

NuTau2021 Whitepaper

Peter B. Denton

NuTau2021

September 28, 2021



Snowmass flow



1. Whitepapers like this one inform Neutrino Frontier Topical Reports
2. Frontier Topical Reports inform Frontier Reports
3. Frontier Reports inform the Snowmass Report
4. The Snowmass Report informs the P5 Report
5. The P5 Report is the guide for HEP funding in the US for the next \sim decade

What the whitepaper is:

- ▶ overleaf.com/read/khpgmxpdccwv (read-only) link is on indico

- ▶ Title: **Tau Neutrinos in the Next Decade: from GeV to EeV
A Snowmass Whitepaper**

Scope: physics where it matters that it's a tau neutrino

- ▶ Sections:

1. History and motivation (Denton)
2. Experimental probes (Bishai, de Roeck(?), & Wissel)
3. Tools (Aurisano)
4. Theoretical interests (de Gouvêa & Mocioiu)
5. Conclusions

Organizers will take charge with the abstract, history, and conclusions with input from all authors

- ▶ This is about the future: Snowmass & P5

How are we going to spend resources on tau neutrinos in the next decade+?

- ▶ Don't (extensively) reproduce existing work

A brief introductory section on tau neutrino history exists

Outline

Executive Summary

I. History and Motivation

A. Tau Neutrino History

1. Theory
2. Experimental discoveries

B. Tau Neutrino Motivations

II. Experimental Probes

A. Long-baseline Accelerator

B. Atmospheric

C. Flavor Experiments

D. Collider

E. Large Water Telescope

F. Ultra-High Energy

III. Tools

A. Production Simulation

B. Tau Neutrino Cross Section Code

C. Reconstruction Techniques

D. Tau Lepton Propagation Code

E. Ultra High Energy Propagation Code

IV. Theoretical Interests

A. Standard Physics Tests

B. New Physics

V. Conclusions

Snowmass connections

- ▶ NF01: neutrino oscillations
- ▶ NF03: neutrino BSM
- ▶ NF04: neutrinos from natural sources
- ▶ NF06: neutrino interaction cross sections
- ▶ NF08/TF11: theory of neutrino physics
- ▶ NF09: artificial neutrino sources
- ▶ NF10: neutrino detectors
- ▶ EF03: EW Physics: Heavy flavor and top quark physics
- ▶ EF09: BSM: More general explorations
- ▶ CF7: Cosmic Probes of Fundamental Physics
- ▶ UF01: Underground Facilities for Neutrinos
- ▶ IF: Instrumentation Frontier

Whitepaper logistics

- ▶ Send L^AT_EX code (that works!) to editor and me
- ▶ Use standard inspirehep bibtex references ONLY: `\cite{Denton:2020jft}`
We'll populate the bib file later

- ▶ Don't copy text
- ▶ Don't screenshot images
- ▶ Get images from the arXiv and include the reference in the caption
- ▶ Figures go in a folder:
`\includegraphics[width=0.49\textwidth]{Figures/plot.pdf}`
- ▶ Include your name, affiliation, and acknowledgements in your email

- ▶ Single column

Exact format may be tweaked

Things to include:

1. Tables comparing code:

- ▶ Cross section
- ▶ Tau propagation
- ▶ High energy tau neutrino propagation

2. Table connecting physics goals and experimental needs, e.g.:

Physics topic	Channel	Capabilities needed	Proposed upgrades
Unitarity	$\nu_\mu \rightarrow \nu_\tau$	τ id in a high energy source	DUNE high energy tune

3. Tables have been started; coordinate to ensure your code/physics interest is included!

Deadlines

1. Contributions submitted to editors: December 10
2. Draft circulated: January 5
3. Comments/additions/corrections due: January 19
4. Draft circulated: January 26
5. Final comments due: January 31
6. Post to arXiv: February 2

7. Contributed whitepaper deadline: March 15

Authorship/journal

Authorship: Alphabetical with asterisks for editors

Attendance at NuTau2021 is not required to contribute – get students/postdocs involved!

Journal options:

1. arXiv only

Easy, some institutions count published documents

2. Submit to journal

Hard, requires copyright, requires finding a journal, requires responding to referees, ...

Writing time!

To the breakout rooms to start organizing!