Contribution ID: **1430** Type: **Axions & ALPs**

Probing axion-like particles with ⌧⌧ final states from vector boson fusion processes at the LHC

Monday 24 May 2021 17:45 (15 minutes)

Axion-like particles (ALPs) are pseudo-Nambu-Goldstone bosons of spontaneously broken global symmetries in theories attempting to address the incompleteness of the Standard Model (SM). In particular, ALPs arise in theoretical resolutions to the strong CP problem, offer explanations for the dark matter (DM) relic abundance, and are ubiquitous in string theory. The ALP mass m_a can range from eV to TeV scale, and thus the ALPs parameter space includes regions relevant to a variety of astronomical, high-precision low-energy, and high-energy collider experiments. The focus of this talk is a feasibility study searching for ALPs using vector boson fusion (VBF) processes at the Large Hadron Collider (LHC). We consider the $a \to \gamma\gamma$ decay mode to show that the requirement of an energetic diphoton pair combined with two forward jets with large dijet mass and pseudorapidity separation can significantly reduce the SM backgrounds, leading to a 5σ discovery region spanning m_a values from MeV scale to TeV scale and revealing LHC sensitivity to previously unstudied regions of the ALP parameter space.

Summary

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Session Classification: Axions & ALPs II