

OCEVU Particle Physics WG

Extension of “New physics from a natural electroweak symmetry breaking”

Main actors involved:

Michele Frigerio (L2C, Montpellier)

Jean-Loïc Kneur (L2C, Montpellier)

Marc Knecht (CPT, Marseille)

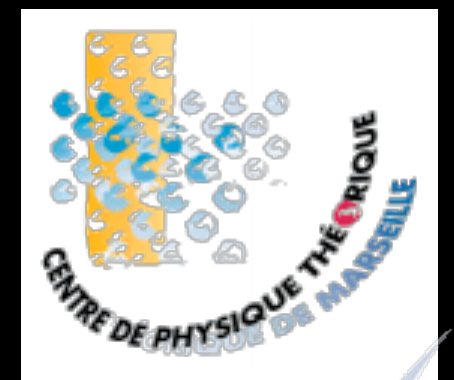


OCEVU PhD Student:

Nicolas Bizot (November 13 - October 16)

Envisaging a Postdoc recruitment:

strongly coupled new physics in various incarnations (Fall 16 - Fall 19)



Trajectory

- PhD thesis of Nicolas Bizot:
 - (i) bottom-up: Higgs couplings constraints on new physics
 - (ii) top-down: calculable model of strongly-coupled electroweak symmetry breaking
- Immediate follow-up with LHC phase II: Higgs non-linearities / exotic resonances / degree of naturalness of the models
- More ambitious, long-term perspectives:
 - (i) effects of heavy resonances in non-collider physics
 - (ii) renormalization for strongly-coupled operators (\rightarrow Kneur)
 - (iii) consistency / gauge invariance of the effective potential (\rightarrow Knecht)
 - (iv) comparing non-perturbative analytic techniques with lattice and/or extra-dimension predictions
- Need for (a) reactivity to new data/ideas (b) complementary competencies: a postdoc already active in the field

RG analysis of strongly coupled BSM / anomalous dimensions

1. *Perturbative anomalous dimensions: RGE code for the $d = 6$ effective operators*

- Complete set of ~ 60 dim 6 'SM' effective operators, contributing to SM deviations in the framework of effective low-energy models, now established in literature.
- Important to account for RG evolution (running), including operator mixing, available th + pheno constraints,... for more precise predictions.
- Many results available (one-loop order) but maybe not systematical/user friendly.

→ Possible task: a RG code 'à la Suspect' for effective new physics scenario?

2. *Large NP anomalous dimensions: comparing RG with Lattice predictions*

- As intermediate step towards fully UV-completed **composite Higgs models**, 4-fermion interaction (NJL-type) models determine, in 'large-N' approximation, gross features of the resonance spectrum (masses and couplings) (**part of N. Bizot PhD**)
- However **large anomalous dimensions** of such 4-fermion operators (making these 'relevant' in the RG sense) required by the dynamics (if nontrivial RG fixed point exists) and/or by phenomenological considerations.
- Calculation of such large anomalous dimensions needs NP methods beyond large-N: typically Lattice simulations, where results exist for some models.

'**RG optimized perturbation**' (Kneur-Neveu) gives analytical handle beyond large-N on some NP aspects of dynamical symmetry breaking. (In QCD, precise estimates of basic scale $F_\pi/\Lambda_{\text{QCD}}$, quark condensate, ...).

→ Could similarly estimate analogous quantities for some composite models ?

→ Could possibly estimate also those large anomalous dimensions ?

Consistency / gauge invariance
of the effective potential