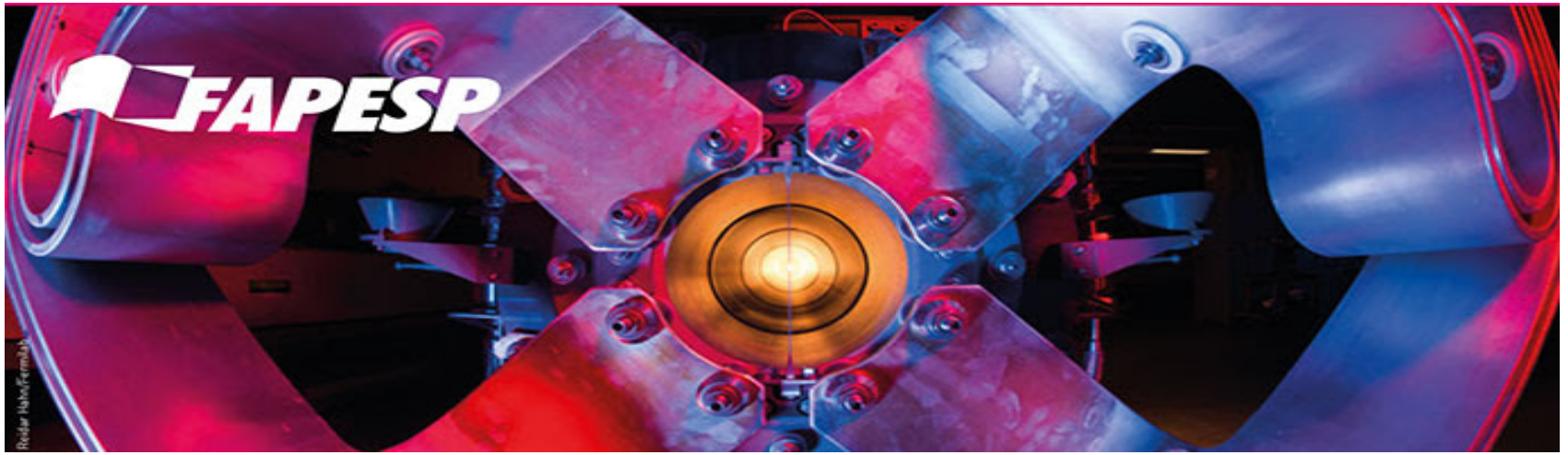


Theoretical aspects of São Paulo Contribution to

THE DEEP UNDERGROUND NEUTRINO EXPERIMENT

Marcelo M. Guzzo
Instituto de Física Gleb Wataghin
UNICAMP

DUNE Workshop, FAPESP, June 1st, 2017

The theoretical contributions to DUNE are concentrated in G E F A N

Grupo de Estudos de Física e Astrofísica de Neutrinos
(Group for research on neutrino physics and astrophysics)

- GEFAN began in 1995 putting together researchers from USP, UNESP, and UNICAMP.
- Today GEFAN is strutured around the FAPESP Thematic Project:

Challenges for Neutrino Physics in XXI Century

Coordinated by Orlando L.G. Peres (UNICAMP) and includes people from

UNICAMP, UNESP, UFABC, UNIFAL, UFG, UFF and Fermilab

GEFAN in numbers:

701 articles in journals with selective publication rules
440 articles and abstracts in proceedings
276 concluded supervisions:

- 20 Post-docs
- 49 Ph.D. theses
- 86 M.Sc. theses
- 110 Undergraduate research projects (Iniciação Científica)
- 11 Profis

Former members have permanent positions in:

- UNICAMP (2)
- UFABC (3)
- UFSCar (1)
- UNIFAL (1)
- UFF (1)
- PUC-Rio de Janeiro (2)
- PUC-Campinas (1)

GEFAN frequent international collaborators include:

- Alberto Gago Medina (PUC-PERU),
- Alexei Y. Smirnov (Max Planck Institute for Nuclear Physics, Heidelberg, GERMANY)
- Omar Gustavo Miranda Romagnoli (CINVESTAV, Mexico)
- Cecilia Lunardini (Arizona State University, USA)
- Maury Goodman (Argonne National Laboratory/ANL, USA)
- José Furtado Valle (CSIC, Universitat de Valencia, SPAIN)
- Maria Amparo Tórtola (CSIC, Universitat de Valencia, SPAIN)
- Maria C. Gonzalez-Garcia (Stony Brook, USA and ICREA, Barcelona, SPAIN)
- Francesco Vissani (LNGS, Italy)
- Remo Ruffini (Università La Sapienza and ICRANet-Rome, Italy)
- Jorge Rueda (ICRANet- Rome, Italy)

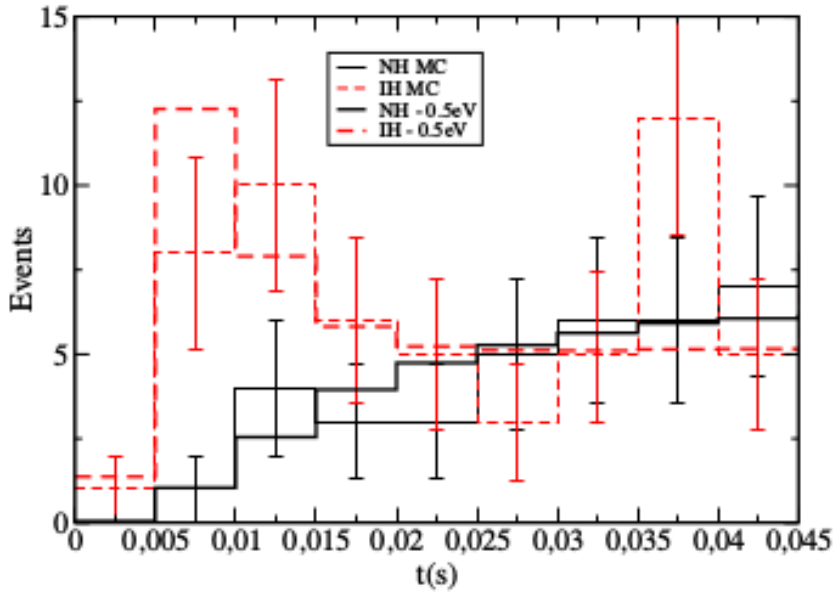
- Theoretical contributions to DUNE from GEFAN are concentrated in UNICAMP and UFABC
-
- Since 2016, GEFAN/Theory at UNICAMP is part of DUNE

Theoretical contributions to DUNE:

- Supernova Neutrinos (2016)
- Proton decay (2017)
- Neutrino decay (2017)
- Lorentz Invariance Violation (2017)
- Random matter density variations (2017)
- Extra-dimensions and SBND (2017)

DUNE and Supernova neutrinos

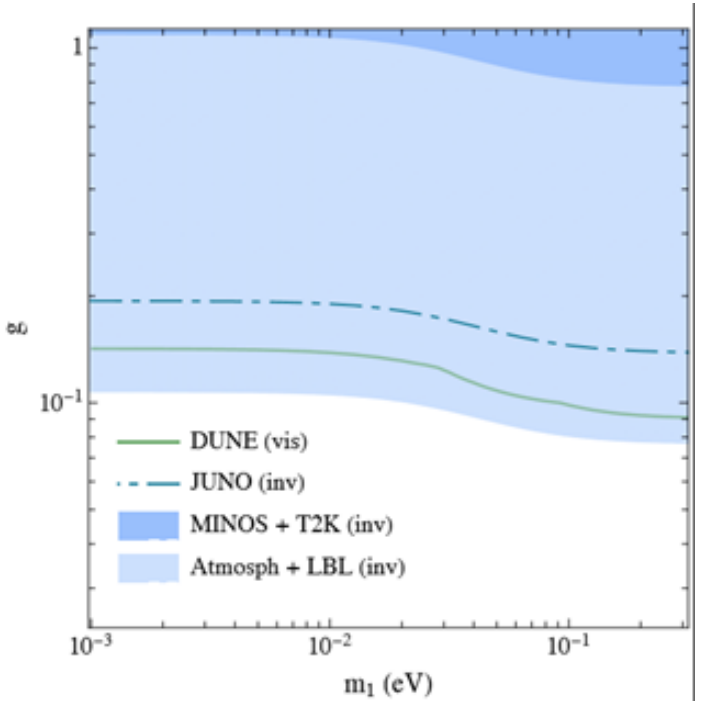
Guzzo, Kemp and Rossi-Torres (UNICAMP 2016)



Considering a SN at 10 kpc e a 34 kton detector, we obtain a limit for neutrino mass of 2.7 eV [O(1) eV] for normal hierarchy [inverted hierarchy].

DUNE and Neutrino Decay

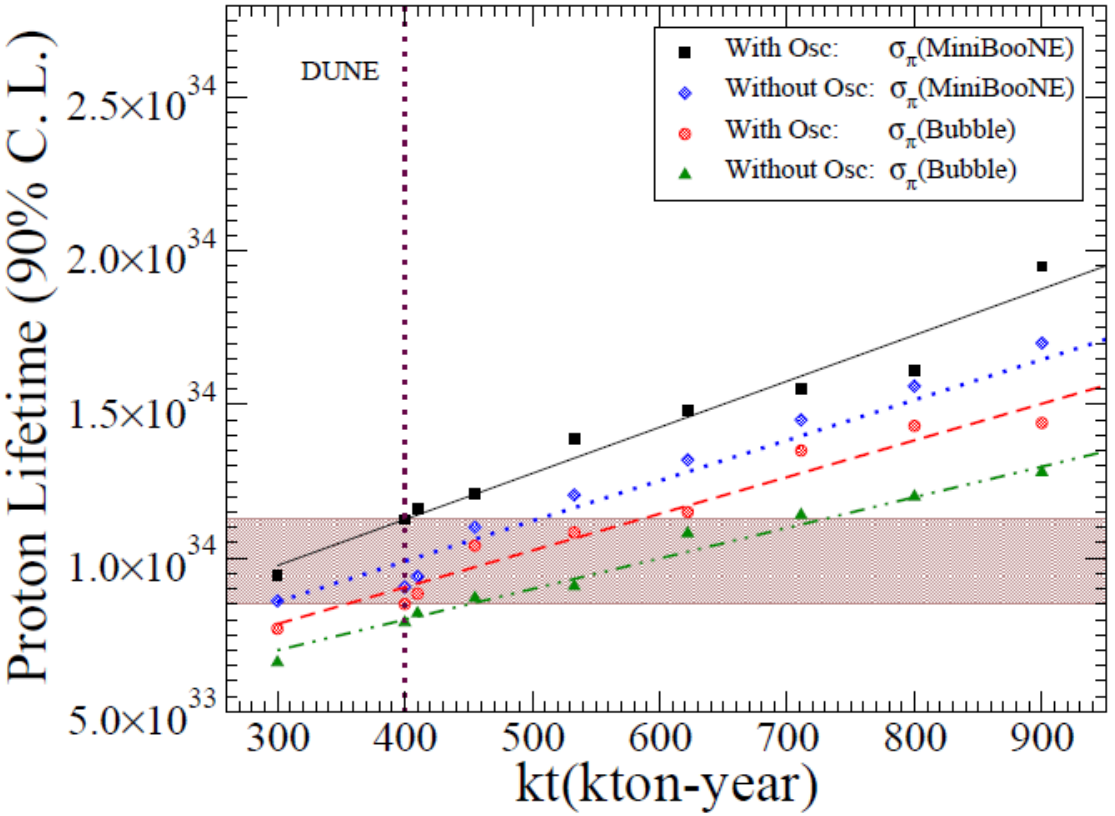
Peres and Coloma (UNICAMP and Fermilab 2017)



DUNE experiment can be used to constrain neutrino decay into visible active neutrinos. The lifetime constraint is *tau* > 2.6 10^{-10} s for 1 eV neutrino mass.

DUNE and Proton Decay

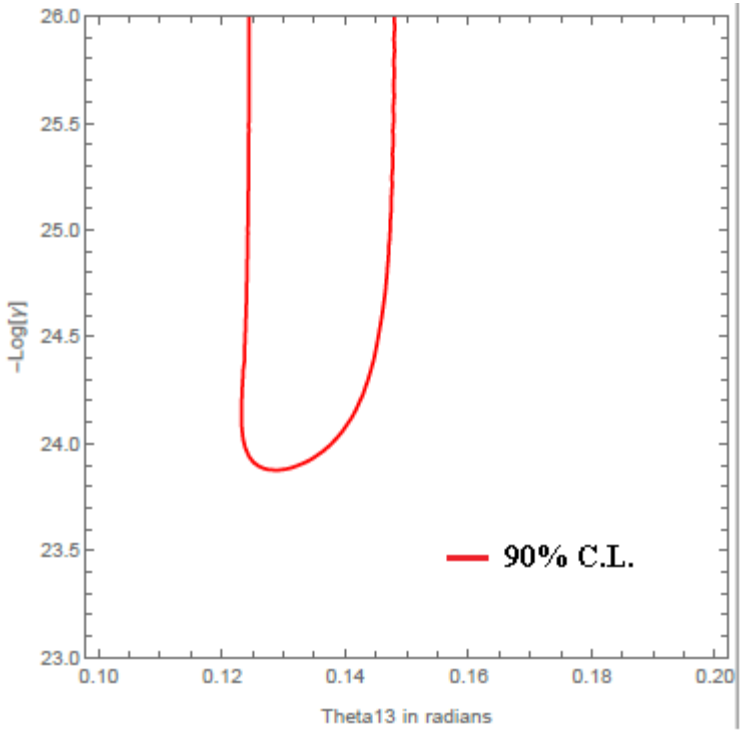
Gratieri, Guzzo and Peres (UNICAMP 2017)



Improvement in measurements of Proton Lifetime including atmospheric neutrino oscillation and new measurements of relevant cross sections: in 10 years, tau > 1.2 x 10^{34} y.

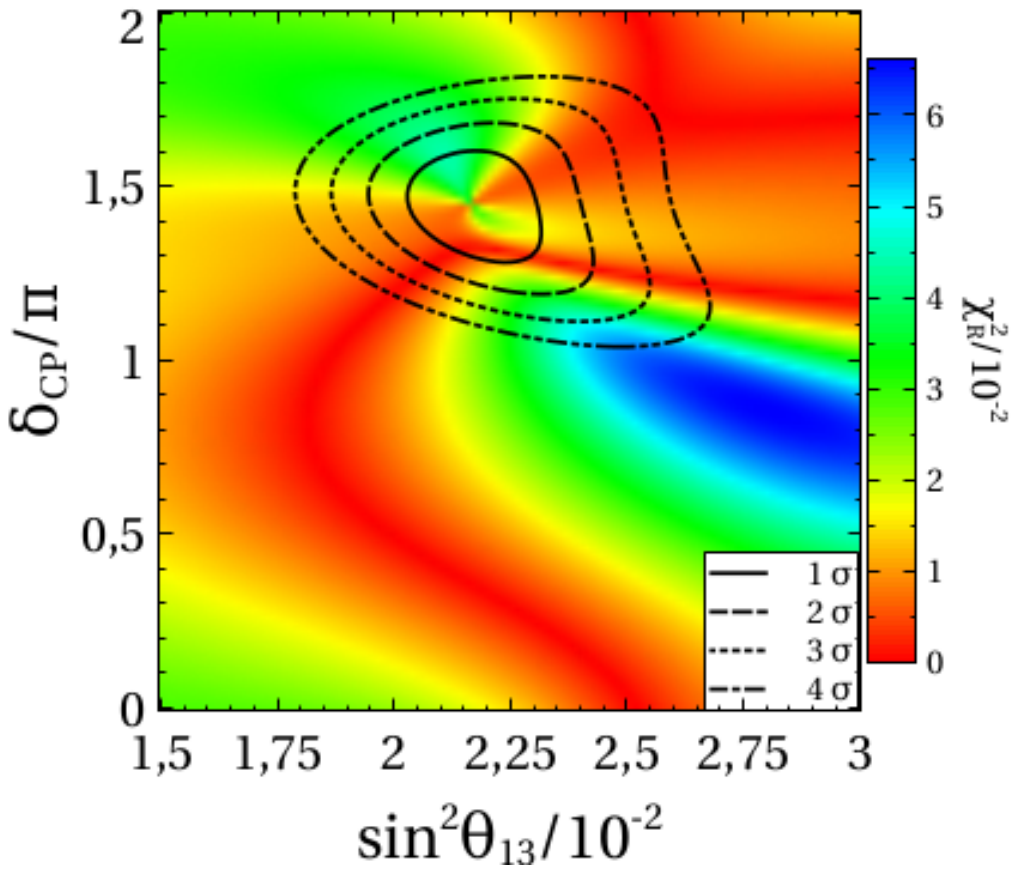
DUNE and Lorentz Invariancce Violation (Preliminary)

Guzzo, Jurkovich, Peres and Rossi-Torres (UNICAMP-2017)



We analyse the potential of detection of Lorentz Invariance Violation in DUNE, our preliminary results show that γ, the parameter associated with LIV, could be excluded for $\gamma > 0.5 \times 10^{-23}$

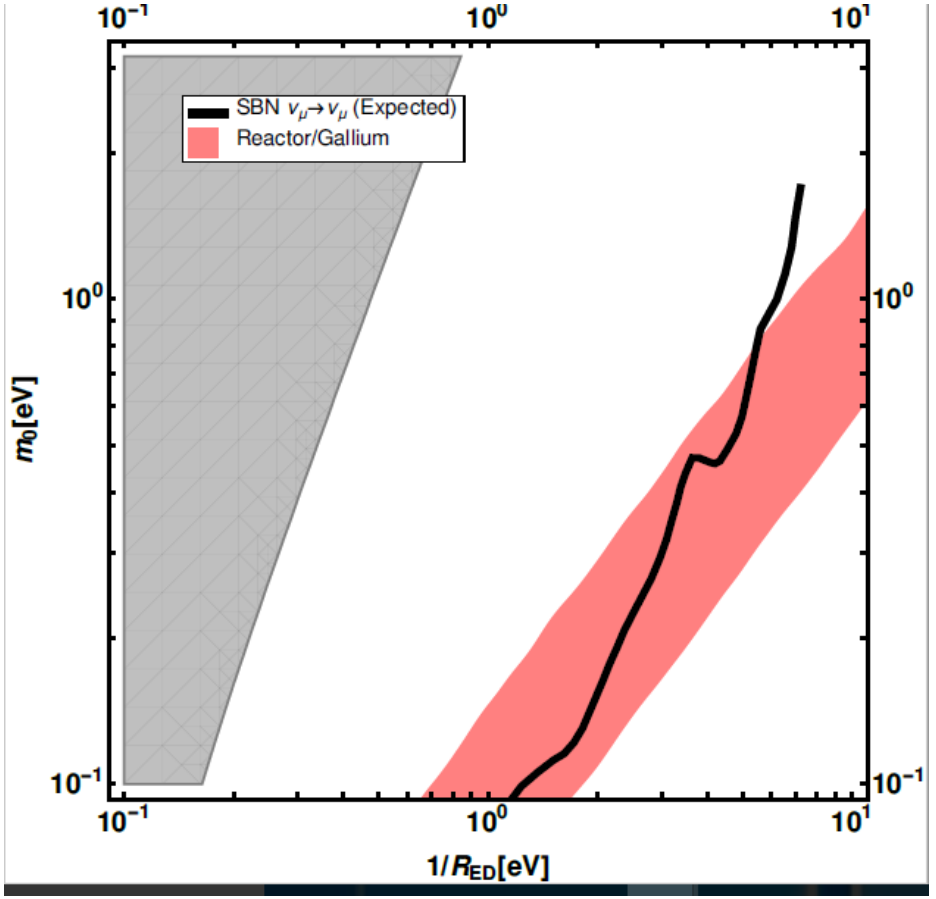
DUNE and Matter Density Variation
Moura and Kamiya (UFABC and Fermilab)



Sensitivity of DUNE for random matter density
Variations compared with standard constant
Density 2.9 g/cm^3, using the X^2 relative method.

SBND and Extra Dimensions

Stenico and Peres (UNICAMP 2017)



Constraints on large extra dimensions from SBND experiment. using only muon disappearance sensitivity (at the left of solid curve) e can rule out most of the reactor anomaly (shown in pink region) in the extra dimension models

My conclusions:

GEFAN participaticipion in DUNE challenges the group towards a new and exciting *modus operandi* which is very welcome!

Thanks for your attention!

GEFAN Team

(UNICAMP, UNESP, UFABC, UNIFAL, UFG, UFF and Fermilab)

Coordinator:

- Orlando L. G. Peres (UNICAMP)

Researchers:

- Carlos Escobar (FERMILAB)
- Ernesto Kemp (UNICAMP)
- Pedro C. de Holanda (UNICAMP)
- Ettore Segreto (UNICAMP)
- Cristiano Cordeiro (UNICAMP)
- Célio A. de Moura Junior (UFABC)
- Marcelo Leigui (UFABC)
- Celso Nishi (UFABC)
- Laura Paulucci Marinho (UFABC)
- Ana Amélia Bergamini Machado (UFABC)
- Gustavo Valdiviesso (UNIFAL)
- Ricardo Avelino Gomes (UFG)
- Arman Esmali (PUC-Rio de Janeiro)
- Diego Rossi Gratieri (UFF)

PIs:

- Vicente Pleitez (UNESP)
- Marcelo M. Guzzo (UNICAMP)

Post-docs:

- Fernando Rossi Torres (UNICAMP)
- Roberto de Oliveira (UNICAMP)
- Luis Fernando Gomez Gonzalez (UNICAMP)
- David Vanegas (UNICAMP)
- Suprab Prakash (UNICAMP)
- Bruno Arsioli (UNICAMP)
- Ana Carolina Machado (UNESP)
- Elaine Cristina Ferreira Silva Fortes (UNESP)
- Javier Montaño Domínguez (UNESP)

+ 67 graduate and undergraduate students

Theoretical contributions to DUNE from GEFAN are concentrated in UNICAMP, which comprehends:

- 3 faculties
- 3 Post-docs
- 10 Ph.D. students
- 2 M.Sc. students
- 6 Undergraduate Research Projects (Iniciação Científica)

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- It has been mainly structured around two FAPESP Thematic Projects:

	Coordinator:
2004-2010	Marcelo M. Guzzo
2016-2021	Orlando L.G. Peres