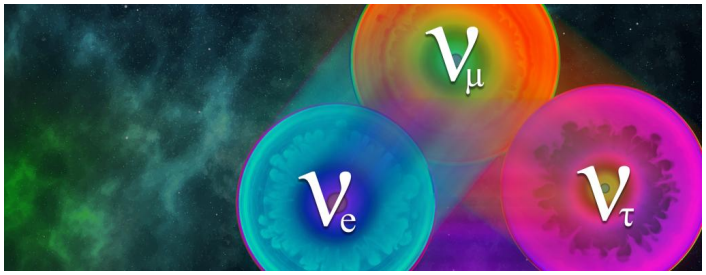

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Exploring Z' and Right-Handed Neutrinos in the BLSM at the Large Hadron Collider use machine learning

Thursday, 22 January 2026 16:00 (30 minutes)

We study the collider phenomenology of the B-L extension of the Standard Model (BLSM), focusing on the production and decay of a heavy neutral gauge boson (\(Z' \)) at the Large Hadron Collider (LHC). In this framework, the \(Z' \) can decay into pairs of heavy right-handed neutrinos (\(\nu_R \)), which subsequently decay into charged leptons and \(W \) bosons. These processes give rise to three distinctive final states: (i) two leptons plus four jets (\(2\ell + 4j \)), (ii) four leptons plus missing transverse energy (\(4\ell + \text{MET} \)), and (iii) three leptons plus two jets and MET (\(3\ell + 2j + \text{MET} \)).
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To enhance signal sensitivity and suppress Standard Model backgrounds, we employ multivariate analysis techniques based on Boosted Decision Trees (BDTs), as well as selection optimizations using the \texttt{XGBOOST} framework. The classifiers are trained on kinematic observables sensitive to the masses of the \(Z' \) and \(\nu_R \). We demonstrate that all three final states offer significant discovery potential for both the \(Z' \) and heavy \(\nu_R \) at the High-Luminosity LHC. Our results highlight the testability of the BLSM at current and future collider experiments, and provide a promising avenue for probing the origin of neutrino masses and the baryon asymmetry of the Universe.

Authors: EZZAT, Kareem (Ain Shams University); Prof. CHAMOUN, nidal (syria university); Prof. KHALIL, shaaban (zewail city)

Presenter: EZZAT, Kareem (Ain Shams University)