

Kyle C. Nelli

Github: github.com/knelli2

LinkedIn: [linkedin.com/in/kyle-nelli](https://www.linkedin.com/in/kyle-nelli)

Email: knelli@caltech.edu

Mobile: 847-494-5028

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 Simulating eXtreme Spacetimes (SXS) collaboration (150+ people, 8+ institutions).
 - Updated and significantly reduced complexity of control loops in MPI-based Spectral Einstein Code (SpEC).Lead SpECTRE Developer/Engineer (500k+ lines of C++ 20)
 - Open-source software designed to run highly accurate simulations of binary black hole mergers and general relativistic magneto-hydro dynamics on HPC and exascale machines.
 - Utilized task-based (asynchronous) parallelism to achieve **3x speedup** when solving partial differential equations on exascale computing resources.
 - **Visualized ~1TB** of output from simulations using Paraview and its Python scripting framework.
 - Implemented detailed memory diagnostics. **Reduced memory usage by 5x** and found three bugs.
 - Designed and oversaw five student projects. Mentored undergraduate, masters, and other doctoral students.
 - **Shapiro Group, University of Illinois Department of Physics, REU** May 2018 - July 2020
Undergraduate Researcher
 - Created visualizations of numerical simulations of black hole and compact star mergers.
 - Wrote novel code in Python and C++ (27k+ lines) 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++11-20, Python, Bash, Perl, Mathematica
 - **Software:** SpECTRE, VSCode, L^AT_EX, 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

- "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

- [1] Teagan A. Clarke, . . . , **Kyle C. Nelli**, et al. "Striking the right tone: towards a self-consistent framework for measuring black hole ringdowns" (Jan. 2024).
- [2] Hengrui Zhu, Justin L. Ripley, . . . , **Kyle C. Nelli**, et al. "Nonlinear Effects In Black Hole Ringdown From Scattering Experiments I: spin and initial data dependence of quadratic mode coupling" (Jan. 2024).
- [3] Hengrui Zhu, . . . , **Kyle C. Nelli**, et al. "Black Hole Spectroscopy for Precessing Binary Black Hole Coalescences" (Dec. 2023).
- [4] Nils Deppe, . . . , **Kyle C. Nelli**, et al. "Simulating magnetized neutron stars with discontinuous Galerkin methods". *Phys. Rev. D* 105.12 (June 2022).
- [5] Milton Ruiz, Antonios Tsokaros, Stuart L. Shapiro, **Kyle C. Nelli**, and Sam Qunell. "Magnetic ergostars, jet formation, and gamma-ray bursts: Ergoregions versus horizons". *Phys. Rev. D* 102.10 (Nov. 2020).
- [6] Roberto Torelli, . . . , **Kyle C. Nelli**, et al. "Evaluation of Shot-to-Shot In-Nozzle Flow Variations in a Heavy-Duty Diesel Injector Using Real Nozzle Geometry" (Apr. 2018).