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Charged Lepton Flavour Violations searches with muons: present and future

Charged-lepton flavor violation (cLFV) is one of the most powerful probes for New Physics (NP). Since lepton flavor conservation is an accidental symmetry in the Standard Model (SM), it is naturally violated in many NP models, with contributions at the level of the current experimental sensitivities. Moreover, the negligible SM contributions would make the observation of cLFV unambiguous evidence of NP. It makes these searches extremely sensitive and, at the same time, extremely pure.

Thanks to the intense muon beams currently available, their intriguing upgrade programs, and the progress in the detection techniques, cLFV muon processes are the golden channels in this field. Experimental programs to search for $\mu^+ \to e^+\gamma$, $\mu^+ \to e^+e^+e^-$ and the $\mu \to e$ conversion in the nuclear field are currently ongoing. We review the current status and the strategic plans for future searches.

This document is an update of the prior cLFV submission to the 2018 European Strategy for Particle Physics (ESPP); the earlier submission should be consulted for more experimental details.

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