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A proposal of a New Charged Lepton Flavor Violation Experiment: μ− e− ⟶ e− e− in muonic atom

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We propose a new process of μ− e− ⟶ e− e− in a muonic atom for a quest of charged lepton flavor violation. The Coulomb attraction from the nucleus in a heavy muonic atom leads to significant enhancement in its rate, compared to μ+ e− ⟶ e+ e−. The search for this process could serve complementarily with the other relevant processes to shed light upon the nature of charged lepton flavor violation.
The wave functions of bound and scattering state leptons are properly treated by solving Dirac equations with Coulomb interaction of the finite nuclear charge distributions. This new effect contributes significantly in particular for heavier atoms, where the obtained decay rate is about one order of magnitude larger than the previous estimation for 208 Pb in particular for contact interactions. We also discuss how to observe the differences among interaction types.

It is based on the works arXiv:1003.1578(PRL 105(2010) 121601), arXiv:1603.01522 (PRD93 (2016) no.7, 076006) and work in progress.

Primary author: SATO, Joe (Saitama University)

Co-author: Dr YAMANAKA, Masato (Maskawa Institute)

Presenter: SATO, Joe (Saitama University)

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