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## Probing charged lepton flavor violation and quantum entanglement in muon on-target experiments

Firstly, we'd like to share a novel and cost-effective experiment proposal to probe the charged lepton flavor violation (CLFV) process mediated by an extra massive neutral gauge boson  $Z'$  beyond the Standard Model, as a part of the Peking University Muon (PKMuon) Experiment. The considered process can be uniquely sensitive to specific CLFV parameter combinations, such as the coupling coefficient product  $\lambda_{e\mu}\lambda_{\mu\mu}$ . Additionally, we will present a realistic proposal and a comprehensive study of quantum entanglement in a state composed of different-flavor fermions in muon-electron scattering. Entanglement in the resulting muon-electron qubit system and the violation of the Bell inequality can be observed with a high event rate. This paves the way for performing quantum tomography with muons.

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