Ander Artola Velasco

✉ artolavelascoander@gmail.com | ▊ +34 610 016 510 | ⊕ https://anderartola.github.io

EDUCATION

2024 - TBD	Doctor of Philosophy (PhD.), COMPUTER SCIENCE at the **Max Planck Institute for Software Systems** & **Rheinland-Pfälzische Technische Universität Kaiserslautern-Landau, Germany**. Supervisor: **Manuel Gomez Rodriguez.**
	Area: *"Machine Learning, Human-Centric Artificial Intelligence, Causality, Reinforcement Learning and Decision-making"*
2023 - 2024	Master of Science, THEORETICAL PHYSICS at **Heidelberg University** (in collaboration with the **Max Planck Institute for Astronomy**).
	Thesis: *"Signature of warm dark matter in the cosmological density fields extracted using Machine Learning."*
2018 - 2023	Bachelor's Degree, PHYSICS (240 ECTS) at **Complutense University of Madrid** (Grade: 9.49/10). **Graduated with honours, highest grade of the cohort.**
	Thesis: *"General Relativity as a gauge theory."*
2018 - 2023	Bachelor's Degree, MATHEMATICS (240 ECTS) at **Complutense University of Madrid** (Grade: 9.40/10).
	Thesis: *"Momentum maps and polytopes."*
2016 - 2018	French scientific Baccalaureate, at **Liceo Francés Internacional de Alicante**.

RESEARCH EXPERIENCE & PROJECTS

2024 - TBD	PhD. in COMPUTER SCIENCE at the **Max Planck Institute for Software Systems**.

- **Efficient counterfactual evaluation of Large Language Models (LLMs).** Evaluation of state-of-the-art LLMs such as **LLAMA3** and **Phi** using counterfactual reasoning and causality.
- **Action sets in Reinforcement Learning.** Designing online-learning multi-armed bandit algorithms to construct action sets for reinforcement learning tasks. Developing advanced algorithms to enhance human decision-making in collaborative settings with trained AI agents, leveraging the principles of human-machine complementarity.

2023 - 2024	Master's thesis in THEORETICAL PHYSICS AND COSMOLOGY at **Heidelberg University** and **Max Planck Institute for Astronomy**.

- Developed a code to compute optical-depth and flux for **Lyman-alpha forest** and applied it to the **Sherwood simulation suite**.
- Applied statistical and signal analysis techniques to understand the influence of different Warm Dark Matter models on the intergalactic medium.
- Used **Bayesian Neural Networks** to extract **density fields** from flux spectra of QSO and constrain **Warm Dark Matter** masses.

May 2024	Advanced School on Applied Machine Learning at the **International Center for Theoretical Physics (ICTP)** and co-organized by the **International School for Advanced Studies (SISSA)**, Trieste, Italy. Poster session presented with the title *"Using Deep Learning to Constrain Warm Dark Matter"*.
April 20224	Challenging the standard cosmological model event organized by the **Royal Society**, London, UK.
2023	Bachelor's thesis in Mathematics at **Complutense University of Madrid**.
	• Worked on the formulation of **Hamiltonian systems** on symplectic manifolds and the action of **Lie groups**. Studied the fundamental properties of moment maps including a generalized **Noether's theorem** and the **Atiyah-Guillemin-Sternberg convexity theorem**.
2023	Bachelor's thesis in Theoretical Physics at **Complutense University of Madrid**.
	• Explored the formulation of **General Relativity** as a **local gauge theory** over the Poincaré group, the form of the Einstein-Hilbert action and Einstein's field equations in terms of the spin connection, and the coupling of fermions to gravity.
June-August 2022	GRANT PROGRAMME SEVERO OCHOA: INTRODUCTION TO RESEARCH at **Institute of Mathematical Sciences (ICMAT), CSIC**.
	• Gained knowledge in recent research on sub-Riemannian geometry, topological Lie groups and Differential geometry.
	• Studied the general properties of SubFinsler and Nilpotent Lie groups and Carnot groups.
2022	Participation in the "Functional analysis and Applications Network conference", "XVII Encuentro de la Red de Análisis Funcional y Aplicaciones" (Topic: Chaos and nonlocal operators), **University of La Laguna**.
	• Study of general properties of chaotic operators on Banach spaces and the proof of results that characterize chaos in the case of fractional differential operators arising in time-stepping schemes.
2018	Participation in the French "Concours général" competition (subjects: physics, chemistry and mathematics).
2017	Participation in the French Mathematical Olympiads.

Technical skills

- Programming languages: **Python**, **MatLab**, **Java**.

- Scientific computing and optimization using MatLab and Python (**NumPy**, **SciPy**, **multiprocessing** code acceleration).

- Experience using High Performance Computing clusters (**Slurm**), such as the **Raven supercomputer** at the Max Planck Computing and Data Facility.

- Data visualization (**Matplotlib**), Bayesian data analysis (**ArviZ**).

- Scientific writing and formatting using Latex and Beamer.

- **Machine Learning** and **Neural Networks** (TensorFlow, PyTorch), architectures (**ConvNet**, **ResNet**,...) and **hyper-parameters optimization** (OPTUNA).

- Statistical analysis, **Bayesian inference** (**PyMC**) and **Bayesian Neural Networks**.

- Signal processing and **Fourier analysis**.

- Analysis of the outputs of state-of-the-art cosmological hydrodynamical simulation codes (**GADGET**, **Nyx**).

- Analysis of quasar (QSOs) spectra (**UVES SQUAD DR1**, **GHOST**).

HONORS & AWARDS

- Extraordinary end of degree award (best academic record of the cohort), Double bachelor's degree in Physics and Mathematics, Complutense University of Madrid.

- 22 university subjects passed with high honours.

- Award to the top 100 grades for the university entrance exam (Complutense University of Madrid) (grade: 13,887/14).

- Awarded the "Excellence-Major" grant by the French Ministry of Foreign Affairs.

- Spanish High School extraordinary award.

- French Baccalaureate passed with high honours "mention très bien" (grade: 19,57/20).

LANGUAGES

Spanish	Mother tongue.
French	Advanced, DALF C1 Diplôme Approfondi De Langue Française.
English	Advanced, Cambridge Certificate in Advanced English, CEFR Level C2.
German	Basic proficiency, A2

PUBLICATIONS

Artola, A., Bosman, S. E. I., Gaikwad, P., Davies, F. B., Nasir, F., Farina, E. P., Protušová, K., Puchwein, E., and Spina, B. (2024). Signatures of warm dark matter in the cosmological density fields extracted using machine learning