Contribution ID: **4**   Type: **not specified**

Naturalness, critical phenomena and new routes to UV-complete theories

Friday, 2 March 2018 09:00 (40 minutes)

The hierarchy problem and thus the absence of technical naturalness in the standard model is not an inconsistency of our theoretical description of fundamental physics, but may rather be viewed as an aesthetic blemish. Renormalization theory of critical phenomena suggests that the amount of unpleasantness can be quantified by critical exponents which are intrinsic properties of a particle physics model. Attempts at solving/beautifying the hierarchy problem can be classified in terms of how critical exponents are modified.

Abandoning aestheticism as a primary motivation, I argue that new routes to theoretical consistency should be searched for - accompanied by a sound view on the available experimental data. I suggest that novel constructions of asymptotically free theories with gauge and Yukawa sectors are a promising direction which can provide new ingredients for model building. Such constructions have recently been identified, leading to UV complete quantum field theories and Higgs interaction potentials approaching asymptotic flatness. The critical exponents of such theories are computable and show novel features of exact marginality.

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Session Classification: Friday morning