

ATLAS Search for Non-Pointing and Delayed Photons

Tuesday, 13 July 2021 15:45 (15 minutes)

Searches for physics beyond the Standard Model (SM) at collider experiments—mostly focused on prompt signatures with high momentum and high missing transverse energy—have thus far produced no definitive evidence for such phenomena. But what if they have been looking in the wrong places? Just as long-lived particles exist in the SM, beyond the SM physics may too feature such particles. Here, a novel search for displaced photons is introduced, using 139 fb^{-1} of pp collision data at center-of-mass energy $\sqrt{s} = 13 \text{ TeV}$ collected with the ATLAS detector. The search specifically targets the relatively unconstrained branching ratio of the Higgs boson to invisible particles, where there is still ample room for signatures featuring relatively soft photons and modest missing transverse energy. Exploiting the longitudinal segmentation and the excellent precision timing capabilities of the ATLAS detector's liquid argon electromagnetic calorimeter, the striking, smoking-gun signature of a displaced photon that both fails to point back to the interaction point and arrives significantly delayed can be employed as a powerful discrimination variable. The analysis strategy, including the entirely data-driven background estimation method and expected sensitivities, is presented in detail.

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No

Primary author: MAHON, Devin (Columbia University (US))

Presenter: MAHON, Devin (Columbia University (US))

Session Classification: Beyond Standard Model

Track Classification: Beyond Standard Model Physics