Curriculum Vitae

Personal Information

Name: Alexandru Dima

ORCID: 0000-0003-4641-3946

Research interests: Gravity, Gravitational Waves, Numerical Relativity, General Relativity, Black Holes, Neutron Stars, Exotic Compatc Objects, Compact Binaries, Data Science, ML/DL applications for Physics, Phyisics Informed Neural Networks, Modified Gravity, Dark Matter, Dark Energy

Professional Experience

2023 - present: Postdoctoral Researcher,
Department of Physics,
Sapienza University of Rome, Rome, Italy
PI: Prof. Paolo Pani

2021 - 2023: Postdoctoral Research Associate,
Department of Physics and National Center for Supercomputing Applications,
University of Illinois at Urbana-Champaign, IL, USA
PIs: Prof. Helvi Witek, Dr. Roland Haas

List of publications

2025 **Title**: The Great Impersonation: $\mathcal{W}$-Solitons as Prototypical Black Hole Microstates.
e-Print: 2509.18245 [gr-qc] (submitted to PRD)
(2 citations counted in INSPIRE as of 17 Oct 2025)
Authors: **A. Dima**, P. Heidmann, M. Melis, P. Pani and G. Patashuri.

2025 **Title**: Nonradial stability of topological stars.
Journal: Phys. Rev. D **111** (2025) no.10, 104001, e-Print: 2502.04444 [gr-qc]
(11 citations counted in INSPIRE, 11 in Google Scholar as of 15 Oct 2025)
Authors: **A. Dima**, M. Melis and P. Pani.

2025 **Title**: Growing black-hole hair in nonminimally coupled biscalar gravity.
Journal: Phys. Rev. D **111** (2025) no.12, 124039, e-Print: 2501.14034 [gr-qc]
(4 citations counted in INSPIRE, 3 in Google Scholar as of 15 Oct 2025)
Authors: C. Richards, **A. Dima**, D. Ferguson and H. Witek.

2024 **Title**: Spectroscopy of magnetized black holes and topological stars.
Journal: Phys. Rev. D **110** (2024) no.8, 084067, e-Print: 2406.19327 [gr-qc]
(20 citations counted in INSPIRE, 17 in Google Scholar as of 15 Oct 2025)
Authors: **A. Dima**, M. Melis and P. Pani.

2023 **Title**: Black holes in massive dynamical Chern-Simons gravity: Scalar hair and quasi-bound states at decoupling.
Journal: Phys. Rev. D **108** (2023) no.4, 044078, e-Print: 2305.07704 [gr-qc]
(14 citations counted in INSPIRE, 18 in Google Scholar as of 15 Oct 2025)
Authors: C. Richards, **A. Dima** and H. Witek.

2021 **Title**: Dynamical Chameleon Neutron Stars: stability, radial oscillations and scalar radiation in spherical symmetry.
Journal: Phys. Rev. D **104** (2021) 8, 084017, e-Print: 2107.04359 [gr-qc]
(25 citations counted in INSPIRE, 28 in Google Scholar as of 15 Oct 2025)
Authors: **A. Dima**, M. Bezares, E. Barausse.

2020 **Title**: Spin-induced black hole spontaneous scalarization.
Journal: Phys. Rev. Lett. **125** (2020), 231101, e-Print: 2006.03095 [gr-qc]
(218 citations counted in INSPIRE, 226 in Google Scholar as of 15 Oct 2025)
Authors: **A. Dima**, E. Barausse, N. Franchini, T. Sotiriou.

2020 **Title**: Numerical investigation of plasma-driven superradiant instabilities.
Journal: Class. Quant. Grav. **37** (2020) 17, 175006, e-Print: 2001.11484 [gr-qc]
(46 citations counted in INSPIRE, 50 in Google Scholar as of 15 Oct 2025)
Authors: **A. Dima**, E. Barausse.

2017 **Title**: Vainshtein Screening in Scalar-Tensor Theories before and after GW170817: Constraints on Theories beyond Horndeski.
Journal: Phys. Rev. D **97** (2018) 10, 101302, e-Print: 1712.04731 [gr-qc]
(134 citations counted in INSPIRE, 142 in Google Scholar as of 15 Oct 2025)
Authors: **A. Dima**, F. Vernizzi.

Public codes

- **Einstein Toolkit:** Maxwell Rizzo, Roland Haas, Steven R. Brandt, Zachariah Etienne, Deborah Ferguson, Lucas Timotheo Sanches, Bing-Jyun Tsao, Leonardo Werneck, David Boyer, Gabriele Bozzola, Cheng-Hsin Cheng, Samuel Cupp, Peter Diener, Terrence Pierre Jacques, Liwei Ji, Hayley Macpherson, Ivan Markin, Erik Schnetter, Wolfgang Tichy, ... Burkhard Zink. (2025). The Einstein Toolkit (The "Martin D. Kruskal" release, ET_2025_05). Zenodo. https://doi.org/10.5281/zenodo.15520463
- **Canuda:** Witek, H., Zilhao, M., Bozzola, G., Cheng, C.-H., Dima, A., Elley, M., Ficarra, G., Ikeda, T., Luna, R., Richards, C., Sanchis-Gual, N., & Silva, H. (2023). Canuda: a public numerical relativity library to probe fundamental physics.
Zenodo. https://doi.org/10.5281/zenodo.7791842

Teaching experience

2024-2025 "Laboratorio di Fisica Computazionale I", by prof. Paolo Pani. Teaching assistant activity and support.

2023 "Introduction to Numerical Relativity", North American Einstein Toolkit School and Workshop, Rochester Institute of Technology, Rochester, NY.

Co-supervision and mentoring experience

2024- S. Lanzi,
Master student, Sapienza University of Rome,
Project: Tidal response of exotic compact objects
under the supervision of Prof. P. Pani

2021-2023 C. Richards,
PhD in Physics, University of Illinois Urbana-Champaign,
Project: Strong field tests of gravity with black holes
under the supervision of Prof. H. Witek

2021-2023 C.-H. Cheng,
PhD in Physics, University of Illinois Urbana-Champaign,
Project: Compact binaries and ultra-light fields
under the supervision of Prof. H. Witek

Academic Education

2017 - 2021: PhD in Astroparticle Physics, *cum Laude*
Thesis on "*Testing the gravitational phenomenology of compact objects: superradiance, scalarization and screening mechanisms*".
Supervisor: Prof. Enrico Barausse,
SISSA, Italy.

2015 - 2017: Master's degree in Theoretical Physics, 110/110 *cum Laude*.
Thesis on "*Nonlinear aspects of the effective theory of dark energy*",
Supervisors: Prof. Filippo Vernizzi, Prof. Sabino Matarrese,
University of Padova, Italy.

2012 - 2015: Bachelor Degree in Physics, 110/110.
Thesis on "*Experimental violations of Bell's inequalities with time bin and polarization entanglement*",
Supervisor: Dr. Giuseppe Vallone,
University of Padova, Italy.

Professional development and further training

- IBM - Data Science (ongoing)
- IBM - Introduction to Deep Learning & Neural Networks with Keras (ongoing)
- Johns Hopkins University - Introduction to Concurrent Programming with GPUs
- DeepLearning.AI - Deep Learning Specialization: Neural Networks and Deep Learning; Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization.

Grants, fellowships and awards

2021 Amaldi Research Center 2021 prize for the PhD thesis:
"Testing the gravitational phenomenology of compact objects: superradiance, scalarization and screening mechanisms"

2021 - 2023 support from NSF-CSSI Grant Award Number (FAIN) 2004879:
"The Einstein Toolkit ecosystem: Enabling fundamental research in the era of multi-messenger astrophysics",
PIs: Prof. Helvi Witek, Dr. Roland Haas

2018 Short Term Scientific Mission supported by the COST Action CA16104.
Hosting institution: IAP, Paris, France.

2017 Erasmus+ scholarship.
Supervisors: Prof. S. Matarrese, Prof. F. Vernizzi
Hosting institution: IphT, Saclay, France.

High-perfomance computing time grants

2022 XSEDE allocation TG-PHY210114
"Probing strong-field gravity with numerical relativity simulations"
supported by NSF Grant No. ACI-1548562,
member of HPC grant at SDSC's Expanse; CPU time: 3.4M CPU hours
PI: Prof. Helvi Witek

2022 Delta Illinois Allocation
"GPU Computing for Computational Astrophysics with the Einstein Toolkit,"
Member of HPC Grant at Delta, GPU time: 2,900.0 GPU hours; CPU time: 205,800 CPU hours
PI: Prof. Helvi Witek

2021 2021 Illinois Blue Waters allocation,
"Strong field tests of gravity: numerical relativity in quadratic gravity"
Member of HPC grant at Blue Waters; CPU time: 689,000 node-hours
PI: Prof. Helvi Witek

Talks, Conferences, Workshops and Schools

2025 **Talk (contributed)**: Echoes from the black hole microstructure.
Event: XXVI SIGRAV conference on general relativity and gravitation, University of Milano-Bicocca, Milan, Italy.

2024 **Talk (contributed)**: Spectroscopy of magnetized black holes and topological stars.
Event: Meeting PRIN "String Theory as a bridge between Gauge Theories and Quantum Gravity", Bra (CN), Italy.

2024 **Talk (contributed)**: Spectroscopy of magnetized black holes and topological stars.
Event: first TEONGRAV international workshop on the theory of gravitational waves, Sapienza University of Rome, Rome, Italy.

2023 **Talk (invited)**: Introduction to Numerical Relativity.
Event: North American Einstein Toolkit School and Workshop, Rochester Institute of Technology, Rochester, NY.

2023 **Talk (invited)**: Into the wilds of strong gravity.
Event: ARC Prize Ceremony, Amaldi Research Center, Sapienza University, Rome.

2022 **Event**: New frontiers in strong gravity, Cientro de Ciencias de Benasque "Pedro Pascual", Benasque, Spain.

2022 **Talk (contributed)**: Binary Black Hole simulations in axi-dilaton gravity.
Event: North American Einstein Toolkit School 2022 - University of Idaho, Moscow, Id, USA.

2022 **Talk (contributed)**: Binary Black Hole merger simulations in scalar-Gauss-Bonnet gravity.
Event: American Physical Society - April meeting 2022, New-York, NY, USA.

2021 **Event**: Midwest Relativity Meeting 2021, Urbana-Champaign, IL, USA.

2021 **Talk (contributed)**: Neutron star simulations in screened modified gravity.
Event: North American Einstein Toolkit School 2021, Urbana-Champaign, IL, USA. (Attended virtually)

2021 **Talk (contributed)**: Neutron star simulations in screened modified gravity.
Event: 57th Karpacz Winter School of Theoretical Physics - "Equation of state of dense matter and multimessenger astronomy", Karpacz, PL.

2021 **Talk (contributed)**: Spin-induced spontaneous scalarization.
Event: XIII Black Holes Workshop, Lisbon. (Attended virtually)

2020 **Event**: Mathematical and Computational Approaches for the Einstein Field Equations with Matter Fields, ICERM Workshop, Brown University. (Attended virtually)

2020 **Event**: Advances in Numerical Relativity: Mathematical and Computational Approaches for Solving the Source-Free Einstein Field Equations, ICERM Workshop, Brown University. (Attended virtually)

2020 **Talk (contributed)**: Numerical investigation of superradiant instabilities.
Event: 3rd meeting of the GWVerse COST action, Trieste, Italy.

2019 **Talk (contributed)**: Black holes and superradiant instabilities in time domain.
Event: Astro@TS 2019, Trieste, Italy.

2019 **Talk (contributed)**: Superradiant instabilities from the plasma frequency.
Event: European Einstein Toolkit Meeting 2019, London, UK.

2019 **Event**: ICTP Summer School on Geometry and Gravity, 2019, Trieste, Italy.

2018 **Event**: Fundamental Physics with LISA, Arcetri, Firenze, Italy.

2018 **Event**: ICTP Summer School on Cosmology, 2018, Trieste, Italy.

Outreach activities

12/2020 "Not all black holes are the same", SISSA press release
`https://www.sissa.it/news/not-all-black-holes-are-same`

12/2020 "Buchi neri, la ricrescita si vede", MEDIA INAF
`https://www.media.inaf.it/2020/12/09/buchi-neri-la-ricrescita-si-vede/`

12/2020 "Le caratteristiche dei Buchi Neri", Podcast Co.Scienza
(timestamp minute start-17:00)

Proficiencies and skills

Programing Languages

- C/C++

- Fortran
- Python
- Julia
- CUDA
- PyTorch, TensorFlow, Keras

Technical skills

- General knowledge of HPC workload managers (e.g TORQUE, SLURM)
- Experience with large numerical simulations on supercomputing clusters like CINECA, XSEDE/Expanse, NCSA Blue Waters, NCSA Delta.
- Basic knowledge of Machine Learning and Deep Learning techniques for Physics and Data Analysis

Languages

- Romenian and Italian native speaker, fluent in English, intermediate Spanish, basic knowledge of French and German.

References

Prof. Paolo Pani, paolo.pani@uniroma1.it, Sapienza University of Rome, Roma, Italy.

Prof. Helvi Witek, hwitek@illinois.edu, University of Illinois at Urbana-Champaign, Urbana, IL, USA.

Prof. Enrico Barausse, barausse@sissa.it, Scuola Internazionale Superiore di Studi Avanzati, SISSA, Trieste, Italy.