

UV/IR Mixing, EFTs, and Origami: Calculating the Higgs Mass in String Theory

Friday, May 27, 2022 11:36 AM (23 minutes)

In this talk, we shall present a non-technical method of understanding UV/IR mixing from a field-theoretic perspective. We will then discuss how these ideas are ultimately realized in string theory, providing a self-contained introduction to relevant string ideas as we proceed. Finally, we shall present a fully string-theoretic framework for calculating one-loop Higgs masses directly from first principles in perturbative closed string theories. Notably, using our framework, we find that a gravitational modular anomaly generically relates the Higgs mass to the one-loop cosmological constant, thereby yielding a string-theoretic connection between the two fundamental quantities which are known to suffer from hierarchy problems in the absence of spacetime supersymmetry. We also discuss a number of crucial issues involving the use and interpretation of regulators in UV/IR-mixed theories such as string theory, and the manner in which one can extract an EFT description from such theories. Finally, we analyze the running of the Higgs mass within such an EFT description, and uncover the existence of a “dual IR” region which emerges at high energies as the consequence of an intriguing scale-inversion duality symmetry. We also identify a generic stringy effective potential for the Higgs fields in such theories. Our results can therefore serve as the launching point for a rigorous investigation of gauge hierarchy problems in string theory.

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