Alexandra Macedo

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Education

California State University, Fullerton (CSUF) Expected May 2025
M.S. in Physics *Fullerton, CA*

University of California, San Diego (UCSD) December 2020
M.S. in Computer Science (specialization in Artificial Intelligence) *San Diego, CA*

University of California, Los Angeles (UCLA) March 2015
B.S. in Molecular, Cell, and Developmental Biology *Los Angeles, CA*

Projects

C++ Tensor Expression Templates | *C++17, C++20, Blaze, template metaprogramming*
- Developed expression templates for high-performance tensor arithmetic in Einstein notation for open-source numerical relativity code, SpECTRE (spectre-code.org) [9]
- Optimized expression runtime to be faster than or on par with loop implementations of tensor arithmetic [10]

A More Flexible Binary Black Hole Mesh | *C++17, C++20*
- Implemented a new coordinate map feature that made the computational mesh used to simulate binary black holes in SpECTRE (spectre-code.org) more flexible near the horizon [8]
- Played a key role in getting binary black hole simulations to merge robustly in SpECTRE [1]

Modeling LIGO's Astronomical Range with Sensor Data | *Python, scikit-learn, GWpy, GWDetChar*
- Developed a tool that uses lasso regression to diagnose noise sources for gravitational-wave observatories [4] [12]
- Automated daily modeling and data visualization for the gravitational-wave scientific collaboration, LVK

Experience

Research Assistant Nov 2017 – Sept 2018, Jun – Aug 2019, Jun 2020 – present
California State University, Fullerton *Fullerton, CA*
- Contributed over 40K lines to SpECTRE, a task-based, massively parallel C++17 astrophysics code, and contributed to GWDetChar, a gravitational-wave detector characterization code
- Implemented a weighted Z-curve, reducing runtime of equal mass binary black hole evolutions by up to 75%
- Reduced compile memory and time of heavily templated executables by up to 20% and 18%, respectively

Teaching Assistant Sept 2024 – present
California State University, Fullerton *Fullerton, CA*
- Independently run a lower division electromagnetism laboratory course of 20 students

Teaching Assistant Sept 2018 – Jun 2019, Sept 2019 – Jun 2020
University of California, San Diego *San Diego, CA*
- Instructed and developed weekly bespoke software for automatically grading 300-600 students in Java Programming; Data Structures; and Computer Organization and Systems Programming
- Co-authored two online interactive programming textbooks used in undergraduate courses [6] [7]
- Mentored 30 graduate computer science teaching assistants, leading weekly group educational practica

Skills

Languages: C++11/14/17/20, C, Python, Java, Bash, LaTeX
Technologies: Git, Linux/UNIX shell, STL, Blaze, Brigand, CMake, Make
Concepts: Template metaprogramming, test driven development, continuous integration, code review, pull requests
Communication: Teaching, mentoring, public speaking, writing

Awards

UCSD Computer Science and Engineering Masters Award for Excellence in Teaching (2020)
UCSD GradWIC Grace Hopper Conference Scholarship Fund (2020)
UCSD Golden State Teaching Scholarship (2018)

Volunteerism and Leadership

- Mentor Teaching Assistant (UCSD, 2019-2020)
- Graduate Mentor (UCSD JUMP, 2019-2020)
- English and American Culture Instructor (UCLA DCISS, 2016-2018)
- President, Member (UCLA Drug Outreach and Education Program, 2013-2015)
- Community Service Commission Liason, Coach (Special Olympics at UCLA, 2013-2015)

Affiliations and Memberships

American Physical Society (2021, 2024–present)
Simulating eXtreme Spacetimes Collaboration (2019 – present)
Nicholas and Lee Begovich Center for Gravitational-wave Physics and Astronomy (2017 – present)
LIGO Scientific Collaboration (now LIGO-Virgo-KAGRA Collaboration) (2017 – 2019)
UCSD Graduate Women in Computing (2018 – 2020)

Publications

Accepted

[1] Geoffrey Lovelace, ..., **Alexandra Macedo**, et al. "Simulating binary black hole mergers using discontinuous Galerkin methods." [**CQG**] [**arXiv**]

Submitted

[2] Nikolas Wittek, ..., **Alexandra Macedo**, et al. "Relieving scale disparity in binary black hole simulations." [**arXiv**]

Peer reviewed

[3] Nils Deppe, ..., **Alexandra Macedo**, et al. "Simulating magnetized neutron stars with discontinuous Galerkin methods." *Phys. Rev. D, 105(12):123031*, 2022. [**PRD**] [**arXiv**]

[4] Marissa Walker, ..., **Alexandra Macedo**, et al. "Identifying correlations between LIGO's astronomical range and auxiliary sensors using lasso regression." *Classical and Quantum Gravity*, 2018. [**CQG**] [**arXiv**]

[5] Sander Valstar, ..., **Alexandra Macedo**, et al. "Faculty Views on the Goals of an Undergraduate CS Education and the Academia-Industry Gap." *Association for Computing Machinery*, 2020. [**ACM**]

Educational

[6] Sophia Krause-Levy, ..., **Alexandra Macedo**, et al. "Computer Organization and Systems Programming (C and ARM)." *Stepik*, 2020. [**Stepik**]

[7] Joseph Gibbs Politz, **Alexandra Macedo**, et al. "Intro to Programming in Python then Java using Media Computation." *Stepik*, 2020. [**Stepik**]

Conference Presentations

Future

[8] **Alexandra Macedo**, Marceline Bonilla, et al. "Improvements to SpECTRE's Computational Domain for Binary Black Hole Simulations." American Physical Society April Meeting, 2025.

Past

[9] **Alexandra Macedo** and Nils Deppe. "Writing Tensor Equations in SpECTRE." Simulating Extreme Spacetimes with SpEC and SpECTRE, ICERM, 2024.

[10] **Alexandra Macedo** and Nils Deppe. "Design, optimization, and updated status of SpECTRE's C++ tensor expression interface." American Physical Society April Meeting, 2024.

[11] **Alexandra Macedo** and Nils Deppe. "SpECTRE's C++ tensor expression interface." American Physical Society April Meeting, 2021.

[12] **Alexandra Macedo**, Marissa Walker, et al. "Identifying correlations between LIGO's astronomical range and auxiliary sensors using LASSO regression." 34th Pacific Coast Gravity Meeting, 2018.