Contribution ID: 24 Type: not specified

## Semileptonic b Decays at Future Z Factories

Friday, 19 August 2022 21:55 (25 minutes)

As one of the hypothetical principles in the Standard Model (SM), lepton flavor universality (LFU) should be measured with a precision as high as possible such that the physics violating this principle can be fully tested. The Z factories at the future  $e^-e^+$  colliders provide a great opportunity to perform this task because of their large statistics and high reconstruction efficiencies for B mesons at Z pole. These advantages are further strengthened if  $\tau$  leptons are produced via the B-meson decays as a third-generation flavor. In this paper, we present a systematic study on the LFU test in different operation scenarios of the future Z factories. The goal is two-fold. Firstly, we study the sensitivities of measuring the LFU-violating observables which have involved the  $b \to c\tau\nu$  transitions, namely  $R_{J/\psi}$ ,  $R_{D_s}$ ,  $R_{D_s^*}$  and  $R_{\Lambda_c}$ , using the mode of muonic  $\tau$  decays. For this purpose, the strategies of event reconstruction are developed on the basis of the charged-track information. Secondly, we interpret the projected sensitivities in the SM effective field theory (with an assumption that the LFU-violating physics occurs to the third generation exclusively), by combining the LFU tests with  $b \to c\tau\nu$  and the measurements of the  $b \to s\tau^-\tau^+$  and  $b \to s\nu\nu$  transitions. We show that the limits on the LFU-violating energy scale can be pushed up to  $\sim 10~{\rm TeV}$  for  $\sim \mathcal{O}(1)$  Wilson coefficients.

## Category

talk

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**Session Classification:** Session 4