

Heavy Neutral Lepton Searches at the Short Baseline Near Detector

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The Short-Baseline Neutrino (SBN) program at Fermilab aims to carry out precision searches for new neutrino physics [1]. Being the closest detector of the program to the Booster Neutrino Beam (BNB), Short Baseline Near Detector (SBND) is expected to measure an extremely high neutrino flux, allowing for world leading neutrino-nucleus interaction measurements as well as searches for physics Beyond Standard Model (BSM). SBND aims to achieve high timing resolution within the order of a few nanoseconds, allowing for the reconstruction of the BNB substructure. The precise timing enables identification of an interaction inside the detector whether it is in-time with the neutrino spill. This opens up possibilities not only to reject out-of-time cosmics muons background, but also to select delayed interactions from the BNB which can be signatures of BSM physics. A candidate for BSM long-lived particles is the Heavy Neutral Leptons (HNLs) [2]. HNLs interact with the SM by mixing with neutrinos, and can provide hints to the neutrino mass mechanism. This talk will explore the searches for HNLs produced from the BNB, that subsequently decay into a SM neutrino and a neutral pion inside SBND. The HNLs can be selected by utilising the delayed interaction time, as well as the unique highly boosted di-showers topology.

[1] P. Machado, O Palamara and D. Schmitz, arxiv 1903.04608 (2019)

[2] Anupama Atre et al, JHEP05(2009)030

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