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Search for an $L_\mu - L_\tau$ gauge boson using Z$\to 4\mu$ events in pp collisions at $\sqrt{s} = 13$ 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 $77.3\ \mathrm{fb}^{-1}$. 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$\to 4\mu$ 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 $\mathcal{B}(\mathrm{Z} \to \mathrm{Z}'\mu\mu) \times \mathcal{B}(\mathrm{Z}' \to \mu\mu)$, 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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