

# DPF-PHENO 2024

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## **PIONEER: a next-generation rare pion decay experiment**

*Monday, May 13, 2024 3:00 PM (15 minutes)*

Lepton flavor universality (LFU) is an assumed symmetry in the Standard Model (SM). The violation of the lepton flavor universality (LFUV) would be a clear sign of physics beyond the Standard Model and has been actively searched from both small- and large-scale experiments. One of the most stringent tests for LFU comes from the precision measurements of rare decays of light mesons. In particular, the ratio of branching fractions for charged pion decays,  $R_{e/\mu}^{\pi} = \Gamma(\pi \rightarrow e\nu(\gamma))/\Gamma(\pi \rightarrow \mu\nu(\gamma))$ , has tested the LFU at 0.1% level. However, while the value of  $R_{e/\mu}^{\pi}$  is predicted to a precision of  $10^{-4}$  in SM, there is an opportunity to improve the experimental probing of LFU by another order of magnitude. In this talk, I will introduce the PIONEER experiment, which has been recently approved at Paul Scherrer Institute (PSI), Switzerland, aiming at bridging the gap between precisions of SM predictions and measurements in experiments. Beside leveraging the intense charged pion beam at PSI, the PIONEER experiment adopts several cutting-edge detector technologies including a fully active 4-D silicon target stopping the pions, a high-performance trigger and data acquisition system, and a liquid Xenon calorimeter with excellent energy resolutions and fast responses. In addition to the precision measurement of  $R_{e/\mu}^{\pi}$ , the PIONEER experiment will also improve the search sensitivities to new physics beyond the standard model through searches of pion exotic decays, such as involving sterile neutrinos. Future phases of PIONEER experiment with higher intensity will contribute to the test of unitarity of CKM matrix through a precision measurement of pion beta decay leading to a precise determination of  $V_{ud}$ .

**Plenary (Invited talks only)**

**Mini Symposia (Invited Talks Only)**

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**Session Classification:** Minisymposium