

# Combination of searches for Higgs boson decays into a photon and a massless dark photon using pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector

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A combination of searches for Higgs boson decaying into a visible photon and a massless dark photon ( $H \rightarrow \gamma \gamma_d$ ) is presented using  $139 \text{ fb}^{-1}$  of proton-proton collision data at a centre-of-mass energy of  $\sqrt{s} = 13$  TeV recorded by the ATLAS detector at the Large Hadron Collider. The observed (expected) 95% confidence level upper limit on the Standard Model Higgs boson decay branching ratio is determined to be  $\text{Br}(H \rightarrow \gamma \gamma_d) < 1.3\%$  (1.5%). The search is also sensitive to higher-mass Higgs bosons decaying into the same final state. The observed (expected) 95% CL limit on the cross section times branching ratio ranges from 16 fb (26 fb) for  $m_H = 400$  GeV to 1.0 fb (1.5 fb) for  $m_H = 3$  TeV. Results are also interpreted in the context of a minimal simplified model.

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