

# Probing Non-Standard Neutrino Interactions at Neutrino Factories

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## Abstract

Based on the work by N. Cipriano Ribeiro *et. al.*, JHEP **0712**, 002 (2007) [arXiv:0709.1980 [hep-ph]], in this poster, we discuss the potential of a neutrino factory to probe the so called non-standard neutrino interactions (NSI) with matter, which may exist as a low-energy manifestation of physics beyond the Standard Model. Using the appearance modes  $\nu_e \rightarrow \nu_\mu/\bar{\nu}_e \rightarrow \bar{\nu}_\mu$ , we demonstrate how powerful is the setting of two detectors with different baselines, one at  $L = 3000$  km and the other at  $L = 7000$  km, where the latter is nearly at the magic baseline which is known to have a great sensitivity to matter density determination. Assuming the effects of NSI at the production and the detection are negligible, we study the impact of NSI in the neutrino propagation, and determine the sensitivity to NSI parameters,  $\varepsilon_{\alpha\beta}$ , and at the same time discuss how the determination of  $\theta_{13}$  and  $\delta$  is affected. We found that the effect of “synergy” of combing two detectors is significant, providing high sensitivity to NSI parameters and powerful enough to resolve the confusion between  $\theta_{13}$  and the NSI effect. We obtain, for example, at  $\sin^2 2\theta_{13} = 10^{-4}$ , the sensitivity of  $|\varepsilon_{e\tau}| \simeq$  a few  $\times 10^{-3}$  at  $3\sigma$  CL for 2 degrees of freedom, without losing much the sensitivity to  $\theta_{13}$  and  $\delta$ . Our results imply that neutrino factory can be a hunting machine for NSI while keeping its primary function of performing precision measurements of the lepton mixing parameters.

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