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W boson mass, dark matter and $(g-2)_\ell$ in the ScotoZee neutrino mass model

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In the light of recent experimental results confirming a 4.2σ discrepancy in the measurement of $(g-2)_\mu$ and a possible 7σ excess in the W boson mass, we propose a simple charged singlet extension of the Scotogenic model, the ScotoZee model, to investigate these anomalies while establishing a direct correlation with the neutrino oscillation data as well as the observed relic abundance. The singlet scalar not only gives corrections to the anomalous magnetic moment of muon (and electron) but also serves as a portal to provide the correct relic density from the fermionic dark matter (DM) candidate naturally admitted by the model. We also study the aforementioned anomalies in the context of scalar dark matter and show that although the CDF measurement of W boson mass shift disfavors the scalar DM candidates in the simple Scotogenic model/IDM, the mixing of the charged singlet scalar evades this complication in our model. We show the consistency of this framework involving both scalar and fermionic dark matter candidates while satisfying constraints from charged lepton flavor violation, direct detection as well as existing collider constraints. Furthermore, the model gives predictions for the lepton flavor violating processes, $\tau \to \ell\gamma$, testable in upcoming experiments.

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