

Search for axions in $H \rightarrow aa \rightarrow 4\gamma$ decays at the LHC's ATLAS experiment

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Abstract

The axion particle discovery could answer the big CP problem as it is hypothetically predicted. Hence A study on the exotic decay of the Higgs boson to two Axion Like Particles (ALPs) [1], [2], which in turn decay to two photons, was carried out. This analysis covers the mass range of ALPs between 100 MeV and 60 GeV and ALPs-photon couplings $C_{a\gamma\gamma}$ of 10^{-5} to 1, a region that includes signatures with significantly displaced vertices and highly collinear photons, which present the challenges of this analysis. No significant deviation from the SM expectations has been found, excluding a large parameter space of models that could have explained the $(g - 2)_\mu$ discrepancy.

Index Terms

Higgs, Axion, ALP, Photons, Anomalous Higgs Decays, HDBS

REFERENCES

- [1] K. Schmieden, M. Schott, O. Vujanovic, P. Kramer, B. Nachman, and H. Imam. Search for axions in $H \rightarrow aa \rightarrow 4\text{photon}$ decays with the ATLAS experiment at the LHC. Technical report, CERN, Geneva, 2022.
- [2] M. Schott. Search for short and long-lived axions in $H \rightarrow aa \rightarrow 4\gamma$ decays with the ATLAS experiment at the LHC. Technical report, CERN, Geneva, 2022.