Contribution ID: **26** Type: **not specified**

Dark photon effects with the kinetic and mass mixing in $Z \to \tau^-\tau^+$

Friday, 17 November 2023 15:00 (20 minutes)

A new $U(1)_X$ gauge boson field X can have renormalizable kinetic mixing with the standard model (SM) $U(1)_Y$ gauge boson field Y. Besides the dark photon kinetic mixing σ, there could be mass mixing by introducing the additional Higgs doublet with vev engaging in $U(1)_X$ and electroweak symmetry breaking simultaneously. The Z boson interaction with SM tau lepton is modified by defining the mixing ratio parameter ϵ, which shows the magnitude of the mass and kinetic mixing of dark photon. We investigate the Z boson phenomenology of dark photon model with both the kinetic mixing and mass mixing. The allowed parameter region is obtained by analyzing these constraints from the vector and axial-vector couplings $g^{\tau}_{V,A}$, the decay branching ratio $Br(Z \to \tau^-\tau^+)$ and tau lepton polarization in $Z \to \tau^-\tau^+$. We found that the mixing ratio plays important role in the Z boson features by choosing different ϵ values.
Further, we attempt to find the common regions to satisfy these above four bounds for $m_X > m_Z$ and $m_X < m_Z$.
However, the regions allowed by g^{τ}_A and $Br(Z \to \tau^-\tau^-)$ tends to the opposite direction so that there are not viable parameter spaces within 2σ errors. The problem can be solved within 3σ errors.

Primary authors: SUN, Jin (Shanghai Joao Tong University); XING, zhi-peng (njnu)

Presenter: XING, zhi-peng (njnu)

Session Classification: Theory