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Future lepton collider potential in the search for top quark FCNC coupling

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Abstract

The Future Circular Collider (FCC-ee), with its clean experimental environment, high energy, and luminosity, offers a unique opportunity for the precise study of the properties and interactions of top quarks. In this study, we have investigated the potential sensitivity of the FCC-ee to flavor-changing neutral current (FCNC) processes involving top quarks using an effective Lagrangian approach. To this end, the production of top quarks in electron-positron collisions at center-of-mass energies of 240 GeV and 365 GeV has been simulated, considering the full hadronic decay of the W boson resulting from the top quark decay. The results of the analyses show that by combining these center-of-mass energies and considering integrated luminosities of 5 ab^{-1} and 1.5 ab^{-1}, an FCNC sensitivity on the order of 10^{-5} can be achieved. These findings highlight the significant potential of the FCC-ee for discovering and precisely studying FCNC processes, which could contribute to a better understanding of physics beyond the Standard Model.

Keywords: Future Circular Collider (FCC-ee), top quark, Flavor-Changing Neutral Current (FCNC), physics Beyond the Standard Model (BSM)

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