Nayara Fonseca

November 2026

Contact

E-mail: nayara.focs@gmail.com **Webpage:** nayarafonseca.com **LinkedIn:** fonseca-nayara

Positions

Visiting Researcher (Maskelyne Fellow) Sep 2026 – Nov 2026
Meridian, Cambridge, UK

Research Manager Mar 2026 – Sep 2026
MATS Research, London
Research management and technical research support for projects aimed at improving the interpretability, evaluation, and scientific understanding of current AI systems.

Research, Consulting, and AI Safety May 2025 – Feb 2026
Senior Research Associate (The Alan Turing Institute, London); AI Evaluation Consultant (Scale AI, Remote); BlueDot Impact AGI Strategy Course and project grant (Remote).

Research Fellow (UKRI Marie Skłodowska-Curie Fellowship) May 2023 – May 2025
Rudolf Peierls Centre for Theoretical Physics, University of Oxford
Project: Phenomenology of Deep Learning

Research Scientist May 2022 – Apr 2023
IBM Research, Daresbury
Search for physics extremes with generative deep learning; machine learning for equation solving; optimization in physics-informed neural networks.

Postdoctoral Researcher Oct 2019 – Sep 2021
International Centre for Theoretical Physics (ICTP), Trieste
Dark matter model building and phenomenology; machine learning for field localization in theory space.

Postdoctoral Researcher Oct 2016 – Sep 2019
Deutsches Elektronen-Synchrotron (DESY) Hamburg
Physics beyond the Standard Model; interplay between particle physics and early universe cosmology; effective field theory tools to generate large hierarchy of scales.

Education

Ph.D. in Theoretical Physics, 2016.

Master of Science in Physics, 2011.

Department of Mathematical Physics, University of São Paulo.
Supervisor: Prof. Gustavo Burdman.

Exchange PhD Student (Sept. 2015 – May 2016)
Deutsches Elektronen-Synchrotron (DESY) (Host: Prof. Géraldine Servant)

Exchange PhD Student (Jan. 2014 – Dec. 2014)
Center for Theoretical Physics, MIT (Host: Prof. Jesse Thaler)

Bachelor of Science in Physics, 2009
Gleb Wataghin Physics Institute, University of Campinas.
Supervisor: Prof. Alberto Saa.

Consulting, Academic Visits, and Other Research Roles

Scale AI Contractor, Remote
Expert-level data and model evaluation, Sep–Dec 2025.

The Alan Turing Institute, London
Senior Research Associate, May–July 2025.

OpenAI Contractor, Remote
Expert-level data and model evaluation, Jun–Sep 2024.

Queen Mary University of London
Postdoctoral Researcher, October 2021 – November 2021.

Lawrence Berkeley National Laboratory
Visitor Research Scholar, October 2018 – November 2018.

Complutense University of Madrid
Undergraduate Exchange Program, September 2006 – February 2007.

Awards, Funding, and Distinctions

2025: BlueDot Impact AGI Strategy Fund (USD 5,000).
2022: Marie Skłodowska-Curie Postdoctoral Fellowship Award at the University of Oxford (EUR 236,000).
2019: 3-year Postdoctoral Research Fellow Position at ICTP, Trieste.
2018: European Union's Horizon 2020 Research and Innovation Staff Exchange Program (Berkeley Lab).
2016: 3-year Postdoctoral Research Fellow Position at DESY Theory Group, Hamburg.
2015 – 2016: FAPESP* Exchange Program Fellowship (DESY Theory Group).
2014: CNPq† Exchange Program Fellowship (Center for Theoretical Physics, MIT).
2011 – 2016: FAPESP Ph.D. Fellowship.
2009 – 2011: FAPESP MSc. Fellowship.
2008 – 2009: FAPESP Undergraduate Scholarship.
2007 – 2008: CNPq Undergraduate Scholarship.
2006: CNPq Undergraduate Scholarship.
2006: Santander Scholarship (Complutense University of Madrid).

*FAPESP: São Paulo Research Foundation.
†CNPq: National Council for Scientific and Technological Development (Brazil).

Technical Skills

- **Programming and ML/Stat Libraries/Packages:** Python, Mathematica, TensorFlow, PyTorch, NumPy, Scikit-learn, Pandas.
- **Mathematical Background:** optimization, probability, numerical methods, differential equations, linear algebra, complex analysis, algorithms, and programming.
- **AI Safety and Model Evaluation:** OpenAI and Scale AI expert-level data and model evaluation; AGI Strategy Course by BlueDot Impact (October 2025); AI Alignment Course by BlueDot Impact with the final project titled: "Polygenic skills: What is the effect of combined tasks?" (March–June 2024).
- **Optimization in Physics Applications:** parameter-space searches of physical observables using a genetic algorithm, used in two publications (JHEP and PRD) that are part of my doctoral thesis.

Publications

– In machine learning papers, an asterisk (*) denotes equal contribution. In theoretical high energy physics, the convention is to order the author list alphabetically.

– Journal of High Energy Physics (JHEP) and Physical Review D (PRD) are top journals in the field, see, e.g., Google Scholar High Energy and Nuclear Physics top publications.

[19] Y. Nam, N. Fonseca, S. H. Lee, C. Mingard, N. Goring, O. E. Harzli, A. H. Erturk, S. Hayou, A. A. Louis, *Decoupling Dynamical Richness from Representation Learning: Towards Practical Measurement.* [ICLR 2026] [arXiv]

[18] Y. Nam*, N. Fonseca*, S. H. Lee, C. Mingard, A. A. Louis, *An exactly solvable model for emergence and scaling laws.* [NeurIPS 2024] [arXiv].

[17] N. Fonseca*, V. Guidetti*, and Will Trojak*, *Probing optimisation in physics-informed neural networks.* ICLR 2023 Workshop on Physics for Machine Learning [Physics4ML] [arXiv].

[16] N. Fonseca* and V. Guidetti*, *Generalizing similarity in noisy setups: the DIBS phenomenon.* European Conference on Artificial Intelligence (ECAI) 2023 [ECAI 2023] [arXiv].

[15] N. Fonseca and E. Morgante, *Probing photophobic (rel)axion dark matter.* Physical Review D [PRD] [arXiv].

[14] N. Fonseca, E. Morgante, R. Sato, G. Servant, *Relaxion Fluctuations (Self-stopping relaxion) and Overview of Relaxion Stopping Mechanisms.* Journal of High Energy Physics [JHEP] [arXiv].

[13] N. Fonseca, E. Morgante, R. Sato, G. Servant, *Axion Fragmentation.* Journal of High Energy Physics [JHEP] [arXiv].

[12] N. Fonseca, B. von Harling, L. de Lima, C. S. Machado, *Super-Planckian axions from near-conformality.* Physical Review D [PRD] [arXiv].

[11] N. Fonseca and E. Morgante, *Relaxion Dark Matter.* Physical Review D [PRD] [arXiv].

[10] N. Fonseca, E. Morgante and G. Servant, *Higgs relaxation after inflation.* Journal of High Energy Physics [JHEP]; [arXiv].

[9] N. Fonseca, B. von Harling, L. de Lima, and C. S. Machado, *A warped relaxion.* Journal of High Energy Physics [JHEP] [arXiv].

[8] N. Bernal, C. S. Fong, and N. Fonseca, *Sharing but not caring: Dark Matter and the Baryon Asymmetry of the Universe.* Journal of Cosmology and Astroparticle Physics [JCAP] [arXiv].

[7] N. Fonseca, L. de Lima, C. S. Machado, and R. D. Matheus, *Large field excursions from a few site relaxion model (N-Relaxion).* Physical Review D [PRD] [arXiv].

[6] N. Fonseca, L. Necib and J. Thaler, *Dark Matter, Shared Asymmetries, and Galactic Gamma Ray Signals.* Journal of Cosmology and Astroparticle Physics [JCAP] [arXiv].

[5] N. Fonseca, R. Z. Funchal, A. Lessa, and L. Lopez-Honorez, *Dark Matter Constraints on Composite Higgs Models.* Journal of High Energy Physics [JHEP] [arXiv].

[4] G. Burdman, N. Fonseca, and G. Lichtenstein, *Resonances from Quiver Theories at the LHC.* Physical Review D [PRD] [arXiv].

[3] G. Burdman, N. Fonseca, and L. Lima, *Full-hierarchy Quiver Theories of Electroweak Symmetry Breaking and Fermion Masses.* Journal of High Energy Physics [JHEP] [arXiv].

– Thesis and Dissertation

[2] *Theories with Large Hierarchy of Scales.*
Ph.D. Thesis, University of São Paulo.

[1] *Dimensional deconstruction and flavor violation.*
Master's Dissertation (In Portuguese), University of São Paulo.

Talks and Seminars (Selected)

- Online Machine Learning Workshop for Afghanistan (ICTP's Physics Without Frontiers), October 2025.
- AI Security Reading Group, Mathematical Institute, University of Oxford, November 2024.
- 'An exactly solvable model for emergence and scaling laws' (joint presentation with Y. Nam), Oxford group meeting, Rudolf Peierls Centre for Theoretical Physics, University of Oxford, April 2024.
- 'About Scaling and Emergent Behavior in Neural Networks' – Part 2, Oxford group meeting, Rudolf Peierls Centre for Theoretical Physics, University of Oxford, February 2024.
- 'About Scaling and Emergent Behavior in Neural Networks' – Part 1, Oxford group meeting, Rudolf Peierls Centre for Theoretical Physics, University of Oxford, January 2024.
- 'An overview of Transformers and Attention Mechanisms', Oxford group meeting, Rudolf Peierls Centre for Theoretical Physics, University of Oxford, September 2023.
- 'Generalization in Contrastive Learning', Oxford group meeting, Rudolf Peierls Centre for Theoretical Physics, University of Oxford, May 2023.
- 'Physics-Informed Artificial Intelligence', Hartree Centre, Sci-Tech Daresbury, November 2022.
- Machine Learning at the Galileo Galilei Institute [YouTube] (joint presentation with V. Guidetti), Florence, September 2022.
- IBM Research Brazil, Rio de Janeiro, August 2022.
- 'Pheno DL: Similarity Learning and Double Descent' [YouTube], U. Autónoma de Madrid, April 2022.
- 'Phenomenology of Deep Learning', The Latin American Symposium of High Energy Physics (SILAFAE) [YouTube], November 2021.
- 'Theory of Deep Learning and Physics', Institute for Fundamental Physics of the Universe, Trieste, April 2021.
- Workshop on probing beyond Standard Model physics at different scales, Magnus-Haus Berlin, January 2020.
- Scuola Internazionale Superiore di Studi Avanzati, ICTP-SISSA Pheno Postdoc Day, Trieste, Italy, December 2019.
- Invisible 2019 Workshop (Neutrinos, Dark Matter and Dark Energy), Valencia, Spain, June 2019.
- Workshop 'Search for New Physics in the Horizon', Korea University, Seoul, May 2019.
- Stanford Institute for Theoretical Physics, USA, November 2018.
- Lawrence Berkeley National Laboratory, USA, October 2018.
- Workshop 'Beyond Standard Model: Where do we go from here?', The Galileo Galilei Institute, Florence, Italy, September 2018.
- CERN TH Institute on Physics at the LHC and Beyond, Geneva, Switzerland, August 2018.
- Mainz Institute for Theoretical Physics, Johannes Gutenberg Universität Mainz, Germany, June 2018.
- 21st International Conference From the Planck Scale to the Electroweak Scale, Bonn, Germany, May 2018.
- Workshop on Cosmological Probes of BSM - from the Big Bang to the LHC, Benasque, Spain, May 2018.
- Institut de Física d'Altes Energies, Universitat Autònoma de Barcelona, May 2018.
- Dalitz Seminar in Fundamental Physics, Department of Physics, University of Oxford, UK, April 2018.
- Confronting Naturalness: from LHC to Future Colliders, DESY Hamburg, Germany, April 2018.
- Workshop on Axions at the crossroads, European Centre for Theoretical Studies in Nuclear Physics and Related Areas, Trento, Italy, November 2017.
- DESY Theory Workshop – Fundamental physics in the cosmos: The early, the large and the dark Universe, Hamburg, Germany, September 2017.
- Theory Seminar at the Bethe Center for Theoretical Physics, Bonn, Germany, June 2017.
- The 29th Rencontres de Blois on Particle Physics and Cosmology, Blois, France, May 2017.
- DESY Theory Workshop – Rethinking Quantum Field Theory, Hamburg, Germany, September 2016.
- ICTP South American Institute for Theoretical Physics, São Paulo, Brazil, August 2015.
- MIT Center for Theoretical Physics Journal Club, Cambridge, March 2014.

Organization of International Events

- Mainz Institute for Theoretical Physics Scientific Program, July 2022 [link].
- Joint Workshop between the Institute for Basic Science (Korea) and the ICTP (Italy), Oct. 2021 [link].
- Joint Workshop between the Institute for Basic Science (Korea) and the ICTP (Italy), Oct. 2020 [link].

Supervision and Mentoring

– *MSc Dissertation Supervisor; Theme: Machine Learning.* Thomas Weatherbee, Title: "Mitigating Catastrophic Forgetting via Adaptive Replay Scheduling", University of Oxford, 2024 – 2025.

– *MSc Dissertation Supervisor; Theme: Machine Learning.* Runze Feng, Title: "Investigating Emergence and Scaling Laws with Multi-subtask MNIST", University of Oxford, 2024 – 2025.

– *MSc Dissertation Supervisor; Theme: Machine Learning.* Samuel Dudley, Title: "Model stitching to investigate the location of simplicity bias in neural networks", University of Oxford, 2024 – 2025.

– *MSc Dissertation Supervisor; Theme: Machine Learning.* Lysander Mawby, Title: "Scale in Deep Learning: Algorithmic Datasets and Sudden Performance Changes", University of Oxford, 2023 – 2024.

– *MSc Dissertation Tutor; Theme: Particle Physics.* Fidele Twagirayezu, Title: "New Light Neutral Particles in Meson Decays", East African Institute of Fundamental Research (Rwanda), 2020 – 2021.

– *Internship Co-supervisor at DESY; Theme: Particle Physics and Cosmology.* Augustin Vanrientvelde, École Polytechnique (France), June 2017 – Sep. 2017.

Professional Activities

– *Dissertation Assessor*, University of Oxford, 2023 – 2025.

– *Examiner for DPhil Confirmation of Status*, University of Oxford, 2024.

– *Peer Review*
  - ML/AI Conferences: NeurIPS, ICML
  - Physics Journals: JHEP, PRD, PRL.

Community

– IBM Research UK Geometric Deep Learning Journal Club (organizer), Dec. 2022.

– ICTP (Italy) Phenomenology Virtual Journal Club (organizer), May 2020 – June 2021.

– ICTP (Italy) Particle Physics Seminars (co-organizer), Oct. 2019 – Sep. 2021.

– DESY (Germany) Journal Club (co-organizer), Oct. 2017 – Sep. 2019.

– DESY (Germany) Friday Cookies (co-organizer), Nov. 2016 – July 2019.

– DESY (Germany) Christmas Party (co-organizer), 2015.

– DESY (Germany) Works Outing (co-organizer), 2015.