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Search for an $L_{\mu} - L_{\tau}$ gauge boson using $Z \rightarrow 4\mu$ events in pp collisions at $\sqrt{s} = 13 \text{ TeV}$

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Search for a narrow Z' gauge boson with a mass between 5 and 70 GeV resulting from an $L_{\mu} - L_{\tau} U(1)'$ symmetry would be reported. Theories that predict such a particle have been proposed as an explanation of various experimental anomalies including the lack of a dark matter signal in direct detection experiments, tension in the measurement of the anomalous magnetic moment of the muon, and reports of possible lepton flavour universality violation in B-meson decays. The data sample consists of proton-proton collisions at $\sqrt{s} = 13$ TeV collected with the CMS detector at the LHC and corresponds to an integrated luminosity of 77.3 fb⁻¹. The search considers events containing four muons with an invariant mass near the Z boson mass, and the selection is further optimized to be sensitive to the Z' signal that may be present in $Z \rightarrow 4\mu$ decays. The observations are consistent with the standard model predictions. Upper limits of 10^{-8} – 10^{-7} at 95% confidence level are set on the branching fraction $\mathcal{B}(Z \rightarrow Z' \mu \mu) \times \mathcal{B}(Z' \rightarrow \mu \mu)$, which excludes a Z' boson coupling strength to muons above 0.004–0.3, depending on the Z' mass. These are the first dedicated limits on the $L_{\mu} - L_{\tau}$ model at the LHC

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