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Search for Higgs boson decays into a pair of pseudoscalar particles in the $\gamma\gamma\tau\tau$ final state using pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector

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Many well-motivated extensions of the Standard Model predict light (pseudo)scalars, referred to as ☒ bosons, that couple to the 125 GeV Higgs boson, enabling new exotic decay modes. This study presents a search for Higgs boson decays into a pair of such particles, $H \to bb$, where one ☒-boson decays into a photon pair and the other into a τ-lepton pair, performed for the first time at the Large Hadron Collider. Both τ-leptons are reconstructed in their hadronic decay modes using a novel dedicated tagger for collimated τ-lepton pairs. The search uses 140/fb of proton–proton collision data at a centre-of-mass energy of $\sqrt{s} = 13$ TeV recorded between 2015 and 2018 by the ATLAS experiment. The search is performed in the mass range of the a boson between 10 GeV and 60 GeV.

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