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Hunting for $B \to K\tau^+\tau^-$ on the $B \to K\mu^+\mu^-$ dimuon spectrum

Master thesis of

Sascha Liechti

Supervised by

Prof. Nicola Serra

Dr. Patrick Owen

Abstract

The standard model as well as general relativity explain many phenomena in physics. However, we know that they don't explain the full picture as there are still some unsolved mysteries. One prominent example are the asymmetries measured at the LHC. One way to search for new physics are flavour changing neutral currents. Here we are analysing the sensitivity of $B \to K\tau^+\tau^-$ on the $B \to K\mu^+\mu^-$ dimuon spectrum. This decay channel is especially sensitive to enhancements through new physics.

Contents

1 Introduction

The Standard Model (SM) of particle physics (Fig. 1) describes all known elementary particles as well as three of the four fundamental forces. According to the SM there are fermions, which make up all matter in the universe, and four gauge bosons, enabling particles to interact with each other.

Fermions are further separated into quarks and leptons. Quarks are the only fermions able to interact through the strong force. All fermions can interact through the weak force and as long as they have electrical charge also through the electromagnetic (em) force.

Fermions are further separated into three generations. The first generation of quarks consists of the up (u) and down (d) quarks while for the leptons it consists of the electron (e) and the electron neutrino (ν_e). Higher generations do have a similar structure but tend to have higher masses than the corresponding particles of lower generations. Here we also want to pay special attention to the b quark (b) which is the down type quark of the third generation. This particle plays a crucial role in the following analysis and is the heaviest quark that still hadronises.

Gauge bosons are the carrier of the forces and hence get exchanged in interactions of particles. Additionally there is the Higgs boson, which is a remnant of the Higgs field, which through its interaction with particles grants them the ability to acquire mass. Special attention here goes to the gauge bosons of the weak force, namely the W bosons ($W^{\pm}$) and the Z boson (Z). It is important to note that according to the SM the only way to change flavour is through the exchange of W bosons.

However while the SM proves to be a robust and good description of the fundamental particles and how they interact, we know that the SM doesn't describe the full picture. Several phenomena are simply not explained by it. Examples are gravity, dark matter, dark energy, neutrino masses and the matter-antimatter asymmetry in the universe.

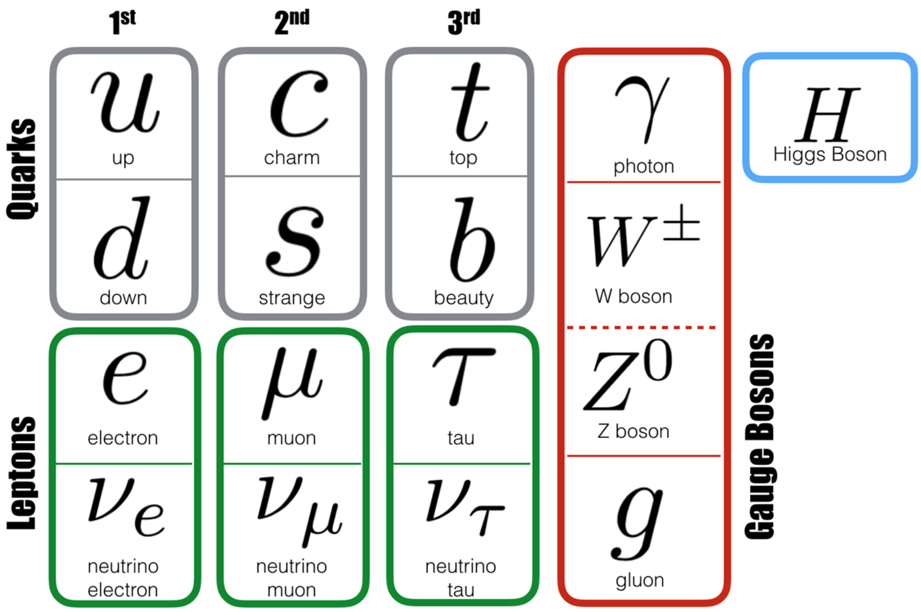

Figure 1: Standardmodel of particles

Additionally there are experimental results that cannot be explained by the SM as for example the $R_{K^{(*)}}$ and $R_{D^{(*)}}$ [**?**] measurement.

References

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