Tristan Hoellinger

Master's degree in Mathematics
Ph.D. candidate in Cosmology

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Academic Employment

October 2023 - September 2026 **Ph.D. Candidate**, *Institut d'Astrophysique de Paris (CNRS – Sorbonne Université)*, Paris, France
Topic : Cosmological physics with Euclid cosmic web additional probes.
International collaborations : Aquila Consortium (2023-), Euclid consortium (2023-)
Advisors : Florent Leclercq (CR CNRS/INSU & INS2I) and Guilhem Lavaux (CR CNRS INSU ; HDR).

Academic Service

2023-2024 **Teaching assistant in Mathematics**, *Sorbonne Université*
Distribution theory and Fourier analysis (32 hours), ODEs (18 hours), numerical methods (14 hours).

2023-2024 **Organizer of the Friday's preseminar meetings at IAP**
Weekly informal meeting between PhD students and the invited external seminar speaker at IAP.

2023 **Member of the IAP LOC for the ML-IAP/CCA conference**, *Nov 27th - Dec 1st, 2023*
Conference on Machine Learning in astronomical surveys, IAP, Paris / Flatiron institute, New York.

Languages

French Native Language — German basic notions (A2)
English Fluent - Cambridge Linguaskill Business : C1+ (highest score, 180+/180)

Talks

March 29th 2024 **PhD day**, Institut d'Astrophysique de Paris
Novel methods for implicit likelihood inference in cosmology, *12 minutes talk*.

Feb 28th 2024 **The Elbereth Conference 2024**, *by & for PhD students*, IAP, Paris
Implicit likelihood inference in cosmology while checking for survey systematics, *12 minutes talk*.

Jan 25th 2024 **Euclid France 12th Symposium**, *IP2I*, Lyon
Implicit likelihood inference in cosmology while checking for survey systematics, *12 minutes talk*.

Nov 6th 2023 **Action Dark Energy Colloquium 2023**, *LAPP*, Annecy
Implicit likelihood inference in cosmology while checking for survey systematics, *15 minutes talk*.

Publications

in prep. Implicit likelihood inference in cosmology while efficiently checking for known survey systematics, Hoellinger and Leclercq

2023 Enhancer/gene relationships: need for more reliable genome-wide reference sets, Hoellinger et al., 2023, Front. Bioinform., Insights in Integrative Bioinformatics, PMC9999192

2020 Data-driven simulation for augmented surgery, Mendizabal et al., 2020, Developments and Novel Approaches in Biomechanics and Metamaterials. Springer, hal-02538101

Research Internships

March 2023 - July 2023 **Research Trainee**, *Institut d'Astrophysique de Paris*, Paris
Trainee in the "Large-scale structure and distant Universe" group at IAP. Topic : extension of novel simulation-based inference techniques (SELFI) to extract cosmological information from galaxy surveys. Advisors : Florent Leclercq & Guilhem Lavaux

February 2022 - February 2023 **Master thesis**, *ONERA - The French Aerospace Lab*, Châtillon
Research trainee in the NFLU and MSAT teams. I developed analytically a new arbitrarily high order Vorticity Confinement correction for the direct numerical simulation of Navier-Stokes equations through Discontinuous Galerkine Methods. Simultaneously, I implemented the method in a 3d massively parallel solver of unsteady compressible turbulent flows. Advisors : Jean-Baptiste Chapelier & Lucas Manueco.

September 2020 - January 2022 **Data Scientist / Junior Bioinformatics Scientist**, *Inserm*, Toulouse
In parallel to my Master's degree in Mathematics, I studied statistical learning and heuristic methods to predict enhancer-gene interactions in human genomes based on high-throughput data, towards application to the search of variants involved in haemochromatosis or complex genetic disorders. Advisor : Sarah Djebali.

July 2021 - August 2021 **Research Trainee**, *Centre for Genomic Regulation*, Barcelona
Guigó lab. Automated identification and analysis of genetic variants associated with intron retention estimated from RNA-sequencing in blood cell types from the Blueprint Project. Advisor : Diego Garrido.

July 2020 1 month **Research Trainee**, *Toulouse Mathematics Institute*, Toulouse
Theoretical study of the convergence rate of QND measurements w/ Tristan Benoist & Clément Pellegrini.

April 2020 - June 2020 **Research Trainee**, *IRAP - Institut de recherche en astrophysique et planétologie*, Toulouse
Theoretical study of kinetic scale plasma turbulence in the solar wind. Advisor : Philippe Louarn.

June 2019 - August 2019 **Research Trainee**, *Inria, National Institute for Research in Digital Science and Technology*
I analysed the robustness of a deep learning method for real-time biomechanical simulation, with respect to data sparsity and noises, in the context of intraoperative augmented surgery. Advisor : Andréa Mendizabal.

Education

2023 - 2026 **Ph.D. Candidate**, *Sorbonne Université (Institut d'Astrophysique de Paris)*, Paris, France
Title : Cosmological physics with Euclid cosmic web additional probes.

2020-2022 **M.Sc. in Mathematics & M.Sc. in Hybrid AI**, *INSA Toulouse x N7*, Toulouse
This is a transversal curriculum leading to 2 *Diplômes d'ingénieur* (2 distinct MS degrees from French *grandes écoles*), built around 3 major axes : numerical mathematical modelling, statistical mathematical modelling, hybrid artificial intelligence. Humanities are part of the curriculum. Major scientific topics :

- deterministic and stochastic optimization, variational data assimilation, optimal control theory
- PDEs, finite volumes and galerkine methods, solving large linear systems, signal/image and wavelets
- advanced statistics, reinforcement learning, advanced and physically constrained machine learning

Master thesis : Development of an arbitrarily high order Vorticity Confinement correction for the discretization of Navier-Stokes equation by Discontinuous Galerkine Methods.

2019-2020 **Academic exchange in Physics**, *Paris-Saclay University*, Gif-sur-Yvette
I took a full year off with respect to my education in Mathematics at INSA Toulouse, in order to develop my knowledge of fundamental physics. I was enrolled in the *Magistère de Physique d'Orsay*, where I studied for one successful semester (hamiltonian mechanics, quantum mechanics, introduction to GR, cosmology, statistical physics, mathematics). I completed my academic year with 2 traineeships in theoretical physics.

2016–2019 **B.Sc. in Mathematics**, *INSA Toulouse*, Toulouse
3-year intensive preparatory cycle in fundamental & applied sciences ; very strong emphasis on mathematics. First part of a highly selective 5-year curriculum leading to a *Diplôme d'ingénieur in Mathematics*.

2013–2016 **High school diploma in sciences**, *Lycée Charles-Emile Freppel*, Obernai, France
Public high school. Highest Honors (18.1/20, top 2% countrywide). Major : mathematics.

Miscellaneous

— National scholarship holder during my studies (level 6/7) + national merit-based grant

— Hobbies : photography, sport (running, bouldering, hiking)

Practical skills in Applied Maths & in Computer Science

Generalities Signal/image processing, (variational) data assimilation, (non-)smooth and stochastic optimisation, inverse problems

Modelling & numerical simulation fluid dynamics, particle-mesh methods, finite volumes methods, (discontinuous) galerkin methods, dynamical systems

Statistics & machine learning (non-)parametric tests, stochastic processes and metamodeling, Bayesian methods, machine learning : kernel methods, neural networks (CNNs, recurrent networks, adversarial networks), variational data-assimilation networks, wavelet scattering transforms, reinforcement learning

HPC solving large linear systems, multiprocessing, parallel computing (OpenMP, MPI)

Programming Python, C++, Fortran, Julia, R

Misc Git, SLURM, AWS, Docker

Referees

Upon request.