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Axion Effective Action

Thursday, 7 July 2022 12:15 (15 minutes)

In this talk, we present the construction of Effective Field Theories (EFTs) in which a chiral fermion, charged under both gauge and global symmetries, is integrated out. These symmetries can be spontaneously broken, and the global ones might also be anomalous. This setting is typically served to study the structure of low-energy axion EFTs, where the anomalous global symmetry can be $U(1)_{PQ}$ and the local symmetries can be the SM electroweak chiral gauge symmetries. Spontaneous symmetry breaking will generate Goldstone bosons, and in the meantime, chiral fermions also become massive. In this setup, we emphasise that the derivative couplings of the Goldstone bosons to fermion will lead to severe divergences and ambiguities when evaluating one-loop computations.

In this talk, firstly, we present the Path Integral formalism for building the EFTs resulting from integrating-out massive chiral fermions. Secondly, within this functional formalism, we show how to solve the ambiguities problem by adapting the anomalous Ward identities to the EFT context, and thus enforcing the gauge invariance results. Our methodology provides a generic and consistent neat result when evaluating the Wilson coefficients of EFT operators involving axion and gauge bosons. Finally, we present the application of our technique to axion models and compute non-intuitive couplings between axion and the massive SM gauge fields that arise when decoupling massive chiral fermions.

References: (arXiv: 2112.00553)
Link: https://inspirehep.net/literature/1981947

In-person participation

Yes

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