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Charged Lepton Flavor Violation in a Lepton Flavor Portal Matter Model

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Increasing attention has been given recently to the theory and phenomenology of portal matter (PM) models —a BSM framework in which the standard model (SM) local gauge symmetry group is augmented by a local dark group $U(1)_D$, of which the mediator is the dark photon, and kinetic mixing between $U(1)_D$ and the SM hypercharge is generated at one loop by the PM fields. The case in which the PM are vector-like leptons (VLL) is of particular interest for the study of precision measurements of the leptonic sector: We have recently studied a simple realization of this $U(1)_D$ model that addresses the potential $(g-2)_\mu$ anomaly [1] and a TeV-scale completion in which the $U(1)_D$ is embedded into a larger non-Abelian dark group, allowing the SM and PM fields to exist as members of the same dark gauge multiplets [2] and resulting in the introduction of new $U(1)_D$-neutral vector-like leptons. Here we study models with leptonic PM and additional $U(1)_D$ neutral vector-like leptons. We analyze the minimal particle content that such a simplified model can have and still produce a sizable correction to the charged lepton flavor-conserving process $(g-2)_\mu$, which shows that only certain combinations of PM and $U(1)_D$-neutral VLL are required, in agreement with [3]. Moreover, given the current stringent constraints on muonic charged lepton flavor violation (CLFV), we study the CLFV processes $\mu^+ \to e^+ + \gamma$, $\mu^+ \to e^+ + e^- + e^+$, and μ to e conversion in nuclei up to one loop level and examine how current and future experiments can constrain its parameter space [4].

[1] George N. Wojcik, Lisa L. Everett, Shu Tian Eu, and Ricardo Ximenes. "Portal Matter, Kinetic Mixing, and Muon g-2." Physics Letters B 841 (2023): 137931.
[2] George N. Wojcik, Lisa L. Everett, Shu Tian Eu, and Ricardo Ximenes. "Lepton flavor portal matter." Physical Review D 108.5 (2023): 055033.
[3] George N. Wojcik, Shu Tian Eu, and Lisa L. Everett. "Graph reinforcement learning for exploring model spaces beyond the standard model." Physical Review D 111.3 (2025): 035007.
[4] George N. Wojcik, Lisa L. Everett, Shu Tian Eu, and Ricardo Ximenes. "Charged Lepton Flavor Violation in a Lepton Flavor Portal Matter Model" - In preparation.

Mini Symposia (Invited Talks Only)

Plenary (Invited talks only)

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