



Contribution ID: 22

Type: **Parallel talks**

Naturalness and UV-sensitivity in Kaluza-Klein theories

Wednesday 19 July 2023 16:00 (20 minutes)

More than twenty years ago a paradigm emerged according to which supersymmetric theories with compact extra dimensions and Scherk-Schwarz SUSY breaking could naturally provide a UV-insensitive Higgs mass m_H , and more generally a UV-insensitive Higgs potential $V_{11}(\phi)$. Some warnings were originally raised on the validity of such an outcome, but the community soon came to an agreement in its favor. Since then, this idea and the related result have been frequently used in models of phenomenological interest, including recent applications to the dark energy problem. The UV-insensitiveness is typically understood as a result of the non-local nature of the Scherk-Schwarz SUSY breaking, and the latter is usually thought to be operative only at distances larger than the compactification radius. In this talk, I intend to present a novel and thorough analysis of the framework on which the paradigm is based. I will show that a source of strong UV-sensitivity, intimately connected to the non-trivial boundary conditions that trigger the Scherk-Schwarz mechanism, so in turn to the non-trivial topology of these models' spacetime, was missed at the time. These findings call for a reconsideration of the usual picture of the Scherk-Schwarz mechanism and of its physical consequences.

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Session Classification: Higgs theory and experiment

Track Classification: Higgs theory and experiment