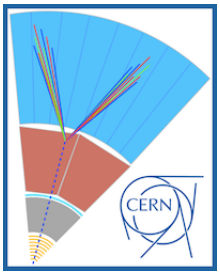

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Limits on long-lived axion-like particles from previous searches for exotic decays of the Higgs boson with the ATLAS detector

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Two ATLAS searches for anomalous decays of the Higgs boson into pseudo-scalar particles are used to set exclusion limits for models containing decays to long-lived axion-like particles (ALPs). Both searches use the full Run˜2 data set of $140 fb^{-1}$ of proton-proton collisions at a centre-of-mass energy of 13 TeV recorded by the ATLAS experiment. The first search involves the decay of the Higgs boson to a Z boson and a light pseudo-scalar particle promptly decaying to two photons, where in this note long-lived ALPs with masses in the range 2-33 GeV and effective ALP-photon couplings, $|C|/\Lambda$, as small as 3×10^{-6} TeV^{-1} are excluded. The second search involves the decay of the Higgs boson to a pair of pseudo-scalar particles with finite lifetimes each decaying to two photons, where in this note ALPs with low masses in the range 0.01-0.1 GeV and effective ALP-photon couplings as small as 0.1 TeV{ˆ−1} are excluded. Upper limits at 95% confidence level are provided on both the branching ratio of the Higgs boson to a Z boson and a non-promptly decaying ALP, and to a pair of non-promptly decaying ALPs, with values in the range 0.05%-20% depending on the ALP mass and couplings.

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