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Naturalness. Higgs mass, cosmological constant and Physical Tuning

Friday, 6 October 2023 12:00 (20 minutes)

Due to unsuppressed quantum fluctuations, the Higgs boson mass and the cosmological constant turn out to be extremely sensitive to the UV modes of the underlying high energy theory, and this usually demands an “unnatural” and “formal” fine-tuning. We show that when the Wilsonian EFT paradigm is properly implemented in the theory, a “physical tuning” scenario naturally emerges. This is clearly illustrated, for instance, by the multiplicative renormalization of the Higgs boson mass. In the usual perturbative framework, the latter is realized only after the “formal” cancellation of quadratic divergences is operated with the help of some renormalization technique (no matter if you see them explicitly, or you hide them as it is, for instance, the case in dimensional regularization). In the EFT (physical) framework it emerges as an IR property of the full Wilsonian running, and naturally gives rise to the IR (measured) value of the mass. The cosmological constant naturalness problem can be studied in a similar way, the tiny measured value emerging in the IR as a result of the RG Wilsonian flow.

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