Thesis abstract Ruifeng Leng

Title: Compactification flavors

Abstract: Since around 2000, attractive extensions of the Standard Model based on extra spatial dimensions have emerged, and in particular the class of warped dimension models with a brane-localized Higgs boson coupled to bulk fermions (dual to composite Higgs models).
In this thesis, we show that the proper treatment of such scenarios does not rely on any Higgs peak regularization, as usually done in the literature, but may require the presence of specific bilinear brane terms instead. The bilinear brane terms could allow elaborating an ultra-violet origin of the chiral nature of the Standard Model and its chirality distribution among quarks/leptons. The new calculation methods presented, implying the independence of excited fermion masses and 4D Yukawa couplings on the 'wrong- chirality' Yukawa terms, have impacts on phenomenological results.
Then we extend those rigorous approaches from the interval configuration to the dual S Z2 "orbifold", which allows, in particular, a strict treatment of the fermion profile discontinuities across the characteristic branes, and we propose a formal approach based on the mathematical theory of distributions, allow- ing to make appear automatically the bilinear brane terms.
We have realized that the bilinear brane terms, located at intermediate positions along the interval, provide an opportunity to explain the existence of flavors: the three families in this context correspond to three different quantum states, of a unique 5D field, localized respectively between such brane terms. This new generation partition mechanism, along the extra dimension, further generates fermion mass hierarchies automatically when the Higgs boson profile is exponentially localized towards the so-called "TeV- brane" to address the gauge hierarchy problem. The studied mechanism also offers a new field theory method to localize all fermions on a (thick) brane, alternatively to the standard soliton coupling approach.