## Phenomenology 2013 Symposium



Contribution ID: 57

Type: parallel talk

## Inspecting the Higgs for New Weakly Interacting Particles

Tuesday 7 May 2013 15:45 (15 minutes)

We explore new physics scenarios which are optimally probed through precision Higgs measurements rather than direct collider searches. Such theories consist of additional electroweak charged or singlet states which couple directly to or mix with the Higgs boson; particles of this kind may be weakly constrained by direct limits due to their meager production rates and soft decay products. We present a simplified framework which characterizes the effects of these states on Higgs physics by way of tree level mixing (with neutral scalars) and loop level modifications (from electrically charged states), all expressed in terms of three mixing angles and three loop parameters, respectively. The theory parameters are constrained and in some cases even fixed by ratios of Higgs production and decay rates. Our setup is simpler than a general effective operator analysis, in that we discard parameters irrelevant to Higgs observables while retaining complex correlations among measurements that arise due to the underlying mixing and radiative effects. We show that certain correlated observations are forbidden, e.g. a depleted ratio of Higgs production from gluon fusion versus vector boson fusion together with a depleted ratio of Higgs decays to bb versus WW. Moreover, we study the strong correlation between the Higgs decay rate to two photons and WW and how it can be violated in the presence of additional electrically charged particles. Our formalism maps straightforwardly onto a variety of new physics models, such as the NMSSM. We show, for example, that with a Higgsino of mass ~ 100 GeV and a singlet-Higgs coupling of ~0.7, the photon signal strength can deviate from the vector signal strength by up to 40-60% while depleting the vector signal strength by only 5-15% relative to the Standard Model.

Author: MCDERMOTT, Samuel

Co-authors: CHEUNG, Clifford; ZUREK, Kathryn (University of Michigan)

Presenter: MCDERMOTT, Samuel

Session Classification: Higgs III