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Widening the $U(1)_{L_\mu - L_\tau}$ Z' mass range for resolving the muon $g-2$ anomaly

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Exchanging a Z' gauge boson is a favored mechanism to solve the muon $(g-2)_\mu$ anomaly. Among such models the Z'
from $U(1)_{L_\mu - L_\tau}$ gauge group has been extensively studied. In this model the same interaction addressing $(g-2)_\mu$, leads to an enhanced muon neutrino trident (MNT) process $\nu_\mu N \to \nu_\mu \mu \bar{\mu} N$ constraining the Z' mass to be less than a few hundred MeV. Many other Z' models face the same problem. It has long been realized that the coupling of Z' in the model can admit $(\bar{\mu}\gamma^\mu \tau + \bar{\nu}_\mu \gamma^\mu L \nu_\tau) Z'_\mu$ interaction which does not contribute to the MNT process. It can solve $(g-2)_\mu$ anomaly for a much wider Z' mass range. However this new interaction induces $\tau \to \mu \bar{\nu}_\mu \nu_\tau$ which rules out it as a solution to $(g-2)_\mu$ anomaly. Here we propose a mechanism by introducing type-II seesaw $SU(2)_L$ triplet scalars to evade constraints from all known data to allow a wide Z' mass range to solve the $(g-2)_\mu$ anomaly. This mechanism opens a new window for Z' physics.

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