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## LHC constraints on $L_\mu - L_\tau$ 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  $M_{Z'} < 1$  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  $pp \rightarrow Z \rightarrow 4e$ ,  $Z \rightarrow 2e2\mu$  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  $pp \rightarrow 2\mu + \cancel{E}_T$ . 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  $\tau$  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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