

Curriculum Vitae



Duvier Suárez Fontanella

Salamanca, Spain.

DOB: 24 of May 1992

 D. Suarez-Fontanella

 0000-0002-3891-0187  D.S. Fontanella

 duvier@usal.es

Personal web: www.duviersuarezfontanella.es

Resume¹

PhD researcher in theoretical and computational astrophysics, specialising in compact objects, dark matter phenomenology, axion/ALP physics, and gravitational wave sources. First-author researcher with international experience at Observatoire de Paris and the University of Salamanca.

My work combines analytical modelling, numerical relativity, scientific computing, and data-driven methods to study high-energy and gravitational phenomena in neutron stars and binary systems. I develop reproducible computational workflows for differential-equation solvers, parameter exploration, scientific visualisation, and model validation.

Research interests. Astroparticle physics; axion and ALP phenomenology; compact objects; dark-sector signatures in gravitational waves; numerical relativity; equation-of-state modelling; and machine-learning applications in astrophysics.

Publicaciones

Total: 10 publications (8 peer-reviewed), 7 first-author, including JCAP (2026), PRD (2025), PLB (2024), 1 publication during undergraduate studies. Key contributor in ET Collaboration Blue Book (> 100 authors)

Citations: 419 INSPIRE-HEP — <https://inspirehep.net/authors/2914623>

2/2026 “*Resonant Axion–Photon Conversion in the Early Inspiral of Neutron Star Binaries*”, **D. Suárez-Fontanella**, M. Pérez-García, C. Albertus, **send to APJ**.

7/2025 “*Probing ALP-photon couplings in Neutron Stars: scalar versus pseudoscalar cases*”, **D. Suárez-Fontanella**, C Albertus, M Pérez-García (Physical Review D)
e-Print:DOI: <https://doi.org/10.1103/gv6n-89k2>

3/2025 “*The Science of the Einstein Telescope*”. Adrian Abac, Raul Abramo, ... **D. Suárez...** ET collaboration. Role: **Key contributor**, Section 7: *Subatomic Physics with ET*. Journal of Cosmology and Astroparticle Physics.

Link: DOI [10.1088/1475-7516/2026/03/081](https://doi.org/10.1088/1475-7516/2026/03/081)

¹Statement: Throughout this CV, underlined words and hyperlinks lead to online sources and relevant contacts that support or provide additional context for the achievements and activities listed.

7/2024	“Gravitational Wave emission in Binary Neutron Star early post-merger within a dark environment”. D Suárez-Fontanella, D Barba-González, C Albertus, M Pérez-García (Physics Letters B.) Link: https://doi.org/10.1016/j.physletb.2025.139358
4/2023	“Dynamic Gravastars: A short review”. DS Fontanella, A Cabo, CM Garcia. (Cuban Sci. 2023, 4(2): 19–21) Link: https://cubanscientist.org/archive/4/2/19
10/2021	“Dynamical gravastars from the interaction between scalar fields and matter”. A. Cabo, D.S. Fontanella, D. Valls-Gabaud. (Eur. Phys. J. C 81, 917 (2021)) Link: https://link.springer.com/article/10.1140/epjc/s10052-021-09726-0
04/2021	“A stability analysis of the static EKG Boson Stars”. D.S. Fontanella, A. Cabo. (Astro-nomical Notes Volume342, Issue1-2) Link:https://onlinelibrary.wiley.com/doi/10.1002/asna.202113911
12/2020	“Real scalar field solutions of the EKG equations including matter”. A. Cabo, D.S. Fontanella. (International Journal of Modern Physics D 30 (2), 2150009) Link:https://www.worldscientific.com/doi/abs/10.1142/S0218271821500097
01/2020	“About the upstream contamination., D.S. Fontanella, A. Cabo. (Rev. Cubana Fis. 36, 8 (2019)) Link:https://www.revistacubanadefisica.org/index.php/rcf/issue/view/84/20
12/2017	<i>Boson stars solutions of the Einstein-Klein-Gordon equations in the sense of Colombeau-Egorov’s theory of generalized functions.</i> A. Cabo, D. Suárez-Fontanella https://onlinelibrary.wiley.com/doi/abs/10.1002/asna.201713444

Education

2022 - present	PhD Researcher at the University of Salamanca, Department of Fundamental Physics and Mathematics, Spain.
2019	Bachelor’s degree in Theoretical Physics from the University of Havana (FF-UH), Cuba. Laurea Magistrale in Physics, following the Bologna Process for the recognition of foreign degrees.

Awards and Scholarships

2022 - 2025	International Santander Scholarship Competitive full doctoral scholarship for Latin American students awarded by Banco Santander and partner universities to support academic mobility and research activities.
2018, 2021	PHC Carlos J. Finlay Scholarship. Scientific mobility grants under the French–Cuban Hubert Curien cooperation agreement to support joint research projects.
2025 - 2026	ICECYL Talento Fellowship, Castilla y León. Regional funding for postgraduate RD and internationalization and research activities awarded by the Junta de Castilla y León.

Languages

- **Spanish (Native)**
- **English (Fluent)**, B_2 according to CEFR scale.

Experience

University of Salamanca

- 9/2022 - 7/2026 PhD Candidate.
Department of Fundamental Physics and Mathematics at USAL, Trilingual Building, University of Salamanca, Plaza de la Merced S/N, E-37008 Salamanca, Spain.
Under the supervision of professors Maria Ángeles Pérez and Conrado Albertus, studying possible signals of dark matter in gravitational wave patterns.
- 2024 - 2025 Teaching Assistant / University Lecturer (during PhD studies)
1- “A Journey to Nuclear Astrophysics and its Mathematical Foundations.”
2- Lab Instructor for Mechanics and Oscillations Laboratory.

Paris Observatory

- 9/2018 and 12/2021 Visiting Researcher.
Department of Theoretical Physics (LUTH) at Paris Observatory (OP), 61 Av. de l’Observatoire, 75014 Paris, France.
Under the supervision of professors Eric Gourgoulon and David Valls-Gabound, studying the final state for the gravitational collapse of a scalar field with spherical symmetry coupled with gravity and matter.
Two research stays.

Institute of Cybernetics, Mathematics, and Physics

- 4/2019 - 9/2022 Research Associate (Theoretical Physics).
Department of Theoretical Physics. Institute of Cybernetics, Mathematics, and Physics (ICIMAF).
Calle E # 309 esq. a 15, 10400 La Habana, Cuba.
Phone number: (+53) 78312806.
Researching in the context of the national project “Dense matter in strong magnetic fields, applications to astrophysics and cosmology,” supervised by professor Alejandro Cabo.
Project head, professor Hugo Pérez Rojas.
- 9/2020-6/2021 Teaching Assistant (Undergraduate Level).
Teaching “Introduction to General Relativity” and “Quantum Field Theory” to undergraduate students from the University of Havana and the Higher Institute of Technologies and Applied Sciences (INTEC) who are interning at ICIMAF.
- 2015-2018 Internship. Department of Theoretical Physics. Institute of Cybernetics, Mathematics, and Physics (ICIMAF). Notable participation in the theoretical explanation of the Upstream Contamination phenomenon first reported in the literature by the Faculty of Physics at the University of Havana.

Academy Service

- 2024–2025 Member of the working group involved in the preparation and proposal of problems for the Castilla y León Regional Physics Olympiad. <https://slsalamancarsef.usal.es/Grupo-de-trabajo>
- 2020 Member of the jury involved in the preparation and selection of problems for the Ibero-American Physics Olympiad (2020). Jury President: Dr. María Sánchez Colina.

Volunteering

- 3/2020 - 6/2021 Volunteer Researcher
Cuban Ministry of Public Health (MINSAP).
Studying the spread of Covid-19 in Cuba through an extended SIR model. Seeking estimation methods for the decline of the R parameter (the main parameter of these models) based on mobility restriction measures.

IT and Software Proficiencies

Broad experience in scientific programming and data-driven analysis for astroparticle and dark-matter research. Skilled in developing machine-learning pipelines and optimized Python/C++ libraries for high-performance numerical modeling. Numerical-relativity infrastructures (Cactus, Lorene) and advanced algebraic frameworks, supported by modern software-engineering practices such as version control, containerization, and reproducible workflows.

-  Python ²: **OOP & Scientific Python**: Python library development for numerical modeling and data analysis. **Neural Networks & AI**: Development of CNN-based classification systems for dark matter detection in CCD data. Application of transfer learning.
-  Wolfram Mathematica : RGTensor, symbolic and tensorial computations.
-  C++ : STL, Boost, Eigen; scientific and high-performance computing.
-  Cactus : Development of custom thorns for numerical relativity simulations.
- Lorene and CompOSE : Neutron-star structure and equation-of-state modeling.
- Quantum Computing : Basic implementation of quantum circuits using Qiskit and PennyLane; variational algorithms and hybrid quantum-classical workflows.
- **General Tools**: Git, GitHub, GitLab; Docker; Linux (Ubuntu); LaTeX; agile development workflows.

Research software: *aXemg*: modular Python package developed and maintained by the author for numerical studies of axion electrodynamics in fixed $3 + 1$ curved spacetimes, including axion–Maxwell coupling, finite-difference evolution, constraint diagnostics, parameter sweeps, and scientific visualization.

²(1) Basic: Fundamental knowledge with the ability to write simple programs. (2) Intermediate: Solid understanding for solving complex problems. (3) Advanced: Mastery of the language and development of complex applications. (4) Advanced with Libraries: Use of specific frameworks to enhance functionality. (5) Advanced with Optimization: Complete mastery and experience in performance optimization and software architecture.

Academic Engagement

Throughout my scientific trajectory, I have taken part in 20 international events, including 5 training schools and 15 conferences and workshops, with 14 oral presentations and 1 posters. I have also organized 6 of these conferences.

Organized Conferences

I have contributed to the organization of 6 international conferences and workshops, supporting technical and operational tasks such as website development, participant and speaker coordination, and schedule management.

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| 05/2025 | 22nd MultiDark meeting. Salamanca, Spain
(oral): <i>Axion Distribution in Magnetically Deformed Neutron Stars</i> .
https://multidark2025.usal.es/en/ |
| 06/2024 | 13th Iberian Gravitational Waves Meeting. Salamanca, Spain
(oral): <i>Influence of viscous dark matter on early post-merger gravitational wave emissions in binary neutron star systems</i>
https://iberiangw2024.usal.es/ |
| 05/2024 | IberiCOS 2024: Iberian Cosmology Meetings. Salamanca, Spain
just organizer
https://ibericos2024.usal.es/ |
| 03/2021 | FT-45: From the Cosmos to Quarks. Online conference.
(oral): <i>Dynamic Gravastars: A short review</i>
https://indico.cern.ch/event/1005700/ |
| 12/2020 | HIPSTARS: Workshop on Heavy Ion Physics and Compact Stars. Online conference.
(oral): <i>A stability analysis of the static EKG Boson Stars</i>
https://indico.cern.ch/event/974441/ |
| 01/2020 | 2nd Cuban Meeting on Physics for Graduate Students. Havana, Cuba. |

Summer programs

Participation in international summer schools has provided focused training in nuclear astrophysics and gravitational-wave physics, including hands-on experience with state-of-the-art computational tools such as Einstein Toolkit, Lorene, CompOSE, and GW analysis methods.

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| 7/2024 | DTP/TALENT 2024 — Nuclear Theory for Astrophysics. Trento, Italy.
https://indico.ectstar.eu/event/221/ |
| 6/2023 | Thematic school GWsNS-2023: Gravitational Waves from Neutron Stars. Aussois, France.
https://indico.in2p3.fr/event/28236/ |
| 05/2019 | Fifth Caribbean Symposium on Cosmology, Gravitation, Nuclear and Astroparticle Physics (STARS 2019). Havana, Cuba / Sixth International Symposium on Strong Magnetic Fields and Neutron Stars (SMFNS 2019). Varadero, Cuba.
https://indico.cern.ch/e/stars2019 |
| 10/2017 | XVI WONP-X NURT Preconference School on High Energy Physics. Havana, Cuba.
www.wonp-nurt.cu |

07/2016 School on High Energy Physics: Particles and Strings. Havana, Cuba.
155.210.92.22/drupal/whepcuba2015/node/19

Conferences and Workshops

- 09/2025 Undark: Astrophysical probes of dark sectors using radiowave observations. Canary Island, Spain. (ora): *ALP Distribution in Magnetically Deformed Neutron Stars*
<https://indico.cern.ch/event/1546907/>
- 05/2023 Dark Matter 2023: From the Smallest to the Largest Scales. Santander, Spain.
(oral and poster): *Binary neutron star mergers in a dark environment with an effective Lagrangian approach*. <https://indico.ifca.es/event/2675/>
- 12/2021 Théorie, Univers et Gravitation. Paris, France.
(oral): *Dynamical gravastar from the interaction between scalar fields and matter* <https://indico.in2p3.fr/event/24746/overview>
- 05/2019 Fifth Caribbean Symposium on Cosmology, Gravitation, Nuclear and Astroparticle Physics (STARS 2019). Havana, Cuba./ Sixth International Symposium on Strong Magnetic Fields and Neutron Stars (SMFNS 2019). Varadero, Cuba.
(oral): *A study in progres about a dynamical gravastar solution*
<https://indico.cern.ch/e/stars2019>
- 04/2018 6th International Symposium on Non-equilibrium Dynamics (NeD-2018). Varadero, Cuba.
Gravitational Collapse for scalar fields
<https://fias.uni-frankfurt.de/ned2018/>
- 10/2017 LASNPA: Latin-American Symposium on Nuclear Physics and Applications WONP-NURT: Workshops on Nuclear Physics and Nuclear Related Techniques. Havana, Cuba
(oral) *On gravastars solutions of the Einstein-Klein-Gordon equations in the sense of Colombeau-Egorov's generalized functions*
<https://indico.global/event/6061/>
- 05/2017 Fourth Caribbean Symposium on Cosmology, Gravitation, Nuclear and Astroparticle Physics (STARS 2017). Havana, Cuba / Fifth International Symposium on Strong Magnetic Fields and Neutron Stars (SMFNS 2017). Varadero, Cuba.
(oral): *"Boson stars solutions of the Einstein-Klein-Gordon equations in the sense of Colombeau-Egorov's theory of generalized functions"*.
<https://indico.cern.ch/event/542644/>
- 11/2016 ICIMAF Scientific Meeting 2016. Havana, Cuba.
(oral): *"Countercurrent Contamination"*.
- 07/2016 Latin-American Conference on High Energy Physics: Particles and Strings II. Havana, Cuba.
<https://agenda.infn.it/event/10553/registrations/78/>

Outreach Activities

- 2026 Napkin Notes: Founder and editor of the science-outreach platform Napkin Notes aimed at communicating physics, astrophysics, and scientific ideas to a broad audience. Responsible for project conception, editorial direction, content development, and dissemination.
Napkin Notes: www.napkinnotes.es

10/2025	Scattering Cimarrón: Founder of a research–outreach initiative that documents the career trajectories of Cuban physicists. Project design, data collection, team coordination, and dissemination of results. <u>Scattering Cimarrón</u>
05/2022	<i>Sobre la masa del Bosón W... sin sensacionalismos</i> D Suárez Fontanella <u>Juventud Técnica , 2022</u>
2020	<i>Book: Contributor (selected article) in the curated international compendium *Covid-19: Existencialismo en tiempos de Covid-19</i> Duvier Suárez Fontanella. <u>MAEditores</u>
2020	<i>MAESTRIA Y DOCTORADO: LA VIDA MAS ALLA DE LA TESIS.</i> G Quintero Angulo, J Cerutti Torres, VL Díaz-Meliána, D Suárez Fontanella, D Alvear Terrero <u>Revista cubana de física. , 2020, Vol.37(1), p.70</u>

Industry Experience

01/ 2026	Industry transfer: R&D internship at Lobera company, focused on dynamic pricing and business analytics for strategic decision-making.
02/ 2024	Industry transfer: I collaborated with SALGO startup (together with Dr. German Rodrigo and Dr. German Sborlini), being selected in prestigious competitions The Collider - Mobile World Capital BCN and “COMTE-EBT” - Fundación General CSIC) and invited to industry collaboration events (“V Foro CPI”, “IND+i Days”, “EIT ClimAccelerator”). Research Project: Development of a CNN- and graph-theory–based system for detecting social agents and modeling population dynamics in event environments.