



Iranian Journal of Physics Research, Vol. 25, No. 1, 2025
DOI: 10.47176/ijpr.25.1.12046

The effect of Lorentz violation on the azimuthal correlation contribution in polarized top quark decay

Z Rezaei and S M Moosavi Nejad*

Faculty of Physics, Yazd University, University Blvd. - Safayieh - Yazd

E-mail: mmoosavi@yazd.ac.ir

(Received 21 January 2025; in final form 04 March 2025)

Abstract

In many models beyond the standard model (SM), the Lorentz invariance violation of physical phenomena is allowed. Various processes have yet been investigated to study the effect of Lorentz violation and some upper limits have been specified for the Lorentz violation (LV) coefficients. A specific process, which is less considered, is the decay of polarized top quark. According to the SM of particle physics, the top quark in the cascade process decays so in the following the W-boson decays into a lepton and its neutrino ($\ell \bar{\nu}_\ell$). In this paper, through the study of polarized top quark decay rate we shall investigate the azimuthal correlation contribution between the event plane and polar plane (including the top quark polarization vector) in more detail. Then, we shall study the Lorentz violation effect on the azimuthal contribution of decay rate. We will show that the LV effect leads to a non-zero contribution for the azimuthal correlation at lowest-order of perturbation. This deviation from the SM results could be considered as a suitable situation to search for the Lorentz symmetry violation and then the new physics. Using the analytical results, we will also determine upper limits for some LV coefficients which are in good consistency with the ones reported by the CERN-CMS collaboration. We will also show that the LV effect leads to another azimuthal correlation contribution, which is absent at all perturbation orders in the SM.

Keywords: Polarized top quark, Azimuthal correlation, Lorentz violation coefficients

For full article, refer to the Persian section