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Leo Werneck, Ph.D.

Computational Physicist

Research Experience

Postdoctoral Researcher, *University of Idaho* 2021 –
- Designed and implemented scientific software for solving complex differential equations.
- Developed performance-critical, CUDA-enabled software for simulations & experiments.
- Generated informative visualizations of large-scale HPC simulations with tools like VisIt.

Visiting Scholar | **Postdoctoral Researcher**, *West Virginia University* 2019 – 2021
- Collaborated on multi-institutional software engineering research projects.
- Leveraged finite differences/volume methods to solve complex differential equations.
- Developed advanced microphysics codes for complex numerical simulations.

Education

Ph.D. in computational astrophysics, *University of São Paulo, Brazil* 2016 – 2020
M.Sc. in mathematical physics, *University of São Paulo, Brazil* 2013 – 2016
B.Ed. in physics, *University of São Paulo, Brazil* 2009 – 2013

Skills

Scientific Computing: Plasma Physics, PDEs, FFT, Linear Algebra, Numerical Methods
Programming: C, C++, Python (NumPy, SciPy, SymPy, Matplotlib), CUDA
HPC Tools: MPI, OpenMP, PBS, Slurm, VisIt
Development: Git, CI/CD, gdb, valgrind, Bash

Software Development

GRHayL: Modular, High-Performance General Relativistic Hydrodynamics Library
- Provides core algorithms for magnetized plasma simulations in extreme environments.
- Reduced large-scale HPC simulation time by 30 %, benefiting hundreds of users.
- Optimized for heterogeneous computing architectures through GPU-friendly kernels.
- Implemented & maintained comprehensive unit testing and CI/CD infrastructure.

RETINAS: CUDA-Accelerated Real-Time Image Analysis Toolkit
- Designed a high-performance computing solution for real-time particle tracking and analysis, improving performance of the original code by >400 %.

NRPy+: Python-based C/C++/CUDA/Charm++ Code Generator for Numerical Relativity
- Enabled rapid code development with sophisticated optimizations like SIMD/SIMT.
- Developed microphysics modules for advanced nuclear equations of state and neutrinos.

Einstein Toolkit: Community-Driven Computational Astrophysics Software Infrastructure
- Developed, integrated, & maintained multiple computational astrophysics modules.
- Demonstrated ability to collaborate in large, distributed software development.

Communication Skills

Effective Communication: Skilled at translating complex ideas into clear, accessible concepts.
Scientific Publication: 8 peer-reviewed papers, 2 preprints. Select papers (highlight in braces):
[1] **Werneck** *et al.*, Rev. Sci. Instrum. 95, 073708 (2024) [**RETINAS announcement paper**]
[2] **Werneck** *et al.*, Phys. Rev. D 107, 044037 (2023) [**Complex algorithms & simulations**]
[3] Assumpção, **Werneck** *et al.*, Phys. Rev. D 105, 104037 (2022) [**Complex algorithms**]
[4] **Werneck** *et al.*, Class. Quantum Grav. 38 245005 (2021) [**Complex algorithms**]
Oral Presentation: 14 public talks, including at major conferences like the APS April Meeting.
Mentoring: undergraduate & graduate students; junior postdoctoral researchers.