# DUNE Collaboration Meeting

Fermilab, May 2017

NSI Working Group Status

Celio Moura – UFABC

# NSI Group tasks (writing)

1) produce and keep updated a literature database with all “relevant” NSI work related to long baseline neutrino experiments, particularly DUNE;
   (a) Have regular discussions in this group about what we are learning from the literature.
2) write a tex document with sections about the specific contribution from each NSI subgroup; to be implemented later in official documents;

# Improving session 4. Neutrino Mixing, Mass Hierarchy, and CP Violation – Search for Nonstandard Interactions

- Current “old” official document
  - LBNE Science Book
- Future DUNE document. Online for editing session 4
  - Using overleaf with git...

# NSI Group tasks (computing)

1) integrate existing/known NSI/non-unitarity models in GLoBES and/or gain expertise in installing and running already existing tools in the DUNE nodes;
2) learn how to produce more realistic simulated DUNE NSI energy spectra by interfacing with the GLoBES simulation of the DUNE ND and FD;
3) produce realistic sensitivities using the whole framework built by doing items 1 and 2.

# Improving the current limits and studying new cases

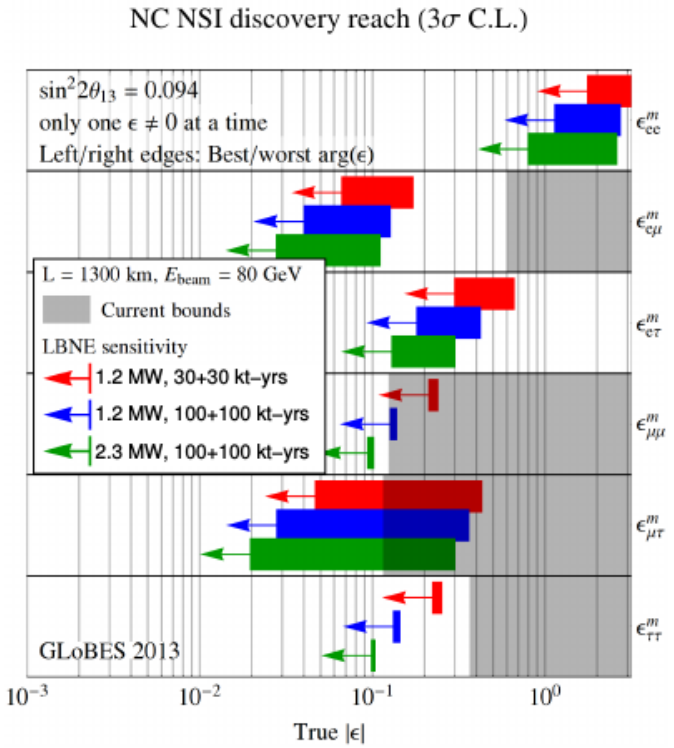
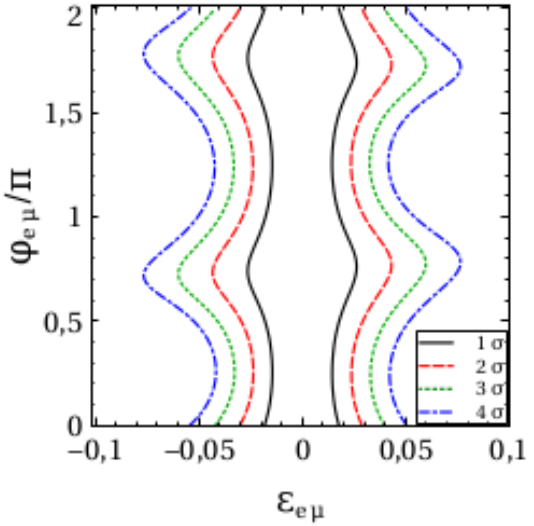



**Figure 4.31:** Nonstandard interaction discovery reach in LBNE with increasing exposure: 1.2 MW, 60 kt·years (red) + 1.2 MW, 200 kt · year (blue) + 2.3 MW, 200 kt · year (green). The left and right edges of the error bars correspond to the most favorable and the most unfavorable values for the complex phase of the respective NSI parameters. The gray shaded regions indicate the current model-independent limits on the different parameters at $3\sigma$ [172,173]. For this study the value of $\sin^2 2\theta_{13}$ was assumed to be 0.09. Figure courtesy of Joachim Kopp.

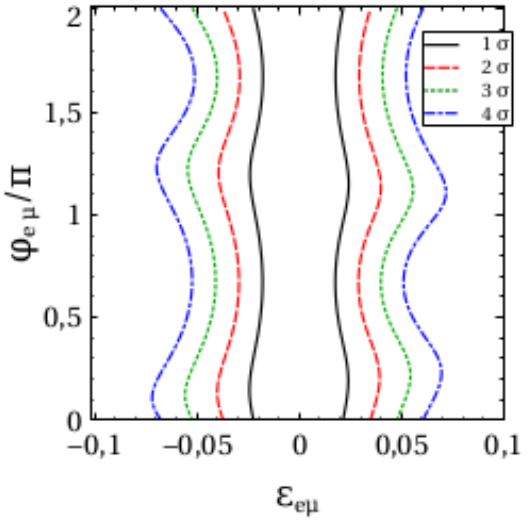
- New limits from others…
- Considering matter density variations
- Include new models from the literature as Non-Unitarity

# Some recent results




NH

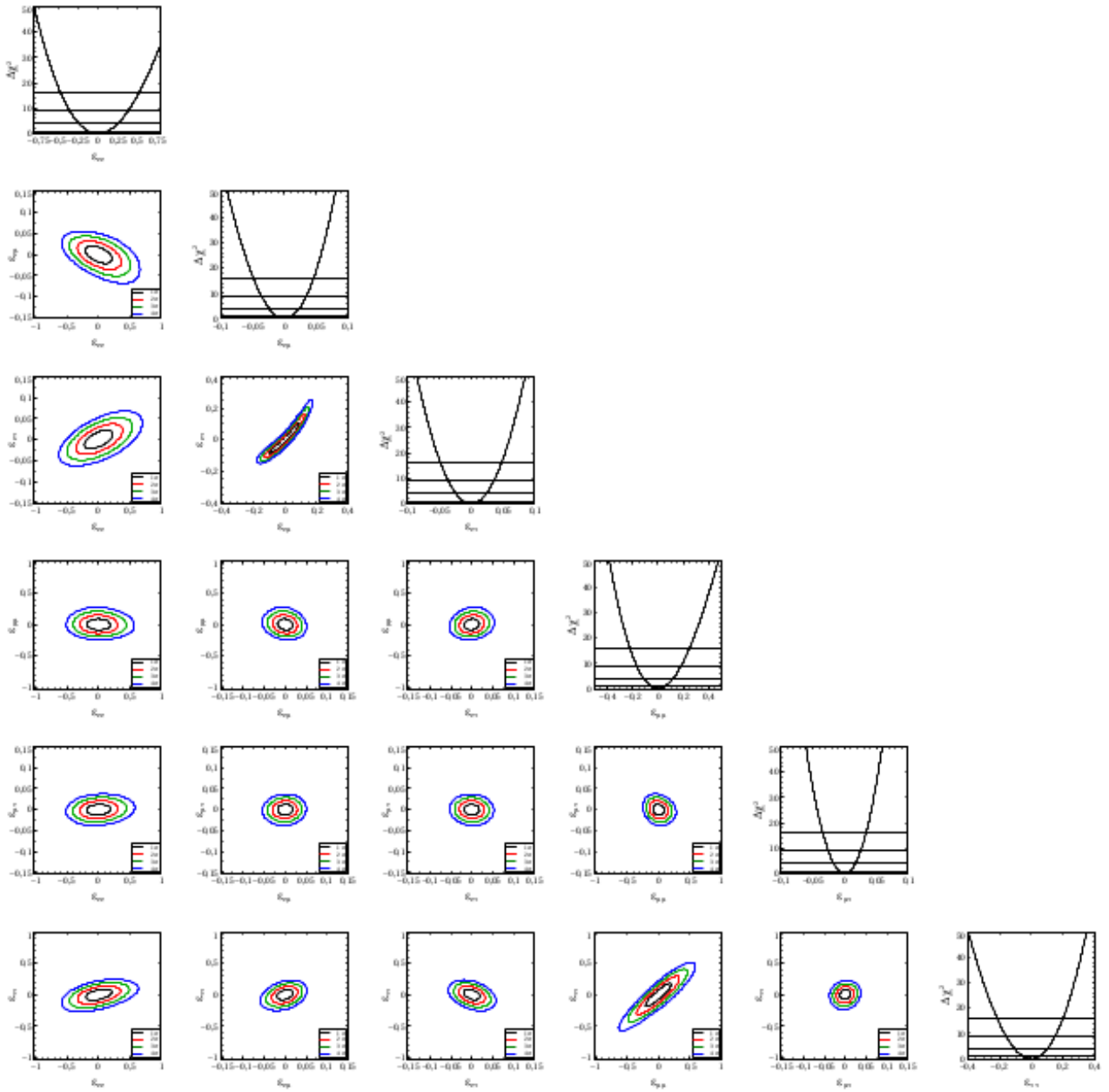
IH




| Parâmetro | $1\sigma$ | $2\sigma$ | $3\sigma$ | $4\sigma$ |
|---|---|---|---|---|
| $\varepsilon_{ee}$ | $[-0.22 \to 0.23]$ | $[-0.36 \to 0.38]$ | $[-0.495 \to 0.535]$ | $[-0.63 \to 0.695]$ |
| $\varepsilon_{e\mu}$ | $[-0.095 \to 0.09]$ | $[-0.13 \to 0.12]$ | $[-0.155 \to 0.15]$ | $[-0.18 \to 0.17]$ |
| $\varepsilon_{e\tau}$ | $[-0.015 \to 0.015]$ | $[-0.025 \to 0.025]$ | $[-0.04 \to 0.04]$ | $[-0.05 \to 0.05]$ |
| $\varepsilon_{\mu\mu}$ | $[-0.21 \to 0.205]$ | $[-0.35 \to 0.33]$ | $[-0.49 \to 0.455]$ | $[-0.63 \to 0.58]$ |
| $\varepsilon_{\mu\tau}$ | $[-0.085 \to 0.085]$ | $[-0.135 \to 0.135]$ | $[-0.185 \to 0.185]$ | $[-0.23 \to 0.23]$ |
| $\varepsilon_{\tau\tau}$ | $[-0.19 \to 0.18]$ | $[-0.315 \to 0.295]$ | $[-0.44 \to 0.4]$ | $[-0.57 \to 0.51]$ |
| $\phi_{e\mu}$ | $[0 \to 2\pi]$ | $[0 \to 2\pi]$ | $[0 \to 2\pi]$ | $[0 \to 2\pi]$ |
| $\phi_{e\tau}$ | $[0 \to 2\pi]$ | $[0 \to 2\pi]$ | $[0 \to 2\pi]$ | $[0 \to 2\pi]$ |
| $\phi_{\mu\tau}$ | $[0 \to 2\pi]$ | $[0 \to 2\pi]$ | $[0 \to 2\pi]$ | $[0 \to 2\pi]$ |

40+40kt in 3.5yr, NH

# All sensitivities - preliminary



# People currently involved

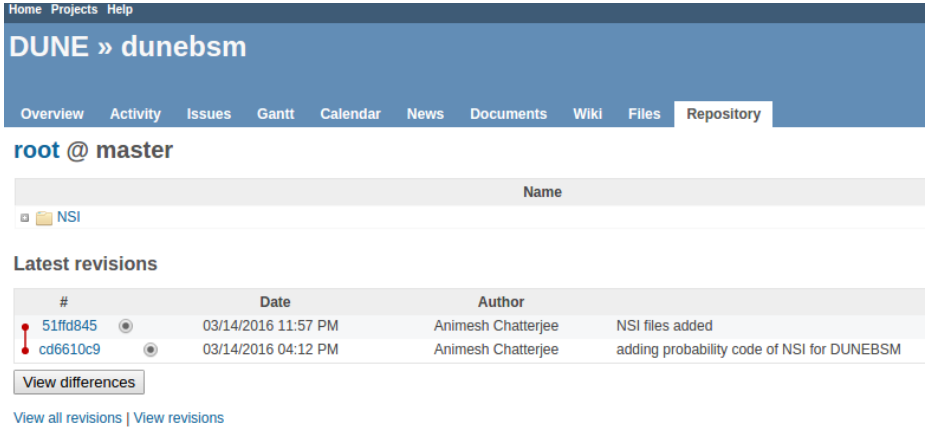
- Felipe Kamiya (my master's student), Gefan-Campinas (Marcelo Guzzo, Orlando Peres, David Vanegas and possibly others), Omar Miranda, Valencia (Mariam Tortola, Gabriela Berenboim) and maybe others
- If you would like to get involved, please, contact Jae, Alex, or Celio

# NSI Group Tools

# BSM Wiki


- https://cdcvs.fnal.gov/redmine/projects/dunebsm/wiki
- Page concentrating all the BSM group information
- Easy access to the repository

# BSM Repository




- https://cdcvs.fnal.gov/redmine/projects/dunebsm/repository
- Page where to find the NSI code for GloBES
- Alternatively:
  - Enrique Fernandez-Martinez (UAM) et al.
  - http://www.theophys.kth.se/~mbl/montecubes/

# Previous meetings

- NSI subgroup meetings (to help people getting started)
  - https://drive.google.com/drive/
- BSM Physics meetings and documents (many concerning NSI)
  - https://indico.fnal.gov/
  - http://docs.dunescience.org