Effective Field Theory for Spacetime Symmetry Breaking

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Symmetry and its spontaneous breaking play an important role in physics. In particular, the Nambu-Goldstone modes and their effective action provide us a generic feature of the low-energy dynamics after the symmetry breaking. For internal symmetry breaking, we have the well-established coset construction of the low-energy effective action, which well describes the pion dynamics for example. On the other hand, the understanding on spacetime symmetry breaking (and its mixture with internal symmetry breaking) is limited so far. In this talk, we would like to develop a general framework for the effective action construction associated with spacetime symmetry breaking.

Our approach is inspired by the inverse Higgs effect [1] and the effective field theory for inflation [2], and our starting point is the effective action in the unitary gauge, where the Nambu-Goldstone modes do not fluctuate. Based on the relevant degrees of freedom and the symmetry structure in the unitary gauge, we first construct the effective action in the unitary gauge and then translate it in terms of the Nambu-Goldstone modes. Our approach is applicable from the condensed matter system such as the liquid crystal system to cosmological setups including various inflation models such as the anisotropic inflation and the chromo-natural inflation. After introducing our general strategy, we will perform concrete effective action constructions in some illustrative examples.

References:

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[2] C. Cheung, P. Creminelli, A. L. Fitzpatrick, J. Kaplan and L. Senatore, JHEP 0803, 014 (2008).