

# Kyle C. Nelli

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## EDUCATION

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- **California Institute of Technology (Caltech), CA** August 2020 - Present  
Doctorate of Philosophy: *Physics*
  - **University of Illinois Urbana-Champaign, IL** August 2016 - May 2020  
Bachelor of Science: *Engineering Physics, Highest Honors*  
Bachelor of Science: *Astronomy, Summa Cum Laude and with High Distinction*

## EXPERIENCE

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- **Teukolsky Group, Caltech** November 2020 - Present  
Graduate Research Assistant
    - Member of the Simulating eXtreme Spacetimes (SXS) collaboration (150+ people).
    - Updated control loops in the Spectral Einstein Code (SpEC) which runs highly accurate simulations of binary black hole mergers. SpEC utilizes MPI for it's parallelization and has been run on large clusters like Frontera at TACC.Lead SpECTRE Developer/Engineer
    - Open-sourced software designed to run highly accurate simulations of binary black hole mergers and general relativistic magneto-hydro dynamics on HPC and exascale machines.
    - Visualized  $\sim 1$ TB of output from simulations using Paraview and its python scripting framework.
    - Implemented numerous unique and intricate infrastructure changes ranging from low system level ones to overarching high-level ones.
    - Expert on utilizing task-based (asynchronous) parallelism to solve partial differential equations on exascale computing resources.
    - Expert in modern C++.
    - Designed and oversaw several complex student projects. Mentored undergraduate, masters, and other doctoral students in these projects.
  - **Shapiro Group, University of Illinois Department of Physics, REU** May 2018 - July 2020  
Undergraduate Researcher
    - Created visualizations of highly accurate numerical simulations of compact object mergers.
    - Wrote novel code in Python and C++ to automate visualization using VisIt software and Blue Waters supercomputer.
  - **Dr. Christopher Powell, Argonne National Laboratory Internship** May 2017–July 2017  
Undergraduate Researcher
    - Utilized Advanced Photon Source (X-rays) to record fuel injector spray patterns.
    - Generated novel Python scripts to analyze experimental data for start of injection time; implemented visualizations with Blender software.

## SKILLS SUMMARY

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- **Languages:** C/C++, Python, Bash, Perl, Mathematica
  - **Software:** SpECTRE, SpEC, VSCode, L<sup>A</sup>T<sub>E</sub>X, GNUPlot, VisIt, Paraview, Blender
  - **Tools:** GIT/GitHub, Docker/DockerHub, Make, CMake, LLVM, GCC, GDB, HPCToolkit, SLURM
  - **Parallelism:** Charm++, MPI, OpenMP
  - **Platforms:** Linux (Ubuntu, Mint, CentOS, RedHat), Windows, MacOS
  - **Clusters:** Wheeler (Caltech), Caltech HPC (Caltech), Frontera (TACC), Anvil (ACCESS, formerly XSEDE), Expanse (ACCESS), Bridges2 (ACCESS), Pleiades (NASA), Ocean (CSUF), Blue Waters (NCSA)

## HONORS AND AWARDS

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- **APS DGRAV Travel Grant, \$300** April 2023
  - **ICERM Travel Grant, \$840** August 2022
  - **David and Barbara Groce travel fund, \$500 per year** 2022-2024
  - **Rochus E. Vogt Graduate Fellowship, \$36,500** Fall 2020 - Fall 2021
  - **Excellence in Physics Scholarship, \$3,000** Spring 2020
  - **Anthony Research Scholarship, \$1,000** Spring 2020
  - **Wyatt, Stanley Memorial Award, \$700** Spring 2020
  - **University of Illinois Dean's List, Top 20% in College of Engineering** August 2016 - May 2020
  - **Illinois Tool Works Scholarship, \$1,500 per academic year** August 2016 - May 2020
  - **Phi Beta Kappa Honor Society, Member** 2019
  - **A.C. Anderson Undergraduate Research Award** Summer 2018

## PRESENTATIONS

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- "Cauchy-Characteristic Matching in SpECTRE", April APS Meeting, April 16 2023, Minneapolis, MN
- "Cauchy-Characteristic Matching in SpECTRE", Pacific Coast Gravity Meeting, April 1 2023, Caltech, CA
- "SpECTRE, Numerical Relativity Community Summer School 2022", Numerical Relativity Community Summer School, Aug. 11 2022, ICERM at Brown University, MA

## PUBLICATIONS

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- [1] Teagan A. Clarke et al. "Striking the right tone: towards a self-consistent framework for measuring black hole ringdowns". In: (Jan. 2024). arXiv: 2402.02819 [gr-qc].
- [2] Nils Deppe et al. "Simulating magnetized neutron stars with discontinuous Galerkin methods". In: *Physical Review D* 105.12 (June 2022). DOI: 10.1103/physrevd.105.123031. URL: <https://doi.org/10.1103/physrevd.105.123031>.
- [3] Sizheng Ma et al. "Fully relativistic three-dimensional Cauchy-characteristic matching". In: (Aug. 2023). arXiv: 2308.10361 [gr-qc].
- [4] Milton Ruiz et al. "Magnetic ergostars, jet formation, and gamma-ray bursts: Ergoregions versus horizons". In: *Physical Review D* 102.10 (Nov. 2020). DOI: 10.1103/physrevd.102.104022. URL: <https://doi.org/10.1103/physrevd.102.104022>.
- [5] Roberto Torelli et al. "Evaluation of Shot-to-Shot In-Nozzle Flow Variations in a Heavy-Duty Diesel Injector Using Real Nozzle Geometry". In: (Apr. 2018). ISSN: 1946-3952. DOI: <https://doi.org/10.4271/2018-01-0303>. URL: <https://doi.org/10.4271/2018-01-0303>.
- [6] Hengrui Zhu et al. "Black Hole Spectroscopy for Precessing Binary Black Hole Coalescences". In: (Dec. 2023). arXiv: 2312.08588 [gr-qc].
- [7] Hengrui Zhu et al. "Nonlinear Effects In Black Hole Ringdown From Scattering Experiments I: spin and initial data dependence of quadratic mode coupling". In: (Jan. 2024). arXiv: 2401.00805 [gr-qc].