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LHC constraints on Lµ – Lτ interactions

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In this paper we examine the constraints dedicated LHC multi lepton searches can place on Z' bosons coming from gauged muon number minus tau number, $L_{\mu} - L_{\tau}$. As the $L_{\mu} - L_{\tau}$ gauge boson does not couple to proton constituents or electrons at tree level, the current bounds are fairly loose, especially for $M_{Z'} < 1 \text{ GeV}$. For $2m_{\mu} < M_{Z'} < M_Z/2$ we develop search strategies using the $pp \rightarrow Z \rightarrow 4\mu$ channel. The cleanliness of the final state, combined with the fact that $pp \rightarrow Z \rightarrow 4e$, $Z \rightarrow 2e 2\mu$ can be used as background control samples, allow us to spot $L_{\mu} - L_{\tau} Z'$ with couplings $\mathcal{O}(10^{-4})$ times the Standard Model couplings with Matrix Element method. For lighter Z', we propose the mode $pp \rightarrow 2\mu + \not \!$ The presence of missing energy means there is a wider set of backgrounds to consider in this final state, such as Drell-Yan production of leptonically decaying τ pairs, however we find these can be controlled with careful cuts.

Summary

we examine the constraints dedicated LHC multi lepton searches can place on Z' bosons coming from gauged muon number minus tau number, $L_{\mu} - L_{\tau}$, where $M_{Z'} < M_Z/2$.

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