Contribution ID: **1** Type: **Poster (one author must be in person)**

Constraining 3-3-1 Models at the LHC and Future Hadron Colliders

Thursday 2 June 2022 17:59 (1 minute)

In this work, we derive lower mass bounds on the Z' gauge boson based on the dilepton data from LHC with 13 TeV of center-of-mass energy, and forecast the sensitivity of the High-Luminosity-LHC with $L = 3000 fb^{-1}$, the High-Energy LHC with $\sqrt{s} = 27$˜TeV, and also at the Future Circular Collider with $\sqrt{s} = 100$˜TeV. We take into account the presence of exotic and invisible decays of the Z' gauge boson to find a more conservative and robust limit, different from previous studies. We investigate the impact of these new decays channels for several benchmark models in the scope of two different 3-3-1 models. We found that in the most constraining cases, LHC with $139 fb^{-1}$ can impose $m_{Z'} > 4$˜TeV. Moreover, we forecast HL-LHC, HE-LHC, and FCC bounds that yield $m_{Z'} > 5.8$˜ TeV, $m_{Z'} > 9.9$˜TeV, and $m_{Z'} > 27$˜TeV, respectively. Lastly, put our findings into perspective with dark matter searches to show the region of parameter space where a dark matter candidate with the right relic density is possible.

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Session Classification: Poster session

Track Classification: PE&D poster