



Contribution ID: 729

Type: **Poster Presentation**

Search for Muon-to-Electron Conversion at J-PARC: COMET Experiment

The COMET Experiment at J-PARC aims to search for the lepton-flavour-violating (LFV) process of muon-to-electron conversion in a muonic atom, $\mu^- N \rightarrow e^- N$, with a branching-ratio sensitivity of 6×10^{-17} , which is 4 orders of magnitude better than the present upper limit.

Complemental searches for two kinds of muon LFV decay modes, $\mu^+ \rightarrow e^+ \gamma$ and $\mu^- N \rightarrow e^- N$, are quite important in order to explore the parameter region predicted by most well-motivated theoretical models beyond the Standard Model such as SUSY-GUT, seesaw, little-Higgs, extra-dimension, etc.

MEG experiment reported the latest result on $\mu^+ \rightarrow e^+ \gamma$ search at PSI in Switzerland, and made a strong limit on new physics models, i.e. filling in the missing piece of muon LFV, $\mu^- N \rightarrow e^- N$, will certainly play a very important role.

The need for such an unprecedented sensitivity places several stringent requirements on both the muon beam and the detector system.

In order to realise the experiment effectively and efficiently, a staged approach to deployment is endorsed by the J-PARC Program Advisory Committee and KEK, and the “COMET Phase-I” experiment will commence its engineering runs in 2019. In Phase-I, a search for $\mu^- N \rightarrow e^- N$ will be performed with an intermediate sensitivity which is 100 times better than the present upper limit.

The construction of experimental facility, beam line, magnets and detectors has been started. The facility building and the main tracking detector has been already completed. One of the most significant milestone to ensure the COMET sensitivity is 8 GeV proton beam commissioning, and the 8 GeV commissioning campaign is currently ongoing at J-PARC.

In this contribution, the current status of construction, results of 8 GeV commissioning, and prospects for COMET Phase-I and Phase-II both are presented.

Experimental Collaboration

COMET

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Session Classification: Poster session

Track Classification: Flavour Physics and Fundamental Symmetries