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A new concept of Mu-antiMu conversion search

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The conversion from muonium ($\text{Mu}, \mu + e^-$) to anti-muonium ($\text{antiMu}, \mu - e^+$) is strongly suppressed in the Standard Model (SM) of particle physics because it violates the conservation of the leptonic family number. In many theories of SM extension, leptonic family numbers (lepton flavors) are not conserved and then the Mu-antiMu conversion can become observable level, just below the current experimental upper limit of 8.3×10^{-11} . Though the search for the Mu-antiMu conversion is strongly motivated in this way, a new experimental method is required to go beyond the current limit which is determined by beam-related background.

We propose to search for the Mu-antiMu conversion with a new method; Mu is produced by injecting muon into a muonium production target such as silica aerogel. Converted antiMu is ionized by laser and μ^- is transported by electric and magnetic components. Because there is no source of μ^- in such an experimental setup, background-free search can be conducted. This method needs an intense pulsed muon beam and a laser system, both of which could be available in MLF J-PARC.

We will present the details of this new Mu-antiMu search concept and the result of the feasibility study performed in D line, MLF to confirm the background level is low enough.

Author: KAWAMURA, Naritoshi

Presenter: KAWAMURA, Naritoshi

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