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Interplay of ALP Couplings at a Muon Collider

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Axion-like particles can couple to Standard Model gluons, electroweak gauge bosons, and massive fermions. A future multi-TeV muon collider provides a favorable environment to probe axion-like particles through multiple production channels, including vector boson fusion via electroweak gauge boson couplings and the top-associated production mediated by direct fermionic couplings. Motivated by the quality issue of the QCD axion, we focus on axion-like particles with masses and decay constants around the TeV scale. We explore how different axion-like particle couplings shape its production and decay modes, revealing a rich and intricate phenomenological landscape.

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