

Carlos Heredia Pimienta

University of Barcelona

PERSONAL DETAILS

Skype: carlosherediapimienta
Mail: carlosherediapimienta@gmail.com
Web page: carlosherediapimienta.com
Linkedin: linkedin.com/in/carlosherediapimienta/
Github: github.com/carlosherediapimienta
Born: 28.07.1993

EDUCATION

Ph.D. in Physics Oct/20 - Mar/23

University of Barcelona (UB), Barcelona, Spain

- Category: Mathematical Physics
- Ph.D.'s thesis: Nonlocal Lagrangian formalism
- Supervisor: Prof. Josep Llosa

Master in Astrophysics, Particle Physics and Cosmology Sep/16 - Jun/17

University of Barcelona (UB), Barcelona, Spain

- Category: Mathematical Physics
- Master's thesis: Hamilton-Jacobi formalism for non-involutive systems
- Supervisor: Prof. Josep M. Pons

Bachelor's Degree in Physics Sep/11 - Jan/16

University of Barcelona (UB), Barcelona, Spain

WORK EXPERIENCE

Senior Data Scientist at DAMM ([DAMM](#)) Oct/23 - Today

Barcelona, Spain

Specialised in: Forecasting with statistical, machine learning and deep learning tools.

Assistant Professor at University of Barcelona ([Department: FQA](#)) Sep/22 - Sep/23

Barcelona, Spain

Teaching: Subjects related to mathematics, physics and numerical methods.

Business Intelligence Consultant at Ernst & Young ([EY](#)) Sep/17 - Oct/20

Barcelona, Spain

Specialised in Machine Learning, Big Data and Data Analytics for the Hospitality industry.

PUBLICATIONS

Nonlocal Mechanics

Carlos Heredia and Josep Llosa [[arXiv: 2508.03601](#) (*hep-th*)]

Modeling AdaGrad, RMSProp, and Adam with integro-differential equations

Carlos Heredia [[arXiv: 2411.09734](#) (*cs.LG*)]

Are nonlocal Lagrangian systems fatally unstable?

Carlos Heredia and Josep Llosa [[arXiv: 2403.19777](#) (*hep-th*)]

Electromagnetic interaction models for Monte Carlo simulation of protons and alpha particles

Francesc Salvat and Carlos Heredia [*Nucl. Instrum. Meth. B* **546** [165157](#)]

Nonlocal Lagrangian fields and the second Noether theorem. Non-commutative $U(1)$ gauge theory

Carlos Heredia and Josep Llosa [*J. High Energ. Phys.* **04**(2024)021]

[Ph.D. Thesis] Nonlocal Lagrangian formalism

Carlos Heredia [[arXiv: 2304.10562](#) (*hep-th*)]

Infinite derivatives vs integral operators. The Moeller-Zwiebach paradox

Carlos Heredia and Josep Llosa [*J. Phys. A: Math. Theor.* **57** [235202](#)]

Nonlocal Lagrangian fields: Noether's theorem and Hamiltonian formalism

Carlos Heredia and Josep Llosa [*Phys. Rev. D* **105** [126002](#)]

Infinite-derivative linearized gravity in convolutional form

Carlos Heredia, Ivan Kolář, Josep Llosa, Francisco José Maldonado Torralba, and Anupam Mazumdar [*Class. Quantum Grav.* **39** [085001](#)]

Nonlocal Lagrangian Mechanics: Noether's theorem and Hamiltonian formalism

Carlos Heredia and Josep Llosa [*J. Phys. A: Math. Theor.* **54** [425202](#)]

Energy-momentum tensor for the electromagnetic field in a dispersive medium

Carlos Heredia and Josep Llosa [*J. Phys. Commun.* **5** [055003](#)]

COLLABORATIONS

NTT Research — Harvard University ([Phi Lab](#))

Dec/23 - Nov/24

Boston, USA

Collaboration with Dr. Hidenori Tanaka on researching Lagrangian formulation and symmetries in adaptive optimizers (e.g., RMSProp, Adam) for deep learning dynamics.

ICCUB — University of Barcelona ([Group: ICCUB](#))

Sep/23 - Today

Barcelona, Spain

Collaborations with Prof. Josep Llosa and Prof. Francesc Salvat in projects based on the study of higher-order Lagrangians and charged particle transport with Penelope/Penhan.

Van Swinderen Institute — University of Groningen (*RUG*)
Groningen, Netherlands

Sep/21 - Mar/23

Collaborations with Prof. Anupam Mazumdar and Dr. Ivan Kolar in projects based on the study of modified theories of gravity.

ICCUB — University of Barcelona (*Group: ICCUB*)
Barcelona, Spain

Jan/18 - Oct/20

Collaboration with Prof. Josep Llosa in a project based on the study of nonlocal theories.

IFAE — Autonomous University of Barcelona (*Group: IFAE*)
Barcelona, Spain

Jan/16 - Oct/16

Collaboration with Prof. Oriol Pujolàs and Dr. Matteo Baggioli in a project based on the study of the conductive properties of graphene through holographic methods for condensed matter.

POSTERS & TALKS

Decoding Non-Locality

Center for Theoretical Physics of the Universe (Prof. Masahide Yamaguchi), Korea

Navegando en la No Localidad

I Congreso Trujillano de Gravitación y Cosmología, Perú

Extending Noether's Theorem to Nonlocal Theories

Machine Learning in Mathematics and Theoretical Physics 2023, University of Oxford

Noether's Theorem for Nonlocal Lagrangians

Symmetry 2023 - The 4th International Conference on Symmetry, Barcelona, Spain

Noether's theorem for non-local theories

Van Swinderen Institute (Anupam Mazumdar's group), University of Groningen

Noether's theorem for non-local Lagrangian mechanics

Cosmology Journal Club, University of Barcelona

Energy-momentum tensor for the electromagnetic field in a dispersive medium

HSE Study Center Voronovo, Moscow

THESIS SUPERVISION

Forecasting Face-Off: From ARIMA to Deep Learning in Financial Market Predictions

Student: Marcos Heredia, type: Master's thesis, year: 2024, Institution: CRM, Barcelona

TEACHING

S23: Practical sessions of principles of Laboratory Practice - #363980

Electronic Engineering and Telecommunications, University of Barcelona

S23: Problems of Multivariable Calculus - #360570

Physics, University of Barcelona

F22: Problems of Calculus 1 - #366693

Biomedical engineering, University of Barcelona

F22: Problems of Calculus 1 - #360569

Physics, University of Barcelona

F22: Problems of Fundamentals of Mechanics - #360563

Physics, University of Barcelona

SUMMER/WINTER SCHOOLS & CONFERENCES

Machine Learning in Mathematics and Theoretical Physics ([Link](#)) Jul/23

University of Oxford, United Kingdom

Sym. 2023 - The 4th International Conference on Symmetry ([Link](#)) Jun/23

The AXA Convention Center, Barcelona, Spain

Moscow International School of Physics 2020 ([Link](#)) Mar/20

HSE Study Center Voronovo, Moscow, Russia

XIII Tonale Winter School in Cosmology ([Link](#)) Dec/19

University of Heidelberg, Passo del Tonale, Italy

TAE 2019 - COST Training School in High Energy Physics ([Link](#)) Sep/19

Centro de Ciencias de Benasque Pedro Pascual, Huesca, Spain

SKILLS

Programming skills

- Fortran 95 // Mathematica 10 // ABAP // R // Python // SQL

Simulation

- Penelope // Penhan

AI tools

- Azure // DataBricks // Pytorch // Git

DISSEMINATION

Book - Chapter 2: Quantum-World

[Books - Dissemination](#)

Nit de la Recerca - Intel·ligència artificial i humanitat. Perills i avantatges

[UB Divulga](#)

The beauty of symmetries

[Severo Ochoa Coffee Talk, CIMNE, Polytechnic University of Catalonia](#)

ACADEMIC REFEREE

Journal of Physics A: Mathematical and Theoretical, ISSN: 1751-8121

Iop science, Journal

Nuclear Physics B journal, ISSN: 1873-1562

Elsevier Publishing, Journal

Classical and Quantum Gravity journal, ISSN: 1361-6382

IOP Publishing, Journal

Selectivitat PAU 2023 - Member of the examining board and proofreader

Catalonia, Spain

LANGUAGES

Spanish (*mother tongue*), **Catalan** (*C1*), **English** (*C1*)

FUNDINGS

COST - TAE2019 HEP *Cost - Funding*

2019