PROCEEDINGS OF SCIENCE

A New Idea for an Experimental Search for μ-e Conversion

Masaharu Aoki* **on behalf of DeeMe Collaboration**
Osaka U.
E-mail: aokim@phys.sci.osaka-u.ac.jp

A new experiment searching for μ-e conversion by fully utilizing a high-power pulsed proton beam available at J-PARC Material and Life Science Facility (MLF) was proposed. The muonic carbon atom formation rate in a muon target of MLF is estimated to be 10^{10}/sec for 1 MW operation of a J-PARC booster. With this high formation rate of the muonic atoms, it is possible to perform a competitive search for μ-e conversion search at the level of 10^{-14}, nearly two orders of magnitude below current limits. A new secondary beam line will be dedicated to extract 105-MeV/c electrons from the muon production target. This beam line is compatible with a new muon g-2 experiment also planned at MLF.

35th International Conference of High Energy Physics
July 22-28, 2010
Paris, France

*Speaker.

PoS(ICHEP 2010)279

Any processes with Charged Lepton Flavor Violation (CLFV) are forbidden in the Standard Model *a priori*. The higher order effect coming from the neutrino oscillation is suppressed by a GIM-like mechanism to the level of 10^{-50},which is far beyond the experimental accessibility. Therefore, the experimental observation of CLFV process is a clear proof of the physics beyond the Standard Model.

The latest experiment to search for μ^--e^- conversion was performed by SINDRUM II collaboration and gave the upper limit, $< 7 \times 10^{13}$[1], for the gold target. There are many CLFV processes other than μ^--e^- conversion, but none of them found CLFV signals yet[2]. On the other hand, there are numerous theoretical models giving predictions for the branching ratios of CLFV processes[3]. A CLFV signal may be seen by experiments which improve the current limits, and it is conceivable that the CLFV signal lies waiting to be discovered right under the current limit. A new experiment searching for $\mu^- - e^-$ conversion process at the 10^{-14} level would be a highly competitive addition to the field.

A New Idea for the Experimental Search

DeeMe is a newly proposed experiment to search for the μ-e conversion at J-PARC MLF by using 3-GeV pulsed proton beam. The experiment utilizes muonic atoms formed in a primary proton target, and extracts 105-MeV/c electrons from the μ-e conversion by using a conventional secondary beamline. The number of muonic atoms formed in the primary target is estimated to be 10^{10}/sec for 1 MW operation of a J-PARC booster. Figure 1 shows the layout of the proposed secondary beamline. DeeMe aims to reach 10^{-14} of the single event sensitivity for silicon target with this beamline and with a silicon-carbide production target.

This beamline is designed so that it can be used for not only DeeMe but also other experiments such as muon $g-2$, muonium hyperfine structure, muonium-antimuonium conversion and so on. Fruitful outcomes of the muon fundamental science will be expected from J-PARC MLF in near future.

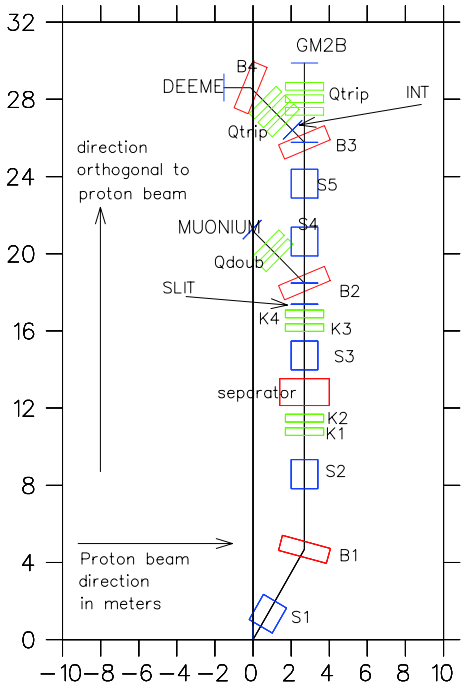

Figure 1: DeeMe beamline.

References

[1] W. Burtl *et al.* (The SINDRUM II Collaboration), *A search for μ-e conversion in muonic gold, Eur. Phys. J. C* **47** (2006) 337.

[2] W.J. Marciano *et al.*, *Charged Lepton Flavor Violation Experiments, Annu. Rev. Nucl. Part. Sci.* **58** (2008) 315.

[3] Y. Kuno and Y. Okada, *Muon decay and physics beyond the standard model, Rev. Mod. Phys.* **73** (2001) 151.