

Renormalization group effects in QCD axion phenomenology

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We study the impact of renormalization group effects on QCD axion phenomenology. Focusing on the DFSZ model, we argue that the relevance of running effects for the axion couplings crucially depends on the scale where the heavier Higgs doublet, charged under the Peccei-Quinn symmetry, is integrated out. We study the impact of these effects on astrophysical and cosmological bounds as well as on the sensitivity of helioscopes experiments such as IAXO and XENONnT, showing that they can be sizable even in the most conservative case in which the two Higgs doublets remain as light as the TeV scale. We provide simple analytical expressions that accurately fit the numerical solutions of the renormalization group equations as a function of the mass scale of the heavy scalars.

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