DPF-PHENO 2024

Contribution ID: **610** Type: **not specified**

Probing a GeV-scale Scalar Boson and a TeV-scale Vector-like Quark Associated with $U(1)_{T3R}$ at the Large Hadron Collider using Machine Learning

Monday 13 May 2024 15:15 (15 minutes)

A model based on a $U(1)_{T3R}$ extension of the Standard Model can address the mass hierarchy between the third and the first two generations of fermions, explain thermal dark matter abundance, and the muon $g-2$ and $R_{K^{(*)}}$ anomalies. The model contains a light scalar boson ϕ' and a heavy vector-like quark χ_u that can be probed at CERN's Large Hadron Collider (LHC). We perform a phenomenology study on the production of ϕ' and χ_u particles from proton-proton (pp) collisions at the LHC at $\sqrt{s} = 13$ TeV primarily through $g-g$ and $t-\chi_u$ fusion. We work adopt a phenomenological framework, an effective field theory approach, in which the χ_u and ϕ' masses are free parameters and consider the final states of the χ_u decaying to b-quarks, muons, and MET from neutrinos and the ϕ' decaying to $\mu^+\mu^-$. The analysis is performed using machine learning algorithms, over traditional methods, to maximize the signal sensitivity with integrated luminosities of of $150, 300$, and 3000 fb^{-1}. Further, we note the proposed methodology can be a key mode for discovery over a large mass range, including low masses, traditionally considered difficult due to experimental constraints.

Mini Symposia (Invited Talks Only)

Authors: GURROLA, Alfredo (Vanderbilt University (US)); SOHAIL QURESHI, Umar (Vanderbilt University)

Presenter: SOHAIL QURESHI, Umar (Vanderbilt University)

Session Classification: Machine Learning & AI

Track Classification: Machine Learning & AI