gamma$ branching ratio is measured to be $1.59^{+0.43}_{-0.39}$ fb, in agreement with the Standard Model prediction. This is the first single channel observation of the ttH production, and the first published measurement using the full ATLAS Run 2 data set.

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