Contribution ID: **25** Type: **Contributed**

Unveiling New Physics with Tau Leptons: Innovative Approaches at Belle II

Friday 12 July 2024 10:00 (20 minutes)

Abstract:

In the quest to explore new physics beyond the Standard Model of particles (BSM), the Belle II experiment at the SuperKEKB collider stands as a pivotal platform for investigating the frontiers of particle physics. With an unprecedented dataset of tau-lepton pairs, this study presents three distinct approaches aimed at unraveling the mysteries of BSM phenomena through tau-lepton decays.

Firstly, we introduce a search for lepton-flavor-violating decays of the tau lepton to a lepton and an invisible spin-0 boson. Utilizing a dataset with an integrated luminosity of 62.8 fb^{-1} at a center-of-mass energy of 10.58 GeV, we set stringent upper limits on the branching-fraction ratios for tau decays to an electron or muon plus an invisible boson, significantly improving upon previous bounds.

Secondly, we propose a new method to enhance the search for invisible BSM particles in tau decays. By meticulously analyzing the kinematics of tau pair decays, our approach offers a substantial improvement in the sensitivity to tau decays to a lepton and an undetected massive particle, expanding the potential to probe BSM physics in both 3×1 and 1×1 prong tau decays.

Lastly, we present the most precise measurement of the tau-lepton mass to date, achieved through the analysis of a large sample of electron-positron collisions producing tau pairs. The measurement is based on the kinematic edge of the tau pseudomass distribution in the decay to three pions and neutrinos, leveraging the full potential of the 190 fb^{-1} dataset used in this study.

Together, these studies exemplify the power of innovative analytical techniques in extracting the maximum information from the rich Belle II dataset, paving the way for new discoveries and a deeper understanding of the fundamental constituents of our universe.

Primary author: DE LA CRUZ BURELO, Eduard (Centro de Investigación y de Estudios Avanzados del IPN (MX))

Presenter: DE LA CRUZ BURELO, Eduard (Centro de Investigación y de Estudios Avanzados del IPN (MX))

Session Classification: Contributed talks