Stefano Castro Tognini

Curriculum Vitæ

Oak Ridge National Laboratory
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stognini

Professional experience

2019 **Postdoctoral Research Associate**, *Oak Ridge National Laboratory*.
Nuclear Energy and Fuel Cycle Division | HPC Methods for Nuclear Applications

Education

2012 – 2018 **Ph.D. in Physics**, *Federal University of Goias*, Brazil.
High Energy Physics, focused on cosmic ray data analysis in the NOνA Experiment
Funding: CAPES, CNPq, ANL

iNSPIRE HEP inspirehep.net/record/1692030

DOE OSTI www.osti.gov/biblio/1468447-observation-multiple-muon-seasonal-variations-noa-near-detector

2010 – 2012 **M.Sc. in Physics**, *Federal University of Goias*, Brazil.
High Energy Physics, focused on cosmic ray Monte Carlo simulation
Funding: CAPES, Fermilab

2005 – 2009 **B.Sc. in Physics**, *Federal University of Goias*, Brazil.

Collaborations | Experiments

2020 **Celeritas Project**, *Oak Ridge National Laboratory*.
A GPU-based HEP Monte Carlo particle transport software celeritas-project

- Core member of the Celeritas development team.
- Implemented electromagnetic physics processes.
- Implemented data import tool to load Geant4 data into Celeritas.
- Developed validations tools to compare physics correctness and code performance against Geant4.
- Developed an event display to visualize detector geometry and particle information.

2020 **URL Muon Detector Project**, *Oak Ridge National Laboratory*.
A compact muon detector apparatus developed to test and validate new non-destructive techniques for geological disposal safety assessments (GDSA).

- Core team member involved with all stages of the project: Detector design, simulation, commissioning, deployment, and analysis.

2013
2018

NOνA Experiment, *Fermilab*.

NuMI Off-axis ν_e Appearance Experiment novaexperiment.fnal.gov

- **Ph.D. Thesis [**Phys. Rev. D **99**, 122004 (2019)**]**
  - Developed a Multi-Hough based reconstruction algorithm tailored to reconstruct cosmic ray muon events.
  - Tweaked existing Monte Carlo to produce multiple-muon events to validate the reconstruction algorithm.
  - Developed software to connect temperature data from ECMWF with the NOνA Near Detector data.
  - Worked on all the data processing necessary for the analysis using the Fermilab GRID.
  - Developed all analysis codes.
- **The NOνA Remote Operation Center at the Federal University of Goias**
  - Commissioned, certified, and maintained the NOνA ROC @ UFG between 2016 and 2018.
- **Integration of CORSIKA in the NOνA ART Framework**
  - Developed an integration layer software for between CORSIKA and Fermilab's ART Framework.
  - Used by the MicroBooNE Collaboration to integrate CORSIKA in LArSoft. The package also became the standard MC of ProtoDUNE.
- **APD quality assessment task force**
  - NOνA detector channels consist of wavelength-shifting fibers submersed in liquid scintillator and connected to Avalanche Photo Diodes (APDs). The work consisted in testing the quality of these APDs before being installed in the NOνA Near Detector.
  - Trained new people to keep the APD testings running at the end of the Near Detector commissioning period.
- **On call emergency contact for Near Detector related issues (8 months)**

2011

MINOS/MINOS+ Experiment, *Fermilab*.

Main Injector Neutrino Oscillation Search Experiment www-numi.fnal.gov

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

- **MINOS/MINOS+ Remote Operation Centers**
  - Worked to produce a centralized package and documentation for commissioning and maintaining Remote Operation Centers (ROCs) for the MINOS/MINOS+ Experiment.
  - Participated in writing a certification process to certify Remote Operation Centers outside Fermilab. It was the base of the current certification process used by all neutrino experiments at Fermilab.
  - Built and maintained the MINOS ROC at the Federal University of Goias. This was the first certified MINOS ROC outside Fermilab, as well as the first certified ROC of any Fermilab neutrino experiment.
  - Provided technical support and keep documentation up to date for all MINOS(+) ROCs.
  - Deployed the MINOS+ ROC software at ROC-West and maintain it until the end of the experiment, on June 29, 2016.
- **Data analyses**
  - Produced Monte Carlo, helped writing, and participated in two data analyses:
    - Observation of seasonal variation of atmospheric multiple-muon events in the MINOS Near and Far Detectors **[**Phys. Rev. D **91**, 112006 (2015)**]**
    - Measurement of the multiple-muon charge ratio in the MINOS Far Detector **[**Phys. Rev. D **93**, 052017 (2016)**]**

Scholarships

2012
2016

Ph.D., Federal University of Goias.

Funding: CAPES.

2014
2015

Argonne National Laboratory & Fermi National Accelerator Laboratory, *Ph.D. candidate*.

Funding: Argonne National Laboratory and Science Without Borders Fellowship (CAPES & CNPq).

2010
2012

MSc., Federal University of Goias.

Funding: CAPES.

2011

Fermi National Accelerator Laboratory, *Master's student*.

Funding: Fermilab.
Period: 3 months.

Skills

Spoken languages

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

Programming & scripting languages

C/C++, Python, SQL, FORTRAN, UNIX Shell scripting, LaTeX

Frameworks

ROOT, Fermilab ART Framework (NOvASoft and LArSoft)

Monte Carlo

CORSIKA, Geant4

Other

GIT, SVN, Redmine, PBS TORQUE

Teaching and mentoring

2012–2018 **Advising assistant**, *Ph.D. student/candidate*, Federal University of Goias.

- **2015**: Co-advised the senior thesis of Matheus Norberto Jacome, entitled **"Stratospheric temperature effects on cosmic ray muon flux"** [in Portuguese], from State University of Goias, Brazil.
- Helped advising most younger students from our UFG HEP Group on different projects over the years.

2012–2013 **Teaching assistant**, *Ph.D. student*, Federal University of Goias.

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

2011–2012 **Teaching assistant**, *Master's student*, Federal University of Goias.

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

Administrative experience

2013–2014 **Member of the 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 field trips for Ph.D. students.

Talks and seminars

2018 **Observation of cosmic ray multiple-muon seasonal variations in the NOνA Near Detector**. *High Energy Physics Seminar*. Syracuse University, NY.
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

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 by the TV show **Connect to UFG – Inovation and Technology**. *TV UFG*, aired on October 26, 2016. [In Portuguese]
Available on Youtube: 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**.

Selected conference presentations

2014 S. C. Tognini and R. A. Gomes. **Simulation of cosmic ray shower using CORSIKA and CRY in the NOνA 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 NOνA experiment**. [Poster] XXXV National Meeting of Particles and Fields, Passa Quatro (MG), Brazil.

2012 S. C. Tognini and R. A. Gomes. **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 S. C. Tognini and R. A. Gomes. **Remote MINOS Shift Station at IF-UFG**. [Poster] I Physics Meeting, Foz do Iguacu (PA), Brazil.

2010 S. C. Tognini and R. A. Gomes. **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 S. C. Tognini and R. A. Gomes. **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.

Publications

Research profiles

orcid.org/0000-0001-9741-6608
inspirehep.net/authors/1074966
publons.com/researcher/1798369/stefano-castro-tognini/
www.researchgate.net/profile/S_Tognini

Journal articles

2021 M. A. Acero, *et al.* (NOνA Collab.) **Seasonal Variation of Multiple-Muon Cosmic Ray Air Showers Observed in the NOvA Detector on the Surface**. Accepted in PRD [PLACEHOLDER]. https://arxiv.org/abs/2105.03848

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. DOI: 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. DOI: 10.1103/PhysRevLett.125.071801

2019 M. A. Acero, *et al.* (NOνA Collab.) **Observation of seasonal variation of atmospheric multiple-muon events in the NOvA Near Detector**. Phys. Rev. D **99**, 122004. DOI: 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. DOI: 10.1103/PhysRevLett.122.091803

2018 M. A. Acero, *et al.* (NOνA Collab.) **New constraints on oscillation parameters from ν_e appearance and ν_μ disappearance in the NOvA experiment**. Phys. Rev. D **98**, 032012. DOI: 10.1103/PhysRevD.98.032012

2017 P. Adamson, *et al.* (NOνA Collab.) **Search for active-sterile neutrino mixing using neutral-current interactions in NOvA**. Phys. Rev. D **96**, 072006. DOI: 10.1103/PhysRevD.96.072006

P. Adamson, *et al.* (MINOS+ Collab.) **Search for flavor-changing nonstandard neutrino interactions using ν_e appearance in MINOS**. Phys. Rev. D **95**, 012005. DOI: 10.1103/PhysRevD.95.012005

P. Adamson, *et al.* (NOνA Collab.) **Measurement of the Neutrino Mixing Angle θ_{23} in NOvA**. Phys. Rev. Lett. **118**, 151802. DOI: 10.1103/PhysRevLett.118.151802

P. Adamson, *et al.* (NOνA Collab.) **Constraints on Oscillation Parameters from ν_e Appearance and ν_μ Disappearance in NOvA**. Phys. Rev. Lett. **118**, 231801. DOI: 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

P. Adamson, *et al.* (NOνA Collab.) **First measurement of muon-neutrino disappearance in NOvA**. Phys. Rev. D **93**, 051104(R). DOI: 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

P. Adamson, *et al.* (NOνA Collab.) **First Measurement of Electron Neutrino Appearance in NOvA**. Phys. Rev. Lett. **116**, 151806. DOI: 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

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

P. Adamson, *et al.* (MINOS Collab.) **Measurement of single π^0 production by coherent neutral-current νFe interactions in the MINOS Near Detector**. Phys. Rev. D **94**, 072006. DOI: 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

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

P. Adamson, *et al.* (MINOS Collab.) **Study of quasielastic scattering using charged-current ν_μ-iron interactions in the MINOS near detector**. Phys. Rev. D **91**, 012005. DOI: 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

2014 P. Adamson, *et al.* (MINOS Collab.) **Combined Analysis of ν_μ Disappearance and $\nu_\mu \to \nu_e$ Appearance in MINOS Using Accelerator and Atmospheric Neutrinos**. Phys. Rev. Lett. **112**, 191801. DOI: 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. DOI: 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. DOI: 10.1103/PhysRevLett.110.251801

Proceedings

2021 S. R. Johnson, S. C. Tognini, *et al.* **Novel features and GPU performance analysis for EM particle transport in the Celeritas code**. vCHEP2021: 25th International Conference on Computing in High-Energy and Nuclear Physics. [REF. PLACEHOLDER].

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

2017 A. Habig, M. Goodman, P. Schreiner, S. C. Tognini, and R. A. Gomes. (On behalf of the NOνA Collaboration) **Seasonal Variation of Multiple-Muon Events in MINOS and NOvA**. 35th International Cosmic Ray Conference (ICRC), Bexco, Busan, Korea. DOI: 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. DOI: 10.1063/1.4919521