

【Grant-in-Aid for Specially Promoted Research】

Science and Engineering (Mathematics/Physics)



Title of Project : Search for Muon Lepton Flavor Violation with High Intensity Muon Beam

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Research Area : Experimental Particle Physics

Keyword : muon

【Purpose and Background of the Research】

The proposed research project is to search for a process of charged lepton flavor violation (CLFV) of muon to electron ($\mu \rightarrow e$) conversion by the first phase of the J-PARC E21 COMET experiment (COMET Phase-I), with an improved experimental sensitivity by more than hundreds. It has been confirmed that neutrinos are massive and mixed by the observation of neutrino oscillation. Therefore, lepton flavor for neutrinos is known to be violated. However, CLFV has been yet to be observed, and a discovery of CLFV is considered to be one of the most important subjects and potentially leading search in particle physics.

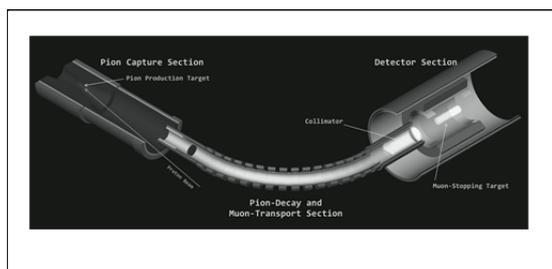


Figure 1 Layout

【Research Methods】

This research method is to construct detectors for COMET Phase-I. The detector of the COMET Phase-I is selected to be a cylindrical drift chamber (CDC) surrounding a muon-stopping target located at its center. Segmented trigger counters are placed at both the upstream and downstream ends of the CDC. The CDC is placed inside a superconducting solenoid magnet of a magnetic field of 1 T. With a total J-PARC proton beam power of 3.2 kW, about 5.8×10^9 stopped muons/s are expected. With a running period of 1.5×10^6 sec and the detector acceptance of 0.062, an expected single event sensitivity is 3.1×10^{-15} . The background events are estimated to be 0.03 events.

【Expected Research Achievements and Scientific Significance】

The Standard Model (SM) of particle physics is known to be incomplete since it has many

self-undetermined parameters, although we have not seen any striking experimental phenomena that the SM cannot explain. The major goal of particle physics is to find new physics beyond the SM. At the high-energy frontier, the Large Hadron Collider (LHC) has made magnificent progress such as discovery a Higgs-like particle, but the LHC cannot find any new particles in their energy region so far. Therefore, the other approach of searching for rare process has attracted much attention recently, in particular on CLFV.

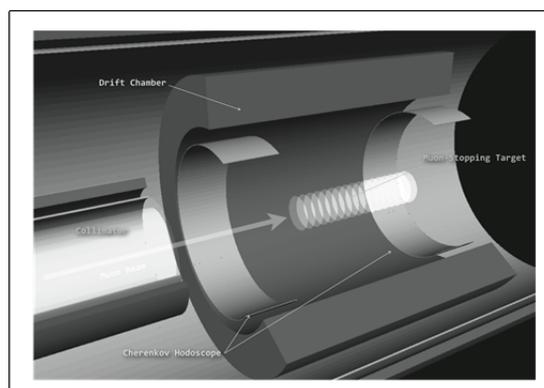


Figure 2 Detector

【Publications Relevant to the Project】

- Y. Kuno, “A Search for Muon-to-electron Conversion at J-PARC: The COMET Experiment”, PTEP 2013 (2013) 022C01, DOI : 10.1093/ptep/pts089
- Y. Kuno and Y. Okada, “Muon Decay and Physics beyond the Standard Model”, Rev. Mod. Phys. 73 (2001) 151-202, DOI : 10.1103/Rev/ModPhys.73.151

【Term of Project】 FY2013-2017

【Budget Allocation】 433,000 Thousand Yen

【Homepage Address and Other Contact Information】

<http://mlfv.hep.sci.osaka-u.ac.jp>