

# Stefano Castro Tognini

## Curriculum Vitæ

Oak Ridge National Laboratory

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stognini



## Professional experience

2023

**Research Scientist**, *Oak Ridge National Laboratory*.

Scalable Algorithms and Coupled Physics  
Computational Sciences and Engineering Division

2019

2023

**Postdoctoral Research Associate**, *Oak Ridge National Laboratory*.

HPC Methods for Nuclear Applications  
Nuclear Energy and Fuel Cycle Division

## Education

2012

2018

**Ph.D. in Physics**, *Federal University of Goias*.

High Energy Physics, focused on cosmic ray data analysis on the NO $\nu$ A Experiment  
Funding: CAPES, CNPq, ANL  
[www.osti.gov/biblio/1468447](http://www.osti.gov/biblio/1468447)

DOE OSTI

2010

2012

**M.Sc. in Physics**, *Federal University of Goias*.

High Energy Physics, focused on cosmic ray Monte Carlo simulation  
Funding: CAPES, Fermilab

2005

2009

**B.Sc. in Physics**, *Federal University of Goias*.

## Collaborations

2020

**Celeritas Project**, *Oak Ridge National Laboratory*.

A GPU Monte Carlo particle transport code for HEP experiments

celeritas-project

DOE CODE

[www.osti.gov/doi/code/biblio/94866](http://www.osti.gov/doi/code/biblio/94866)

2020

**URL Muon Detector Project**, *Oak Ridge National Laboratory*.

A compact muon detector developed to test and validate new non-destructive techniques for geological disposal safety assessments (GDSA).

2013

2019

**NO $\nu$ A Experiment**, *Fermilab*.

NuMI Off-axis  $\nu_e$  Appearance Experiment

novaexperiment.fnal.gov

2011

**MINOS/MINOS+ Experiment**, *Fermilab*.

Main Injector Neutrino Oscillation Search Experiment

(Data taking period ended on June 29, 2016. Data analyses are still ongoing.)

www.numi.fnal.gov

## Skills

### Programming & scripting languages

C/C++, Python, SQL, FORTRAN, UNIX Shell scripting,  $\text{\LaTeX}$

### Frameworks, libraries & tools

ROOT, Geant4, CORSIKA, Fermilab art Framework (NOvASoft and LArSoft), GIT, SVN, Doxygen, SAM/samweb, Spack, Jobsub, LSF, PBS TORQUE

## Spoken languages

Portuguese (native), English (fluent), Italian (fluent), French (conversational)

## Scholarships & funding

2012  
2016

### **CAPES.**

Ph.D. scholarship.

2014  
2015

### **Science Without Borders Fellowship (CAPES & CNPq) & Argonne National Laboratory.**

One year period at ANL and Fermilab working on NO $\nu$ A and MINOS/MINOS+.

2010  
2012

### **CAPES.**

M.Sc. scholarship.

2011

### **Fermi National Accelerator Laboratory.**

3 months period at Fermilab working on MINOS/MINOS+.

## Teaching and mentoring

2022

### **Mentor, Oak Ridge National Laboratory.**

- Mentored Ethan A. Asano during his Summer internship. The project consisted in validating *Celeritas* physics models by comparing them against Geant4.

2012  
2018

### **Advising assistant, Federal University of Goias.**

- Helped advising most younger students from my HEP research group on multiple projects.

2015

### **Co-advisor, Federal University of Goias.**

- *Stratospheric temperature effects on cosmic ray muon flux*. Senior Thesis of Matheus Norberto Jacome, from State University of Goias.

2012  
2013

### **Teaching assistant, Federal University of Goias.**

- Physics I.
- Physics III.
- Introduction to Elementary Particle Physics.

2011  
2012

### **Teaching assistant, Federal University of Goias.**

- Physics I.
- Laboratory of Physics II.
- Introduction to Elementary Particle Physics.

## Leadership roles

2013  
2014

### **Administrative Council of the Physics Ph.D. Program, Institute of Physics, Federal University of Goias.**

- Elected representative of MSc. and Ph.D. students with the purpose to suggest, discuss, and vote on administrative resolutions, including the graduate program guidelines and funding approvals for graduate students, such as work-related trips for Ph.D. students.

## Selected talks and seminars

**2022 From muons to supercomputers.** Fermilab Students and Postdocs Association Early Career Seminar.

 <https://spa.fnal.gov/early-career-seminar-series/>

***Celeritas*: Bringing exascale computing to HEP detector simulation.** *Colloquium*. Department of Physics and Astronomy, University of Mississippi.

 <https://relativity.phy.olemiss.edu/Colloquia/#tognini>

- 2019 Particle Physics.** *XI Physics School*. Institute of Physics, Federal University of Goias. Presented as a part of a series of lectures at undergraduate level. [In Portuguese]  
<https://if.ufg.br/e/23682-xi-escola-de-fisica-do-if-ufg>
- 2018 Observation of cosmic ray multiple-muon seasonal variations in the NO $\nu$ A Near Detector.** *High Energy Physics Seminar*. Department of Physics, Syracuse University.  
<http://physics.syr.edu/event-items/2018/2018-04-11-stefano-tognini-hep-seminar.html>
- 2013 The loop of habit.** *Perturbative Theories*—a series of seminars organized and presented by the graduate students of the Physics Institute at UFG. [In Portuguese]  
<http://teoriasperturbativas.wikidot.com/blog:22>
- 2012 The problem with the speed of neutrinos.** *Perturbative Theories*—a series of seminars organized and presented by the graduate students of the Physics Institute at UFG. [In Portuguese]  
<http://teoriasperturbativas.wikidot.com/blog:4>

## Selected conference presentations

- 2022 S. C. Tognini and S. R. Johnson. *Celeritas*: HEP detector simulation on GPUs.** [Poster] Snowmass Community Summer Study Workshop. Seattle (WA).  
<https://indico.fnal.gov/event/22303/contributions/243736/>  
***Celeritas* experiment integration.** HSF Detector Simulation on GPU Community Meeting.  
<https://indico.cern.ch/event/1123314/>  
 T. M. Evans and S. C. Tognini. **HEP-CCE: *Celeritas*.** HEP-CCE All Hands Meeting.  
<https://indico.fnal.gov/event/53750/>
- 2017 A. Habig, S. C. Tognini, et al.** (On behalf of the NO $\nu$ A Collaboration) **Seasonal Variation of Multiple-Muon Events in MINOS and NO $\nu$ A.** [Poster] 35<sup>th</sup> International Cosmic Ray Conference (ICRC), Bexco, Busan, Korea.  
<https://pos.sissa.it/301/>
- 2014 S. C. Tognini and R. A. Gomes. Simulation of cosmic ray shower using CORSIKA and CRY in the NO $\nu$ A Far Detector.** [Poster] XXXV National Meeting of Particles and Fields, Passa Quatro (MG), Brazil.  
 S. C. Tognini and R. A. Gomes. **Neutrino oscillation physics at the NO $\nu$ A experiment.** [Poster] XXXV National Meeting of Particles and Fields, Passa Quatro (MG), Brazil.
- 2012 Simulation of atmospheric temperature effects on cosmic ray muon flux.** [Poster] NuInt12: Eight International Workshop on Neutrino-Nucleus Interactions in the Few-GeV Region, Rio de Janeiro (RJ), Brazil.
- 2011 Remote MINOS Shift Station at IF-UFG.** [Poster] I Physics Meeting, Foz do Iguacu (PA), Brazil.
- 2010 Monte Carlo simulation of the cosmic ray muons at the MINOS Far Detector.** [Poster] XXXI National Meeting of Particles and Fields, Passa Quatro (MG), Brazil.
- 2009 Status and results in neutral hyperon physics at KTeV (Fermilab) and NA48/1 (CERN).** [Poster] XXX National Meeting of Particles and Fields, Passa Quatro (MG), Brazil.






## Scientific outreach

- 2020 Being a scientist outside the University.** Invited speaker at PUC Goias. [In Portuguese]  
<https://www.pucgoias.edu.br/noticias/eventos/a-vida-de-cientista-fora-da-universidade/>








- 2018** **How particle accelerators revolutionized our World.** Invited speaker at Campus Party Brasilia, Brazil. [In Portuguese]  
 <https://campuse.ro/events/Campus-Party-Brasilia-2018-CPBSB2/talk/internet-tratamentos-de-cancer-producao-de-eletronicos-pneus-de-carro-como-aceleradores-de-particulas-revolucionaram-nosso-mundo-cpbsb2/>
- 2016** Interviewed at **Connect to UFG – Inovation and Technology.** *TV UFG*, aired on October 26, 2016. [In Portuguese]  
 <https://www.youtube.com/watch?v=TeTco24vgY4>
- 2015** Volunteer scientist to interact with adults and children at the **Fermilab's Family Open House.** Briefly interviewed at: <https://www.dailyherald.com/article/20150208/news/150208893/>
- 2014** Invited scientist to answer questions from community decision leaders and VIPs at the **Future of Fermilab Address and Reception.**

## Publications

### Research profiles

-  [orcid.org/0000-0001-9741-6608](https://orcid.org/0000-0001-9741-6608)
-  [inspirehep.net/authors/1074966](https://inspirehep.net/authors/1074966)
-  [publons.com/researcher/1798369/stefano-castro-tognini/](https://publons.com/researcher/1798369/stefano-castro-tognini/)
-  [scholar.google.com/citations?user=M4To0NcAAAAJ](https://scholar.google.com/citations?user=M4To0NcAAAAJ)
-  [www.researchgate.net/profile/Stefano-C-Tognini](https://www.researchgate.net/profile/Stefano-C-Tognini)

### Journal articles

- 2021** M. A. Acero, *et al.* (NO $\nu$ A Collab.) **Seasonal variation of multiple-muon cosmic ray air showers observed in the NO $\nu$ A detector on the surface.** *Phys. Rev. D* **104**, 012014.  
 [10.1103/PhysRevD.104.012014](https://doi.org/10.1103/PhysRevD.104.012014)
- 2020** P. Adamson, *et al.* (MINOS+ Collab.) **Precision Constraints for Three-Flavor Neutrino Oscillations from the Full MINOS+ and MINOS Dataset.** *Phys. Rev. Lett.* **125**, 131802.  
 [10.1103/PhysRevLett.125.131802](https://doi.org/10.1103/PhysRevLett.125.131802)
- P. Adamson, *et al.* (MINOS+ Collab.) **Improved Constraints on Sterile Neutrino Mixing from Disappearance Searches in the MINOS, MINOS+, Daya Bay, and Bugey-3 Experiments.** *Phys. Rev. Lett.* **125**, 071801.  
 [10.1103/PhysRevLett.125.071801](https://doi.org/10.1103/PhysRevLett.125.071801)
- 2019** M. A. Acero, *et al.* (NO $\nu$ A Collab.) **Observation of seasonal variation of atmospheric multiple-muon events in the NO $\nu$ A Near Detector.** *Phys. Rev. D* **99**, 122004.  
 [10.1103/PhysRevD.99.122004](https://doi.org/10.1103/PhysRevD.99.122004)
- P. Adamson, *et al.* (MINOS+ Collab.) **Search for Sterile Neutrinos in MINOS and MINOS+ Using a Two-Detector Fit.** *Phys. Rev. Lett.* **122**, 091803.  
 [10.1103/PhysRevLett.122.091803](https://doi.org/10.1103/PhysRevLett.122.091803)
- 2018** M. A. Acero, *et al.* (NO $\nu$ A Collab.) **New constraints on oscillation parameters from  $\nu_e$  appearance and  $\nu_\mu$  disappearance in the NO $\nu$ A experiment.** *Phys. Rev. D* **98**, 032012.  
 [10.1103/PhysRevD.98.032012](https://doi.org/10.1103/PhysRevD.98.032012)
- 2017** P. Adamson, *et al.* (NO $\nu$ A Collab.) **Search for active-sterile neutrino mixing using neutral-current interactions in NO $\nu$ A.** *Phys. Rev. D* **96**, 072006.  
 [10.1103/PhysRevD.96.072006](https://doi.org/10.1103/PhysRevD.96.072006)

- P. Adamson, *et al.* (MINOS+ Collab.) **Search for flavor-changing nonstandard neutrino interactions using  $\nu_e$  appearance in MINOS.** Phys. Rev. D **95**, 012005.  
 doi [10.1103/PhysRevD.95.012005](https://doi.org/10.1103/PhysRevD.95.012005)
- P. Adamson, *et al.* (NO $\nu$ A Collab.) **Measurement of the Neutrino Mixing Angle  $\theta_{23}$  in NOvA.** Phys. Rev. Lett. **118**, 151802.  
 doi [10.1103/PhysRevLett.118.151802](https://doi.org/10.1103/PhysRevLett.118.151802)
- P. Adamson, *et al.* (NO $\nu$ A Collab.) **Constraints on Oscillation Parameters from  $\nu_e$  Appearance and  $\nu_\mu$  Disappearance in NOvA.** Phys. Rev. Lett. **118**, 231801.  
 doi [10.1103/PhysRevLett.118.231801](https://doi.org/10.1103/PhysRevLett.118.231801)
- 2016 P. Adamson, *et al.* (MINOS Collab.) **The NuMI neutrino beam.** Nucl. Instr. Meth. A **806**, 279-306.  
 doi [10.1016/j.nima.2015.08.063](https://doi.org/10.1016/j.nima.2015.08.063)
- P. Adamson, *et al.* (NO $\nu$ A Collab.) **First measurement of muon-neutrino disappearance in NOvA.** Phys. Rev. D **93**, 051104(R).  
 doi [10.1103/PhysRevD.93.051104](https://doi.org/10.1103/PhysRevD.93.051104)
- P. Adamson, *et al.* (MINOS Collab.) **Measurement of the multiple-muon charge ratio in the MINOS Far Detector.** Phys. Rev. D **93**, 052017.  
 doi [10.1103/PhysRevD.93.052017](https://doi.org/10.1103/PhysRevD.93.052017)
- P. Adamson, *et al.* (NO $\nu$ A Collab.) **First Measurement of Electron Neutrino Appearance in NOvA.** Phys. Rev. Lett. **116**, 151806.  
 doi [10.1103/PhysRevLett.116.151806](https://doi.org/10.1103/PhysRevLett.116.151806)
- P. Adamson, *et al.* (Daya Bay Collab., MINOS Collab.) **Limits on Active to Sterile Neutrino Oscillations from Disappearance Searches in the MINOS, Daya Bay, and Bugey-3 Experiments.** Phys. Rev. Lett. **117**, 151801.  
 doi [10.1103/PhysRevLett.117.151801](https://doi.org/10.1103/PhysRevLett.117.151801)
- P. Adamson, *et al.* (MINOS Collab.) **Search for Sterile Neutrinos Mixing with Muon Neutrinos in MINOS.** Phys. Rev. Lett. **117**, 151803.  
 doi [10.1103/PhysRevLett.117.151803](https://doi.org/10.1103/PhysRevLett.117.151803)
- P. Adamson, *et al.* (MINOS Collab.) **Measurement of single  $\pi^0$  production by coherent neutral-current  $\nu$ Fe interactions in the MINOS Near Detector.** Phys. Rev. D **94**, 072006.  
 doi [10.1103/PhysRevD.94.072006](https://doi.org/10.1103/PhysRevD.94.072006)
- P. Adamson, *et al.* (MINOS Collab.) **Constraints on large extra dimensions from the MINOS experiment.** Phys. Rev. D **94**, 111101(R).  
 doi [10.1103/PhysRevD.94.111101](https://doi.org/10.1103/PhysRevD.94.111101)
- 2015 P. Adamson, *et al.* (MINOS Collab.) **Observation of seasonal variation of atmospheric multiple-muon events in the MINOS Near and Far Detectors.** Phys. Rev. D **91**, 112006.  
 doi [10.1103/PhysRevD.91.112006](https://doi.org/10.1103/PhysRevD.91.112006)
- P. Adamson, *et al.* (MINOS Collab.) **Study of quasielastic scattering using charged-current  $\nu_\mu$ -iron interactions in the MINOS near detector.** Phys. Rev. D **91**, 012005.  
 doi [10.1103/PhysRevD.91.012005](https://doi.org/10.1103/PhysRevD.91.012005)
- P. Adamson, *et al.* (MINOS Collab.) **Precision measurement of the speed of propagation of neutrinos using the MINOS detectors.** Phys. Rev. D **92**, 052005.  
 doi [10.1103/PhysRevD.92.052005](https://doi.org/10.1103/PhysRevD.92.052005)
- 2014 P. Adamson, *et al.* (MINOS Collab.) **Combined Analysis of  $\nu_\mu$  Disappearance and  $\nu_\mu \rightarrow \nu_e$  Appearance in MINOS Using Accelerator and Atmospheric Neutrinos.** Phys. Rev. Lett. **112**, 191801.  
 doi [10.1103/PhysRevLett.112.191801](https://doi.org/10.1103/PhysRevLett.112.191801)

P. Adamson, *et al.* (MINOS Collab.) **Observation of muon intensity variations by season with the MINOS near detector.** Phys. Rev. D **90**, 012010.

 [10.1103/PhysRevD.90.012010](https://doi.org/10.1103/PhysRevD.90.012010)

**2013** P. Adamson, *et al.* (MINOS Collab.) **Measurement of Neutrino and Antineutrino Oscillations Using Beam and Atmospheric Data in MINOS.** Phys. Rev. Lett. **110**, 251801.

 [10.1103/PhysRevLett.110.251801](https://doi.org/10.1103/PhysRevLett.110.251801)

### Proceedings

**2022** H. R. Gadey, R. Howard, *et al.* **Using Cosmic Ray Muons to Assess Geological Characteristics in the Subsurface.** International High-Level Radioactive Waste Management (IHLRWM).

 [\[Accepted; Proceedings are in preparation\]](#)

S. C. Tognini, P. Canal, *et al.* **Celeritas: GPU-accelerated particle transport for detector simulation in High Energy Physics experiments.** Submitted to the Proceedings of the US Community Study on the Future of Particle Physics (Snowmass 2021).

 [arXiv.2203.09467](https://arxiv.org/abs/2203.09467)


**2021** S. R. Johnson, S. C. Tognini, *et al.* **Novel features and GPU performance analysis for EM particle transport in the Celeritas code.** 25<sup>th</sup> International Conference on Computing in High Energy and Nuclear Physics (CHEP 2021). EPJ Web of Conferences **251**, 03030.

 [10.1051/epjconf/202125103030](https://doi.org/10.1051/epjconf/202125103030)

**2020** T. M. Evans, S. R. Johnson, *et al.* **Celeritas—a nascent GPU detector simulation code.** Letter of Interest for Snowmass 2021.

 [www.snowmass21.org/docs/files/summaries/CompF/SNOWMASS21-CompF2\\_CompF1-053.pdf](https://www.snowmass21.org/docs/files/summaries/CompF/SNOWMASS21-CompF2_CompF1-053.pdf)

**2017** A. Habig, M. Goodman, P. Schreiner, S. C. Tognini, and R. A. Gomes. (On behalf of the NO $\nu$ A Collaboration) **Seasonal Variation of Multiple-Muon Events in MINOS and NO $\nu$ A.** 35<sup>th</sup> International Cosmic Ray Conference (ICRC), Bexco, Busan, Korea.

 [10.22323/1.301.0200](https://doi.org/10.22323/1.301.0200)

**2012** S. C. Tognini and R. A. Gomes. **Simulation of atmospheric temperature effects on cosmic ray muon flux.** NuInt12: Eight International Workshop on Neutrino-Nucleus Interactions in the Few-GeV Region, Rio de Janeiro (RJ), Brazil. AIP Conf. Proc. **1663**, 120015.

 [10.1063/1.4919521](https://doi.org/10.1063/1.4919521)

### Technical reports

**2022** S. C. Tognini, H. R. Gadey, *et al.* **URL Muon Detector Project Simulation Status Report.** Sponsor Report ORNL/SPR-2022/2568.

H. R. Gadey, R. Howard, *et al.* **Muon Detector Development Status Report.** Sponsor Report PNNL-32802.

**2021** J. Meszaros, S. C. Tognini, *et al.* **Underground Research Laboratory Muon Detector Project Progress Report.** Sponsor Report ORNL/SPR-2021/2077.