Nathan Giha

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Research interests

Nuclear fission; Reaction reconstruction; Nuclear structure; Instrumentation

Education

University of Michigan

2019 – 2024 (Expected) — Ph.D. Nuclear Engineering & Radiological Sciences — 4.0/4.0
Dissertation Topic: Spin-energy correlations in nuclear fission

2019 – 2022 — M.S.E. Nuclear Engineering & Radiological Sciences — 4.0/4.0
Highlighted coursework: Elementary particle physics; Electrodynamics & classical fields; Quantum mechanics

2015 – 2019 — B.S.E. Nuclear Engineering & Radiological Sciences, *Summa Cum Laude* — 3.9/4.0
Minor in Mathematics

Research experience

Feb 2022 – Present — **Argonne National Laboratory**
NSF Graduate Research Fellow
Laboratory Advisor: Fredrik Tovesson (Physics Division)

- Analyzing experimental correlations between fission fragment properties and the particles they emit to discover how angular momentum is generated in nuclear fission
- Contributed to the construction and characterization of a twin Frisch-grid ionization chamber and experimental campaign correlating fission fragment properties with neutron and γ-ray emission

Sep 2019 – Present

University of Michigan
NSF Graduate Research Fellow
Advisor: Sara Pozzi (Detection for Nuclear Nonproliferation Group)

- Analyzed correlations between the emitted γ rays and the excitation energy of the fissioning system in $^{239}\mathrm{Pu}(n,\mathrm{f})$ to understand how angular momentum is generated in nuclear fission (arXiv)
- Equipped laboratory for scintillator manufacturing and characterized organic glass scintillator bars coupled to silicon photomultipliers for neutron imaging (IEEE-NSS Proc., NIM:A)

Jun 2021 – Aug 2021

Argonne National Laboratory
Visiting Graduate Researcher
Mentor: Filip Kondev (Physics Division)

- Constrained angular momenta of discrete levels of ^{146}Ce populated in β decay of ^{146}La by studying γ-ray cascades with Gammasphere
- Found evidence of ground-state deformation in ^{146}La, flipping the spins of the ground and isomeric states in the present evaluation (APS DNP).

May 2016 – Aug 2019

University of Michigan
Undergraduate Research Fellow
Mentors: William Steinberger, Angela Di Fulvio, Marc Ruch, Sara Pozzi (Detection for Nuclear Nonproliferation Group)

- Designed and assembled readout electronics (IEEE-NSS Proc.) for silicon photomultiplier arrays
- Developed radiation imaging algorithms in Python and validated with Monte Carlo simulations
- Characterized radiation imaging systems (Scientific Reports, NIM:A)
- Contributed to experimental campaign at Idaho National Laboratory, imaging kg quantities of special nuclear material

May 2018 – Aug 2018 **Los Alamos National Laboratory**
Undergraduate Research Intern
Mentor: Marc Ruch (Safeguards Science & Technology Group)

- Developed an algorithm for analyzing time-correlated coincidence data for localizing correlated neutron sources
- Simulated detection scenarios and tested algorithm on high-performance computing cluster
- Presented findings orally (LA-UR-18-27463) and in an internal technical note

Awards and honors

2022 First Place, Innovations in Nuclear Tech R&D (US Department of Energy)
2020 NSF Graduate Research Fellowship (National Science Foundation)
2019 Dean's Fellowship (UM College of Engineering)
2019 NSSC Graduate Fellowship (UC Berkeley, did not accept)
2019 Carver Fellowship (UIUC, did not accept)
2019 Best in Detection & Measurements, ANS Student Conference
2018 Michigan Competitive Scholarship (State of Michigan)
2017, 2018 Andrew A. Kucher Scholarship (NERS Department)
2016, 2017 Summer Research Fellowship (Consortium for Verification Technology)
2016 James D. Butt Scholarship (NERS Department)
2016 NERS 2nd Year Scholarship (NERS Department)

Journal articles

1. **N. Giha**, S. Marin, J. A. Baker, I. E. Hernandez, K. J. Kelly, M. Devlin, J. M. O'Donnell, R. Vogt, J. Randrup, P. Talou, A. E. Lovell, I. Stetcu, O. Serot, O. Litaize, A. Chebboubi, S. D. Clarke, and S. A. Pozzi. "Correlations Between γ-Ray Multiplicity and Compound Nucleus Excitation Energy in ^{239}Pu(n, f)". *Phys. Rev. Lett.* (Submitted July 2022). URL: https://arxiv.org/abs/2207.02743

2. R. Lopez, W. M. Steinberger, **N. Giha**, P. Marleau, S. D. Clarke, and S. A. Pozzi. "Neutron and gamma imaging using an organic glass scintillator handheld dual particle imager". *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* (2022), p. 167407. ISSN: 0168-9002. DOI: https://doi.org/10.1016/j.nima.2022.167407

3. W. M. Steinberger, **N. Giha**, R. Lopez, J. C. Nicholson, S. D. Clarke, and S. A. Pozzi. "Passive gamma-ray imaging of special nuclear materials using a handheld dual particle imager". *IEEE Transactions on Nuclear Science* (Submitted July 2021)

4. W. M. Steinberger, **N. Giha**, P. Marleau, S. D. Clarke, and S. A. Pozzi. "Source isolation and identification using the handheld dual particle imager". *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* (Submitted June 2021)

5. **N. Giha**, W. M. Steinberger, L. Q. Nguyen, J. S. Carlson, P. L. Feng, S. D. Clarke, and S. A. Pozzi. "Organic glass scintillator bars with dual-ended readout". *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* 1014 (2021), p. 165676. ISSN: 0168-9002. DOI: 10.1016/j.nima.2021.165676

6. W. M. Steinberger, **N. Giha**, M. Y. Hua, S. D. Clarke, and S. A. Pozzi. "Anisotropic neutron response of trans-stilbene and impact on a handheld dual particle imager". *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* 1003 (2021), p. 165266. ISSN: 0168-9002. DOI: 10.1016/j.nima.2021.165266

7. W. M. Steinberger, M. L. Ruch, **N. Giha**, A. Di Fulvio, P. Marleau, S. D. Clarke, and S. A. Pozzi. "Imaging Special Nuclear Material using a Handheld Dual Particle Imager". *Scientific Reports* 10.1 (2020), p. 1855. DOI: 10.1038/s41598-020-58857-z

Conference proceedings

1. **N. Giha**, W. M. Steinberger, S. D. Clarke, S. A. Pozzi, L. Q. Nguyen, J. S. Carlson, and P. L. Feng. "Melt-Cast Organic Glass Scintillators for a Handheld Dual Particle Imager". *2020 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)*. 2020, pp. 1–5. DOI: 10.1109/NSS/MIC42677.2020.9507862

2. W. M. Steinberger, **N. Giha**, P. Marleau, S. D. Clarke, and S. A. Pozzi. "Optimizing the Position of Inorganic Scintillators in a Handheld Dual Particle Imager". *2020 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)*. 2020, pp. 1–5. DOI: 10.1109/NSS/MIC42677.2020.9508098

3. W. M. Steinberger, **N. Giha**, M. Bondin, S. D. Clarke, and S. A. Pozzi. "Neutron Imaging and Spectroscopy of Plutonium Using a Handheld Dual Particle Imager". *2019 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)*. 2019, pp. 1–3. DOI: 10.1109/NSS/MIC42101.2019.9059619

4. **N. Giha**, M. L. Ruch, A. Di Fulvio, W. M. Steinberger, and S. A. Pozzi. "Readout Electronics of a Handheld Dual Particle Imager". *2017 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)*. 2017, pp. 1–3. DOI: 10.1109/NSSMIC.2017.8532622

5. A. Di Fulvio, K. A. Beyer, T. H. Shin, **N. Giha**, S. D. Clarke, and S. A. Pozzi. "SiPM readout of stilbene crystals for safeguards applications". *2017 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)*. 2017, pp. 1–3. DOI: 10.1109/NSSMIC.2017.8532859

Conference presentations

1. Prompt gamma-ray multiplicity in fast neutron-induced fission of ^{239}Pu
   15th International Conference on Nuclear Data for Science and Technology (Jul 2022)
2. Correlations between fragment angular momentum and excitation energy
   Workshop on Fission Fragment Angular Momenta (Jun 2022)
3. Correlations Between γ-Ray Multiplicity and Compound Nucleus Excitation Energy in ^{239}Pu(n, f)
   *University Program Review 2022** (Jun 2022)
4. Correlations between γ-ray multiplicity and incident neutron energy in ^{239}Pu(n, f)
   *2022 MTV Workshop** (Mar 2022)
5. Decay properties of low- and high-spin beta-decaying isomers in ^{146}La
   2021 Fall Meeting of the APS Division of Nuclear Physics (Oct 2021)
6. Excitation energy dependence of fission neutron and γ-ray emission from ^{239}Pu(n, f)
   University Program Review 2021 (Sep 2021)
7. Exploring novel wavelength shifters in organic glass scintillators
   2021 MTV Workshop (Mar 2021)
8. Melt-Cast Organic Glass Scintillators for a Handheld Dual Particle Imager
   *2020 IEEE Nuclear Science Symposium and Medical Imaging Conference** (Nov 2020)
9. A Palm-Sized Adaptive Neutron Scatter Camera
   MTV Virtual Student Research Symposium (Jun 2020)
10. Melt-Cast Organic Glass
    2020 MTV Workshop (Mar 2020)
11. Development of a Neutron Scatter Camera using SiPMs Coupled to Stilbene
    2019 American Nuclear Society Student Conference (Apr 2019)
12. Readout Electronics of a Handheld Dual Particle Imager
    *2018 CVT Workshop** (Oct 2018)

13. Resolving the Position of Fission Sources in a ^{3}He Well Counter using List-Mode Analysis
Los Alamos National Laboratory Student Symposium (Aug 2018)

14. SiPM Readout of Stilbene Crystals for a Fast-Neutron Multiplicity Counter
2018 American Nuclear Society Student Conference (Aug 2018)

15. Readout Electronics of SiPMs Coupled to Stilbene in a Fast-Neutron Multiplicity Counter
*2017 CVT Workshop** (Nov 2017)

16. Readout Electronics of a Handheld Dual Particle Imager
*2017 IEEE Nuclear Science Symposium and Medical Imaging Conference** (Oct 2017)

17. Prototype Printed Circuit Board for Readout of a Handheld Dual Particle Imager
*2016 Consortium for Verification Technology Workshop** (Oct 2016)

*poster presentation

Invited talks

Aug 2022 — Fission neutrons and gamma rays
2022 MTV Nuclear Engineering Summer School (245 students)

Jul 2021 — Neutrons & Gammas from Fission
2021 MTV Nuclear Engineering Summer School (244 students)

May 2020 — Gamma-Ray Detection
2020 MTV Nuclear Engineering Summer School (224 students)

Mentorship and teaching

Jan 2021 – Present — James Baker Jr. (undergraduate)
Projects: Multiplicity correlations in fast neutron-induced fission; Correlations between fragment properties and emissions

Jan 2022 – Apr 2022 — Isabel Hernandez (undergraduate)
Project: Simulating γ-ray cascades from highly-excited nuclei

Jan 2020 – Mar 2020 — Emma Cho (undergraduate)
Project: Casting and characterizing organic glass scintillators

Fall 2018 **Instructional Assistant, NERS 211: Introduction to Nuclear Engineering & Radiological Sciences (University of Michigan)**
Delivered lessons, graded assignments, and held office hours for a course on basic principles of nuclear physics and engineering. This course was intended for upper-level engineering majors outside the department (47 students).

Outreach

Summer 2022 **University of New Mexico/U. Michigan Undergraduate Research Experience**
Hosted undergraduate student visitors from the University of New Mexico. Coached the students on graduate school and fellowship applications.

Summer 2019 **Consortium for Verification Technology Outreach Program**
Hosted laboratory tours for high school students belonging to groups that are historically underrepresented in STEM. Taught basics of radiation interactions with matter and detector physics.

Summer 2019 **Xplore Engineering Outreach Program**
Introduced University of Michigan alumni and their 4th - 7th grade children to radiation detection through laboratory tours and demonstrations.

Leadership

2020 – Present **Detection for Nuclear Nonproliferation Group**
Fellowships & Scholarships Lead

2019 – 2021 **UM Student Chapter, IEEE Nuclear & Plasma Sciences Society**
President 2020-21
Vice President 2019-20

2018 – 2021 **UM Student Chapter, Institute for Nuclear Materials Management**
President 2020-21
Vice President 2019-20
Communications Chair 2018-19

Technical skills

Programming languages
Proficient in: Python, C++, Mathematica
Familiar with: C#, MATLAB

Software
ROOT, RadWare, MCNP, Geant4, LaTeX, Git, CAEN FPGA, CadSoft EAGLE (PCB design & layout), SolidWorks (CAD), SRIM

Hardware
Machining, soldering, detector construction

Languages
English (fluent), French (basic), Korean (basic), Spanish (basic)

Professional membership

2021 – Present	American Physical Society
2019 – Present	IEEE Nuclear & Plasma Sciences Society
2016 – 2022	American Nuclear Society
2017 – 2021	Institute for Nuclear Materials Management

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