

**LIO International Conference
on "Asymptotic safety in
Quantum Field Theory: Grand
Unification"**

**Rapport sur les
contributions**

ID de Contribution: **1**

Type: **Non spécifié**

Welcome and introduction

mercredi 5 juin 2024 09:15 (15 minutes)

ID de Contribution: 2

Type: **Non spécifié**

Phenomenology with trans-Planckian asymptotic safety

mercredi 5 juin 2024 09:30 (45 minutes)

I will discuss some of the phenomenological aspects of embedding the Standard Model and/or models of New Physics in the framework of trans-Planckian asymptotic safety. In this setting, the presence of an interactive UV fixed point in the renormalization group flow of the gauge and Yukawa couplings imposes boundary conditions at the Planck scale. In the case of New Physics models, the ensuing fixed-point analysis leads to specific predictions for the IR phenomenology. This heuristic approach relies on simplifying approximations, including the computation of renormalization group equations at 1-loop, an arbitrary definition of the position of the Planck scale, and instantaneous decoupling of gravity. I will discuss how robust the predictions from asymptotic safety are if the assumptions listed above are relaxed.

Orateur: KOWALSKA, Kamila

ID de Contribution: 3

Type: **Non spécifié**

Naturally small neutrino mass from asymptotic safety

mercredi 5 juin 2024 11:00 (45 minutes)

I will discuss the possibility of dynamically generating arbitrarily small Yukawa couplings in the framework of trans-Planckian asymptotic safety. This effective mechanism may provide an interesting alternative to other dynamical means to generate small neutrino masses, e.g., the see-saw mechanism, and can be applied to various new physics scenarios requiring feeble Yukawa interactions (freeze-in dark matter, etc). I will show that this mechanism can be consistent with first-principle calculations in quantum gravity using the functional renormalization group. Finally, I will discuss possible gravitational-wave signals arising from the connection between these extreme UV and IR sectors.

Orateur: SESSOLO, Enrico

ID de Contribution: 4

Type: **Non spécifié**

UV-Completion Beyond Asymptotic Safety: Vainshtein Screening, UV/IR Mixing & Electroweak Naturalness

mercredi 5 juin 2024 15:00 (45 minutes)

If one could probe sub-Planckian length scales by a hard (UV) scattering experiment, one would expect to end up with an extended semi-classical state (black hole) that decays into many soft (IR) quanta by Hawking radiation. This UV/IR mixing in gravity (dubbed classicalization) is a deeply nonlocal phenomenon. It suggests a path towards UV-completion by UV-obstruction, different from the traditional Wilsonian UV-fixed point (asymptotic safety). If the Standard Model is extended by specific self-sourced operators, the electroweak scale could also be stabilized against new large scales via Vainshtein screening that requires a little hierarchy. In this talk, I will discuss that implementing a ghost-free nonlocal Higgs mechanism leads to classicalization of the Higgs field, suggesting that fuzzy interactions trigger classicalization. References: arXiv:1010.1415, arXiv:2307.11741, arXiv:2311.08311

Orateur: Dr NORTIER, Florian (CNRS/IN2P3 - IP2I Lyon)

ID de Contribution: 5

Type: **Non spécifié**

Dualities in the UV

jeudi 6 juin 2024 09:30 (45 minutes)

Orateur: BAJC, Borut

ID de Contribution: 6

Type: **Non spécifié**

Asymptotic Grand Unification in 5 dimensions

jeudi 6 juin 2024 11:00 (45 minutes)

Orateur: CACCIAPAGLIA, Giacomo (IP2I Lyon)

ID de Contribution: 7

Type: **Non spécifié**

Orbifold Stability of Asymptotic GUTs

jeudi 6 juin 2024 14:00 (45 minutes)

Orateur: PREDA, Anca

ID de Contribution: 8

Type: **Non spécifié**

(remote) Standard Model from low-scale E8 grand unification in ten dimensions

The construction and general implications of a model with complete supersymmetric unification of the Standard Model matter content, interactions and families' replication into a single E8 gauge superfield in ten dimensions is presented. The gauge and extended Poincaré symmetries are broken through compactification of the T6/Z3xZ3 orbifold with Wilson lines, which reduces the original symmetry and matter content into those of the Standard Model plus additional heavier states. Proton decay can be suppressed automatically while the compactification scale may be as low as 10^9 GeV, so that the corresponding GUT-scale physics may be potentially accessible and testable by future collider measurements.

Orateur: PASECHNIK, Roman

ID de Contribution: 9

Type: **Non spécifié**

Interplay of chiral transitions in the standard model

vendredi 7 juin 2024 11:00 (45 minutes)

We investigate nonperturbative aspects of the interplay of chiral transitions in the standard model in the course of the renormalization flow. We focus on the chiral symmetry breaking mechanisms provided by the QCD and the electroweak sectors, the latter of which we model by a Higgs-top-bottom Yukawa theory. The interplay becomes quantitatively accessible by accounting for the fluctuation-induced mixing of the electroweak Higgs field with the mesonic composite fields of QCD. In fact, our approach uses dynamical bosonization and treats these scalar fields on the same footing. In the first project we look at the changed infrared behaviour of the theory under inclusion of the QCD sector, compared to the pure Higgs-top-bottom model, with a focus on studying the naturalness problem in the model. In the current project we investigate UV completions within the Higgs-QCD model, a first analysis shows the existence of CEL-like scaling solutions.

Orateur: SCHMIEDEN, Richard

ID de Contribution: **10**

Type: **Non spécifié**

Safety, Criticality and Large N

vendredi 7 juin 2024 14:00 (45 minutes)

I will discuss new RG relations obtained from studying the critical exponent in d dimension. As an example, I will apply those results to the Large N_f paradigm before discussing higher order corrections.

Orateur: VATANI, Shahram (GGI Firenze)

ID de Contribution: 11

Type: **Non spécifié**

(Remote) On the many natures of the Higgs: From Composite Higgs Dynamics to the Standard Model as Magnetic Theory

mercredi 5 juin 2024 13:30 (45 minutes)

Orateur: SANNINO, Francesco

ID de Contribution: 12

Type: **Non spécifié**

Musings on horizontal gauge symmetries

vendredi 7 juin 2024 09:30 (45 minutes)

Orateur: DARME, Luc

ID de Contribution: 13

Type: **Non spécifié**

Directions for Model Building beyond Asymptotic Freedom

jeudi 6 juin 2024 15:00 (45 minutes)

It is widely appreciated that the Standard Model is incomplete. Yet, and despite of significant experimental efforts, clear-cut signatures for new physics are unavailable. Also, theory guidance beyond the paradigms of asymptotic freedom or effective theories is scarce.

In this talk, I discuss top-down and bottom-up directions for model building. From a bottom-up perspective, it is proposed to turn the quest for vacuum stability into a primary model building task. The rationale for this is that while the onset of the SM instability around 10^{11} GeV is a high energy effect, a solution may arise from any scale below the Planck scale. Using the renormalisation group, I explain perturbative mechanisms for stability and sketch out the landscape of Planck-safe models. From a top-down angle, prospects for asymptotically safe UV completions of the SM are discussed. Concrete model building results and challenges are highlighted in the context of supersymmetry and UV-safe extensions of the MSSM.

Orateur: LITIM, Daniel (University of Sussex)