Marlo Morales
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EDUCATION

Washington State University, Pullman, WA
Master in Physics Expected May 2024

- Research Area: Numerical Relativity and High-Performance Computing

California State University, Fullerton, Fullerton, CA
Bachelor of Science in Physics June 2022

- Research Area: Numerical Relativity and High-Performance Computing

RESEARCH EXPERIENCE

Graduate Research Assistant, Washington State University, Physics and Astronomy Department
Advisor: Dr. Matthew Duez **August 2022 – Present**

- Contributing to higher-order boundary condition improvements in the Spectral Einstein Code (SpEC - https://www.black-holes.org/code/SpEC.html) essential to studying gravitational waves with higher harmonics.

Undergraduate Research Student, Cornell University, Astronomy Department
Advisor: Dr. Saul Teukolsky and Dr. Larry Kidder **June 2021 – June 2022**

- Remote Research Experience for Undergraduates Program (REU) in Astrophysics and Planetary Science, sponsored by the National Science Foundation.
- Contributed to a Spherical Kerr-Schild gauge transformation code in SpECTRE (https://spectre-code.org) that increases the efficiency of high-spin binary black hole simulations by keeping the black holes' horizons (surfaces) spherical for longer, reducing the resolution (and thus the computational cost).

Undergraduate Research Assistant, California State University, Fullerton, Physics Department
Nicholas and Lee Begovich Center for Gravitational-Wave Physics and Astronomy
Advisor: Dr. Geoffrey Lovelace **Jan. 2020 – Aug. 2022**

- Contributed to the software development of SpECTRE (https://spectre-code.org), an open-source code that uses numerical relativity to simulate and study extreme spacetimes and astrophysical events, including binary black holes and binary neutron star mergers.
- Implemented the metadata code necessary to measure the properties of black hole apparent horizons, such as their surface areas and the measures of mass and spin angular momenta in SpECTRE.
- Developed a zero-crossing-predictor function in SpECTRE. A prerequisite for measuring when the apparent horizon surface and the excision surface of a black hole will collide with each other so that SpECTRE's control system can adjust the grid to avoid the collision.

POSTER PRESENTATIONS AND TALKS

A Spherical Black Hole Gauge Transformation in SpECTRE **2022**
American Physical Society (APS) April Meeting - *Talk*

A Spherical Black Hole Gauge Transformation in SpECTRE **2021**
Cornell Summer Research Experience – *Poster and Talk*

Calculating Apparent Horizon Quantities with SpECTRE **2021**
American Physical Society (APS) April Meeting – *Virtual Conference*

Calculating the Behavior of Warped Space-time of a Black Hole with SpECTRE **2021**
Council on Undergraduate Research (NCUR) – *Virtual Conference*

Calculating the Behavior of Warped Space-time of a Black Hole with SpECTRE **2021**
The Natural Sciences and Mathematics Inter-Club Council Symposium – *Virtual Poster*

Burn Severity, Water Contamination Comparison, and the Ecosystem **2019**
Citrus College Summer Research Experience (SRE) Symposium – *Poster*

AWARDS & SCHOLARSHIPS

Department of Energy Computational Science Graduate Fellowship **2021 - Present**

NASA Space Grant Fellowship in Physics **2023**

Dean's List, California State University, Fullerton **2020, 2021, 2022**

The Black Family Fellowship **2021**

Citrus College Mathematics Award **2020**

Edison/STEM Scholarship **2019**

PROFESSIONAL MEMBERSHIPS

LIGO Scientific Collaboration Member **2021 - 2023**

Sally Casanova Pre-Doctoral Program Scholar **2021 - 2022**

American Physical Society (APS) **2021 - Present**

Simulating eXtreme Spacetimes Collaborations Member (SXS) **2020 - Present**

McNair Scholar **2020 - 2022**

Nicholas and Lee Begovich Center for Gravitational-Wave Physics and Astronomy Member **2020 - 2022**

Louis Stokes Alliances for Minority Participation (LSAMP) Scholar **2020 – 2022**

PUBLICATIONS

L. Buchman, M. Duez, **M. Morales**, M. Scheel, T. Kostersitz, A. Evans, Numerical Relativity Multimodal Waveforms using Absorbing Boundary Conditions, submitted to General Relativity and Quantum Gravity (2023), https://arxiv.org/abs/2402.12544.

N. Deppe, F. Hebert, L. Kidder, W. Throwe, I. Anantpurkar, C. Armaza, G. Bonilla, M. Boyle, H. Chaudhary, M. Duez, N. Fischer, F. Foucart, M. Giesler, J. Guo, Y. Kim, P. Kumar, I. Legred, D. Li, G. Lovelace, S. Ma, A. Macedo, D. Melchor, **M. Morales**, J. Moxon, K. Nelli, E. O'Shea, H. Pfeier, T. Ramirez, H. Ruter, J. Sanchez, M. Scheel, S. Thomas, D. Vieira, N. Wittek, T. Wlodarczyk, and S. Teukolsky, Simulating Magnetized Neutron Stars with Discontinuous Galerkin Methods, submitted to Phys. Rev. D, (2021), arXiv:2109.12033v1.

Deppe, Nils, Throwe, William, Kidder, Lawrence E., Fischer, Nils L., Hébert, François, Moxon, Jordan; Armaza, Cristóbal, Bonilla, Gabriel S., Kumar, Prayush, Lovelace, Geoffrey; O'Shea, Eamonn, Pfeiffer, Harald P.; Scheel, Mark A., Teukolsky, Saul A., Anantpurkar, Isha, Boyle, Michael, Chaudhary, Himanshu, Foucart, Francois, Giesler, Matthew; Guo, Jason S., Iozzo, Dante A. B., Kim, Yoonsoo, Legred, Isaac, Li, Dongjun, Ma, Sizheng, Macedo, Alexandra, Melchor, Denyz, **Morales, Marlo**, Nelli, Kyle C., Ramirez, Teresita, Rüter, Hannes R., Sanchez, Jennifer, Thomas, Sierra, Vieira, Daniel, Wittek, Nikolas A., and Wlodarczyk, Tom, SpECTRE (2021), https://doi.org/10.5281/zenodo.5762413. Note: my contributions to SpECTRE are listed at https://github.com/sxs-collaboration/spectre/commits?author=MarloMo.

LANGUAGES

English, Spanish

SKILLS

C++-17, Python, Unix/Linux command line, SSH client operation for high-performing computer clusters, Jupyter notebooks, ParaView