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Constraining ALP couplings using SMEFT-interference

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Axions and axion-like particles (ALPs) are pseudo Nambu-Goldstone bosons interacting with the SM fields via classically shift-invariant operators starting at dimension-5. Loop diagrams where the ALP is present as a virtual particle are generally UV-divergent and require renormalization. Consequently, dimension-6 SMEFT operators are generated as counterterms at the scale of global symmetry breaking via renormalization group evolution, regardless of the mass of the ALP. Since many SMEFT coefficients are experimentally tightly constrained, these bounds can be translated into indirect bounds on the ALP couplings to the SM in a global analysis.

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