Seach for $B \to \nu\bar{\nu}$ decays at the Belle II experiment

Thesis at University of Strabourg under the supervision of
Pr. Isabelle Ripp-Baudot and **Pr. Giulio Dujany**

by
Corentin Santos

University of Strasbourg
Date

Abstract

This is a summary.

Contents

1

Theoretical context

The Standard Model (SM) of particle physics is a theoretical framework that describes the electromagnetic, weak and strong nuclear interactions between elementary particles. Based on the principles of Quantum Field Theory (QFT), it has been tested extensively and has been able to describe the observations of particle physics experiments with great accuracy. However, there are several phenomena that the SM is not able to explain, such as the existence of Dark Matter (DM) or the matter-antimatter asymmetry in the universe. For reasons we will discuss later, many tensions with the SM have been previously observed when quark's flavour transitions occur, such as in the $b \to sl^+l^-$ or $b \to c\tau\nu$ transitions. In this chapter, we will first introduce the theoretical framework behind the SM and its limitations (1.2), which will lead us to the formulation of the SM as an Effective Field Theory (EFT) (1.3) and the study of the $b \to s\nu\bar{\nu}$ transition (1.4), which is the focus of this thesis. Finally, we will mention New Physics (NP) models which could intervene in the $b \to s\nu\bar{\nu}$ transition and the experimental constraints on these models (1.5).

1.1 The Standard Model of particle physics

1.2 The Standard Model of particle physics

1.3 An Effective Field Theory approach to the Standard Model

1.4 The $b \to s\nu\bar{\nu}$ transition in the Standard Model

1.5 New Physics models in the $b \to s\nu\bar{\nu}$ transition

[1]

2

Conclusion

This is a conclusion.

List of acronyms

DM Dark Matter. 5

EFT Effective Field Theory. 5

NP New Physics. 5

QFT Quantum Field Theory. 5

SM Standard Model. 5

Bibliography

[1] A N Kolmogorov. *Foundations of the theory of probability.* Chelsea Publishing Company, New York, NY, USA, 1956. (cited on page 6)