

The Standard Model (SM) is a successful theory of interactions of elementary particles. It is well established both theoretically (the last component, the Higgs boson discovered in 2012, was theoretically predicted in the middle of 60') and experimentally: having 19 independent parameters, all determined experimentally, it gives accurate predictions for thousands of independent measurements! Nevertheless, there are both observational facts (e.g. matter antimatter asymmetry in the universe and the existence of dark matter) and some theoretical problems in the SM itself, strongly suggesting that the SM is not the fundamental theory of Nature but just an effective one, an approximation to a deeper theory. In fact, limited accuracy of the experimental measurements still leaves some room for corrections from a deeper theoretical description. Searching for an extension of the SM is at present the main goal of particle physics, both in experiment and theory.

No statistically significant effects of any physics beyond the SM have been observed so far. In particular no new particles have been directly observed. It is plausible that new mass scales related to new degrees of freedom are beyond the reach of the forthcoming LHC data but they will manifest themselves indirectly, by some disagreement with the SM predictions at energies below those mass scales. Naturally, we will then want to learn as much as possible from the available data. In such a scenario a particularly efficient theoretical tool is the so called Effective Field Theory (EFT) approach: to investigate New Physics (NP) effects one does not introduce new particles explicitly in the theoretical description, hence the exact unknown bigger theory does not have to be specified at this point. The question we try to answer is: can we discover NP based on the forthcoming data before discovering new particles? That is, can we learn anything about the Beyond the SM Physics using the effective approach, and how to do that? The latter proves to be highly non-trivial as EFT description exhibits limitations due to its limited range of validity.

In the context of forthcoming LHC data it is particularly interesting to investigate the process of vector boson scattering as it could shed light upon the mechanism of spontaneous electroweak symmetry breaking – a mechanism explaining the existence of masses of particles, otherwise forbidden by symmetry principles – indeed the SM Higgs boson can only be a simple parametrization of some deeper underlying mechanism.