LEONARDO (LEO) ROSA WERNECK

Postdoctoral researcher

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BIOGRAPHICAL DATA

Birth date: September 24, 1991
Birth place: São Paulo, Brazil
Citizenship: Brazil
Languages: English (fluent), Portuguese (native), Spanish (basic)

WORK EXPERIENCE

University of Idaho, USA *2021 – Present*
Postdoctoral researcher

University of West Virginia, USA *2020 – 2021*
Postdoctoral researcher

EDUCATION

University of São Paulo, Brazil *2016 – 2020*
Ph.D. in Physics

University of São Paulo, Brazil *2013 – 2016*
M.Sc. in Physics

University of São Paulo, Brazil *2009 – 2013*
Physics Teaching Degree

RESEARCH INTERESTS

Compact object binaries in fully dynamical spacetimes

- Black hole-black hole (Pubs. [2]).
- Neutron star-neutron star (Pubs. [1], [5]).

Black hole accretion (Pubs. [1], [4], [5]).

Critical phenomena in gravitational collapse (Pubs. [3], [6]).

Development of numerical relativity software (Pubs. [1], [2], [3], [5], [6]).

SOFTWARE DEVELOPMENT

`IllinoisGRMHD`[1] *2019 – Present*
Developer & maintainer
`Einstein Toolkit` thorn providing GRMHD for dynamical spacetimes.
– Documented entire code in pedagogical Jupyter notebooks.
– Added support for finite-temperature, microphysical equation of state tables.

`NRPy+`[2] *2019 – Present*
Developer & maintainer
`Python`-based `C` code generator for Numerical Relativity and beyond.
–– Contributed several modules & tutorial notebooks.

`Einstein Toolkit`[3] *2019 – Present*
Contributor

A community-driven software platform of core computational tools to support research in relativistic astrophysics and gravitational physics.

-– Contributed several new thorns, as well as documentations, optimizations, and extensions to several existing thorns.

`NRPyElliptic`[4] *2021 – Present*

Developer & maintainer

Easily extensible, `NRPy+`-based elliptic solver for Numerical Relativity initial data.

– Lead developer of `Einstein Toolkit` thorn version of the code, `NRPyEllipticET`.

`NRPyLeakage`[5] *2022 – Present*

Lead developer & maintainer

`NRPy+`-based neutrino leakage code.

– Also lead developer of `Einstein Toolkit` thorn version of the code, `NRPyLeakageET`.

`NRPyCritCol`[6] *2019 – Present*

Lead developer & maintainer

User-friendly, well-documented `NRPy+`-based code to study critical phenomena.

`SFcollapse1D`[7] *2018 – Present*

Lead developer

User-friendly, well-documented `C++` code to study critical phenomena of a massless scalar field in 1D.

[1]: https://github.com/IllinoisGRMHD
[2]: https://nrpyplus.net
[3]: http://einsteintoolkit.org
[4]: http://github.com/assumpcaothiago/NRPyElliptic
[5]: https://github.com/IllinoisGRMHD
[6]: https://github.com/zachetienne/nrpytutorial
[7]: https://github.com/leowerneck/SFcollapse1D

MENTORING

2021

Mentored two undergraduate students on how to use `SFcollapse1D` for their senior thesis & one graduate student in the development of `NRPyElliptic`.

2020

Mentored two undergraduate students on how to use `SFcollapse1D` for their senior thesis.

FELLOWSHIPS

CAPES (Brazil) Ph.D. fellowship *2016 – 2020*

CAPES (Brazil) M.Sc. fellowship *2013 – 2016*

CNPq (Brazil) undergraduate research fellowship *2011 – 2013*

PUBLICATIONS

2022 preprints

[1] **L. R. Werneck**, Z. B. Etienne, A. Murguia-Berthier, R. Haas, F. Cipolletta, S. C. Noble, L. Ennoggi, F. G. L. Armengol, B. Giacomazzo and T. Assumpção, *et al.*, *"Addition of tabulated equation of state and neutrino leakage support to IllinoisGRMHD,"* arXiv: 2208.14487. *Submitted to Phys. Rev. D* (**2022**).

2021 peer-reviewed publications

[2] T. Assumpcao, **L. R. Werneck**, T. P. Jacques and Z. B. Etienne,*"Fast hyperbolic relaxation elliptic solver for numerical relativity: Conformally flat, binary puncture initial data,"* Phys. Rev. D, **105**, no.10, 104037. arXiv: 2111.02424 (**2021**).

[3] **L. R. Werneck**, Z. B. Etienne, E. Abdalla, B. Cuadros-Melgar and C. E. Pellicer,*"NRPyCritCol & SFcollapse1D: an open-source, user-friendly toolkit to study critical phenomena,"* Class. Quant. Grav., **38**, no.24, 245005. arXiv: 2106.06553 (**2021**).

[4] A. Murguia-Berthier, S. C. Noble, L. F. Roberts, E. Ramirez-Ruiz, **L. R. Werneck**, M. Kolacki, Z. B. Etienne, M. Avara, M. Campanelli and R. Ciolfi, *et al.*"*HARM3D+NUC: A New Method for Simulating the Post-merger Phase of Binary Neutron Star Mergers with GRMHD, Tabulated EOS, and Neutrino Leakage,*" Astrophys. J., **919**, no.2, 95. arXiv: 2106.05356 (**2021**).

2021 preprints

[5] F. G. L. Armengol, Z. B. Etienne, S. C. Noble, B. J. Kelly, **L. R. Werneck**, B. Drachler, M. Campanelli, F. Cipolletta, Y. Zlochower and A. Murguia-Berthier, *et al.*, *"Handing-Off the Outcome of Binary Neutron Star Mergers for Accurate and Long-Term Post-Merger Simulations,"* arXiv: 2112.09817. *Submitted to Phys. Rev. D* (**2021**).

Dissertations & Theses

[6] **L. R. Werneck**,*"Aspectos de relatividade numérica: campos escalares e estrelas de nêutrons,"* Ph.D. Thesis, University of São Paulo (Brazil). doi:10.11606/T.43.2020.tde-01092020-014914. (**2020**).

[7] **L. R. Werneck**,*"A gauge theory for continuous spin particles,"* M.Sc. Disseration, University of São Paulo (Brazil). doi:10.11606/d.43.2016.tde-07062016-114220. (**2016**).

TALKS

2022

- North American Einstein Toolkit "Working Workshop", *An introduction to* `NRPy+`, University of Illinois at Urbana-Champaign, IL, USA.
- North American Einstein Toolkit Summer School, *Accurate, long-term binary neutron stars simulations with* `IllinoisGRMHD` *and* `HARM+NUC`, University of Idaho, ID, USA.
- APS April Meeting, *Accurate, long-term binary neutron stars simulations with* `IllinoisGRMHD` *and* `HARM+NUC`, New York Marriott Marquis, NY, USA.

2021

- Midwest Relativity Meeting, `IllinoisGRMHD`+`HARM3D`: *Next-generation binary neutron stars simulations*, University of Illinois at Urbana-Champaign, IL, USA.
- North American Einstein Toolkit School, `NRPy+` *tutorial: Maxwell's equations in flat space & ET thorn generation*, University of Illinois at Urbana-Champaign, IL, USA (online event).
- TCAN Workshop, `IllinoisGRMHD` *progress update—advanced, tabulated equation of state support*, Rochester Institute of Technology, NY, USA (online event).
- APS April Meeting, *New, user-friendly codes to study critical collapse*, online event.

2020

- TCAN Workshop, `IllinoisGRMHD` *progress update—piecewise polytropic equation of state support*, Rochester Institute of Technology, NY, USA (online event).

OUTREACH

2022

- North American Einstein Toolkit Summer School: *Member of Scientific & Local Organizing Committees*. University of Idaho, ID, USA.
- First Einstein Toolkit Hackaton: `NRPy+` *mentor*; *contributor* to the documentation of several thorns (online event).