



Contribution ID: 451

Type: **Parallel Talk**

Towards an asymptotically safe completion of the Standard Model

Saturday, July 8, 2017 9:20 AM (20 minutes)

We explore a possibility to UV-complete the Standard Model in an asymptotically safe manner. We assume the existence of N_F new types of vector-like fermions which minimally couple to $SU(3)_C$ and/or $SU(2)_L$ and modify the running of the corresponding gauge couplings in such a way that at least one of them is not asymptotically free anymore. If additionally the BSM fermions carry a non-zero hypercharge, the $U(1)_Y$ gauge coupling can become asymptotically free, thus avoiding the problem of the Landau Pole.

We classify the emerging UV fixed points and discuss their dependence on transformation properties of the new fermions under the gauge symmetries. We also show that additional constraints on the structure of the BSM sector arise if one requires an asymptotically safe UV fixed point to be connected to the Standard Model through a well-defined RG trajectory.

Finally, we discuss experimental signatures of the asymptotically safe scenarios.

Experimental Collaboration

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Session Classification: QFT and string theory

Track Classification: Quantum Field and String Theory