PAUL SCHERRER INSTITUT

Particle Theory Seminar

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"Searching for new physics with a non-decoupling effective theory"

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Abstract:

The Large Hadron Collider should allow to answer the fundamental question of the electroweak symmetry breaking by the discovery of new particles (Higgs bosons and/or others). In parallel to these high-energy studies, one can conceive low-energy searches for small modifications of electroweak couplings of known particles due to physics beyond the Standard Model. A combination of these two approaches can help to interpret the forthcoming experimental results.
In this talk, we will introduce a non-decoupling low-energy effective theory based on a higher non-linearly realised symmetry, offering an alternative to the standard electroweak symmetry breaking mechanism. This theory leads to a parametrization and a hierarchical classification of the effects beyond the Standard Model. This classification is systematic, it follows a power counting scheme and the deviations from the Standard Model are controlled by the underlying symmetry. At Next-to-Leading Order, universal non-standard couplings of fermions to W and Z appear such as direct couplings of right-handed quarks to W. We will analyse how these effects can be experimentally probed. We will discuss specifically in the light quark sector the $K^L_{\mu 3}$ decays and the hadronic τ decays. We will also show how these non-standard couplings of fermions to the Z boson are in good agreement with the present precision tests allowing in particular to solve the long-standing b-quark asymmetry puzzle.