

KPipe: A Short-Baseline Muon-Neutrino Disappearance Experiment using Neutrinos from Kaon Decay-at-rest

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Recently, anomalies consistent with neutrino oscillations with mass splittings on the order of 1 eV^2 have been observed. These anomalies have been seen in experiments measuring ν_e appearance and ν_e/ν_{μ} disappearance, while no corresponding evidence for muon neutrino disappearance has been detected. A common interpretation of the anomalies involves postulating the existence of one or more “sterile” neutrinos that, unlike the three Standard Model neutrinos, do not interact via the electroweak force. While models with sterile neutrinos can explain the current data, they all require that some amount of muon neutrino disappearance must occur, with several models indicating that evidence for the process might have been just below the sensitivities of past experiments. In this talk, I present a new type of experiment that will search for muon neutrino disappearance at the Materials and Life Science Facility (MLF), which is a part of the JPARC accelerator complex in Tokai, Japan. The facility features a high intensity, pulsed beam of 3 GeV protons used to produce neutrons, muons, and neutrinos for various experiments. In our proposal, we would measure mono-energetic neutrinos coming from kaon decay-at-rest with a detector consisting of a 3 m diameter by 90 m long pipe filled with liquid scintillator. This setup would aim to measure directly the L/E oscillation wave in the event rate along the length of the detector. Such a signal would provide convincing evidence for a sterile neutrino and avoids some of the difficulties in past experiments in characterizing the incoming neutrino flux and modeling neutrino-nucleus interaction cross sections.

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