外国語要旨

Phenomenological study in R-parity violating supersymmetric standard model
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Though the Standard Model (SM) of particle physics explain almost all results of high energy collider experiments, it has some problems, e.g. no candidate of the Dark Matter (DM) in SM. Therefore new physics beyond the SM is necessary to understand the problems. Minimal Supersymmetric Standard Model (MSSM) is known as a promising candidate of new physics beyond the SM. In MSSM, a discrete symmetry, so-called "R-parity" is introduced in order to forbid baryon and lepton number violations. Because baryon and lepton number violations give rise to proton decay of which there is currently no experimental evidence. If the R-parity is conserved, the Lightest Supersymmetric Particle (LSP) must be stable and thus is a good candidate for DM. The R-parity conservation (RPC), therefore, plays an important role to realize the observations. But the R-parity in MSSM is imposed by hand because the MSSM dose not have the origin of the R-parity. Thus we need to consider R-parity violating (RPV) MSSM and to discuss whether RPV-MSSM satisfies phenomenological requirements or not. RPV gives rich phenomenological consequences, notably the flavor physics. We therefore investigated allowed regions of the parameter space for RPV-MSSM from the experimental data of flavor physics based on more general framework than previous studies.

In this paper, we study contributions of RPV interactions to leptonic decays of D_s^+ and B^+ mesons. In the early stage of our research project, it has been pointed out that the experimental data of leptonic decays, $D_s^+ \to \tau^+\nu$ and $B^+ \to \tau^+\nu$ have shown a certain deviations from the SM predictions. Therefore we examined possibilities of RPV-MSSM to explain the discrepancies, and find the allowed parameter space of the RPV couplings [1, 2].

In RPV-MSSM, contributions of supersymmetric particles to leptonic decays of D_s^+ and B^+ mesons are given by down-type-squark exchange in the t-channel diagram and charged slepton exchange in the s-channel diagram. In the earlier works for these issues [3–7], the authors relied on a certain assumption among the RPV interactions, or adopted so-called "single coupling dominance" hypothesis so that supersymmetric contributions to those processes are drastically simplified. In our study, we did not adopt the single coupling hypothesis or other artificial assumptions on the RPV interactions. We investigate the supersymmetric contributions to the leptonic decays of D_s^+ and B^+ mesons taking account of the interference effects between the s- and t- channel diagrams. Taking account of the interference effects between those diagrams, we show the allowed

region of RPV couplings where the deviations between the experimental data and the SM predictions could be explained.

Note that the interference between two diagrams could be either constructive or destructive due to the relative sign of the RPV couplings in two diagrams. We find therefore that the experimental data constraints not only the size of RPV couplings but also the relative sign between the RPV couplings in s- and t- channel diagrams, which has not been examined in the previous studies.

We also study in this thesis the contributions of the RPV interactions to the leptonic decays with both the lepton flavor conservation and lepton flavor violation (LFV). Because the flavor identification of neutrinos is impossible experimentally, we have to consider the latter case.

The RPV interactions which lead to the LFV in the final state of the leptonic decays also contribute to the other LFV processes. Thus we must take into account to constraints from the data of other LFV experiments. As a result, we show that contributions of RPV (and LFV) interactions to $D_s^+ \to \tau^+\nu_\mu$ are suppressed by a few orders of magnitude compared to the flavor conservation case ($\tau\nu_\tau$) owing to the constraints from the other LFV processes, while those for B^+ can be as large as $\tau\nu_\tau$.

In our study, we address explanation for the deviations between the SM expectations and the experimental data of $D_s^+ \to \tau^+\nu$ and $B^+ \to \tau^+\nu$ with RPV-MSSM. The allowed parameter region of RPV couplings is achieved by taking into account of all contributions to leptonic decays of D_s^+ and B^+ mesons.

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