Contribution ID: **75** Type: **not specified**

Higgs decays in gauge extensions of the standard model

Monday 5 May 2014 15:15 (15 minutes)

The "Lonely higgs"picture has put considerable pressure on theories that aim to solve the hierarchy problem. The focus has now shifted to the determination of its detailed properties and in particular whether or not it possesses any anomalous couplings not predicted by the Standard Model by extensive analysis of the higgs production and decays. **The dominant contribution to the $H \to \gamma\gamma$ and $Z\gamma$ comes from the charged spin 1 states, specifically the W-bosons which can have different contribution to these channels in extensions of SM.** Moreover, in gauge extensions of SM, new spin 1 states appear which could modify higgs decay rates and in certain cases also yield a non-zero tree level S parameter. In this talk I will present the **loop contributions arising from a set of generic spin 1 states which exhibit the most generic gauge invariant vector interactions**. I will also explore the **interplay between the divergent structure of the loop amplitudes and the S parameter contributions**. I shall also discuss an example calculation in a four-site moose model that contains degrees of freedom that model the effects of vector and axial-vector resonances arising from TeV scale strong dynamics.

Summary

I will first describe a framework for constructing gauge invariant low-energy effective theories that allow for modified higgs couplings to both Standard Model and exotic spin-1 states, and also allow for a complete range of vector cubic and quartic self-interactions consistent with U(1)EM. I will discuss the classes of actions we consider, and then characterize the most general self-interactions of the vector fields with each other and with the higgs, under the constraint that all interactions be gauge invariant. Then I will review the relevant Feynman rules in a generic framework, and outline our parameterization for the one-loop amplitudes.

Later I shall construct an explicit model which contains composite scalar resonance in the spectrum. As an example of the interactions of the mass and kinetic eigenstates, I will discuss the derived the Feynman rules relevant for a calculation of the $h \to Z\gamma(\gamma\gamma)$ amplitudes. Then **I will explore the decay rates over the parameter space of the model, paying particular attention to correlations between the tree-level contribution to the S-parameter, the $h\gamma\gamma$ rate, and the $h \to Z\gamma$ rate as these are of especial interest in these types of effective theories**. I will also talk about the tree level contributions to the $hZ\gamma$ and $h\gamma\gamma$ couplings inherited from strong coupling effects. Then I shall conclude.

This talk is based on PhysRevD.89.035014 (arXiv link)

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Session Classification: BSM Higgs I