Topical Workshop: Rethinking Naturalness

Report of Contributions

https://agenda.infn.it/e/8527

Contribution ID: **0** Type: **not specified**

SUSY “naturalness”and LHC-14

Wednesday, 17 December 2014 11:30 (1 hour)

The idea of “Natural SUSY”, understood as a supersymmetric scenario where the fine-tuning is as mild as possible, is a reasonable guide to explore supersymmetric phenomenology. I will discuss the probabilistic meaning of conventional fine-tuning measures and re-examine the MSSM naturalness bounds including several improvements; e.g. the role played by potential extra fine-tunings, which must be combined with the electroweak one. I will also discuss what are the most model-independent naturalness bounds and what are the most stringent ones (they do not coincide), in connection to LHC-14.

Presenter: ALBERTO CASAS

Contribution ID: **1** Type: **not specified**

Criteria for Natural Hierarchies

Thursday, 18 December 2014 11:30 (1 hour)

I revisit the issue of naturalness, discussing some of the implicit assumptions that underly most of the discussions on this topic. I discuss a more pragmatic definition of the hierarchy problem that does not rely on peeking beyond the murky boundaries of quantum field theory and investigate the fine-tuning of the electroweak scale associated with thresholds from heavy particles, which are both calculable and dependent on the nature of the would-be ultraviolet completion of the Standard Model. More concretely, I discuss different manifestations of new high-energy scales that are favored by experimental hints for new physics with an eye toward making use of fine-tuning in order to determine natural regions of the new physics parameter space.

Presenter: ANDRÉ DE GOUVÊA

Contribution ID: **2** Type: **not specified**

Electroweak Vacuum Stability after LHC8

Thursday, 18 December 2014 15:00 (1 hour)

The discovery of the Higgs boson by the LHC in 2012, and especially the determination of its mass around 125 GeV, together with the absence of any trace of new physics, make it conceivable that we live in a metastable electroweak vacuum. This vacuum turns out to be extremely long-lived as that particular mass value means we live quite close to the stability boundary. I will describe the state-of-the-art calculation that leads to this intriguing conclusion and elaborate on possible implications as well as a simple cure of this instability of the Higgs potential.

Presenter: JOSE RAMON ESPINOSA

Contribution ID: **3** Type: **not specified**

Conformal and Electro-Weak Symmetry Breaking

Thursday, 18 December 2014 10:00 (1 hour)

I will discuss possible connections between the breaking of conformal and electro-weak symmetry. Models realizing this ideas and phenomenological implications as well as open questions will be covered as well.

Presenter: MANFRED LINDNER

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

Classical scale invariance, Physical Naturalness and the stability of scales

Wednesday, 17 December 2014 10:00 (1 hour)

The discovery of Higgs boson, apparent absence of any new physics at EW scale and the existence of perturbative physics at and above Planck scale, as hinted by BICEP2, require rethinking the paradigm of naturalness. I suggest that no explicit mass terms exist in fundamental Lagrangian (the concept of classical scale invariance) and all scales are generated via logarithmic dimensional transmutation, explaining their vast differences. Physical Naturalness principle, involving very small couplings that are natural by ʻt Hooft criteria, explains the stability of this setup. I illustrate the general principles with simple models beyond the SM explaining the EW scale, Dark Matter, Planck scale and inflation with minimal new degrees of freedom. In this context, the Planck scale is just a "low scale" imprint of transplanckian (inflationary) physics.

Presenter: MARTTI RAIDAL

Contribution ID: **5** Type: **not specified**

Composite versus Elementary Higgs: Problems and Progress

Friday, 19 December 2014 11:30 (1 hour)

I will critically introduce, classify and discuss the fundamental open issues related to either composite or elementary Higgs extensions of the standard model. As for the progress I will exhibit, among other things, our first proof of existence of nonsupersymmetric Gauge-Yukawa theories (structurally identical to the standard model) which are UV finite thanks to the existence of an exact calculable quantum UV fixed point. I will then comment on the possible phenomenological impact of this discovery

Presenter: FRANCESCO SANNINO

Contribution ID: **6** Type: **not specified**

Quantum scale invariance and naturalness

Friday, 19 December 2014 10:00 (1 hour)

I will discuss quantum scale invariant effective theories of particle physics and gravity and their relevance to the hierarchy problem.

Presenter: MIKHAIL SHAPOSHNIKOV

Contribution ID: **7** Type: **not specified**

Theoretical implications of present LHC unobservation

Wednesday, 17 December 2014 15:00 (1 hour)

The experimental results of the first run of the Large Hadron Collider lead to the discovery of the Higgs boson but have not confirmed the dominant theoretical paradigm about the naturalness of the electro-weak scale, according to which the Higgs boson should have been accompanied by supersymmetric particles or by some other new physics able of protecting the Higgs boson mass from quadratically divergent quantum corrections. I present new non conventional ideas about the origin of mass scales in nature and in particular of the electro-weak scale.

Presenter: ALESSANDRO STRUMIA

Contribution ID: **8** Type: **not specified**

Dark matter and the multiverse: WIMPs and axions

Friday, 19 December 2014 15:00 (1 hour)

The observed values of the cosmological constant and the abundance of dark matter can be understood, using certain measures, by imposing the anthropic requirement that density perturbations go non-linear and virialize to form haloes. This requires a probability distribution favoring low amounts of dark matter, i.e. low value of the axion scale f for the QCD axion and low values of the superpartner mass scale for LSP thermal relics.

Presenter: DUCCIO PAPPADOPULO (California U., Berkeley)