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Probing the B-Meson Anomalies Using ttbar+Z' Processes and Machine Learning ELIJAH SHERIDAN, Vanderbilt University — We perform a feasibility study to search for Z' particles by probing their production in association with boosted top quarks at the LHC. In particular, we focus on the $Z' \to b\bar{b}$ decay mode and a semileptonic, semihadronic final state. Motivated by the lepton non-universality suggested by recent experimental findings in b physics and muon $g-2$ studies, we focus on a Z' which couples strongest to the third generation fermions, substantiating our selected signal process. Assuming proton-proton collisions at $\sqrt{s} = 13$ TeV, we present the total $pp \to t\bar{t}Z'$ production cross sections and relevant kinematic distributions as a function of $m_{Z'}$ and the coupling product $g_{t\bar{t}Z'}g_{b\bar{b}Z'}$. We employ contemporary machine learning binary classification models—in particular, decision trees with gradient boosting—to discriminate between our signal and Standard Model backgrounds, resulting in increased discriminating power and a 5σ discovery reach that exceeds existing $m_{Z'}$ limits.

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