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Searches for rare Higgs boson decays

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Throughout the decade that has elapsed since the discovery of the Higgs boson, a considerable amount of effort has been put into precise measurements of its properties. Higgs boson couplings to vector bosons, τ leptons, bottom/top quarks, and (via loop processes) photons and gluons have now been established. As all current measurements point to the Higgs boson being Standard Model (SM)-like, rare and unobserved Higgs boson decay modes are an important contribution to further test the SM. This is particularly true for decay modes mediated by loops, which can be especially sensitive to physics beyond the SM.

This talk will focus on challenges and opportunities associated with rare decay searches, and highlight one such ATLAS search: the yet-unobserved $H \longrightarrow Z/\gamma^* + \gamma$ decay. While not sensitive enough to claim observation of this decay process, current results hint at a slight tension with the SM expectation, with a $H \longrightarrow Z\gamma$ decay rate of $(2.2 \pm 0.7) \times$ the SM prediction.

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