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Effective Theory of Muon-to-Electron Conversion: Applications to Mu2e and COMET

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An e ective theory of charge lepton flavor violation (CLFV) was recently developed, yielding a complete set of nucleon-level operators through linear order in the nucleon and muon velocities. The embedding of this operator basis in a nucleus then determines what can and cannot be learned about CLFV from muon-to-electron conversion. Due to several technical tricks introduced, we were able to treat the associated nuclear responses completely, e.g., with the inclusion of all distorted partial waves of the electron. The EFT was then extended in two important ways. One was its generalization to include inelastic nuclear contributions, where it emerged that Mu2e and COMET may be able to place multiple constraints on CLFV given anticipated backgrounds, due to the fortuitous choice of 27Al as a target. The second was the linking of the nuclear-level EFT to a tower of EFTs constructed for higher energy scales, so that constraints obtained from next

generation experiments can be "ported up"to SMEFT scales and beyond. 1. Evan Rule, WCH, Ken McElvain: "Nuclear-level e ective theory of muon-to-electron conversion,"Phys. Rev. Lett. 130 (2023) 131901
2. WCH, Evan Rule, Ken McElvain, Michael J. Ramsey-Musolf: "Nuclear-level e ective theory of muon-toelectron conversion: Formalism and Applications,"Phys. Rev. C 107 (2023) 035504
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