Andrea Combette

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Education

École Normale Supérieure (ENSL), Lyon — **2024**
M2 Numerical Modelling ; mark: 17/20 — *Lyon, France*

École Normale Supérieure (ENS), Paris — **2023**
M1 ICFP in Physics; mark: 16.04/20 — *Paris, France*

École Normale Supérieure (ENS), Paris — **2022**
B.Sc. Degree in Physics — *Paris, France*

Lycée Joffre, Montpellier — **2020 – 2021**
Classes Préparatoires — *Montpellier, France*

UFR Médecine, Montpellier — **2019**
PACES (common first year of health studies) — *Montpellier, France*

Lycée Joffre, Montpellier — **2018**
High School Degree; mark: 19.63/20, with honors — *Montpellier, France*

Experience

CNRS - ENSL — **Feb 2025 – Now**
Intern — *Lyon, France*
- Inverse problem for ocean dynamics using Machine Learning
- PINNs and SIREN architecture enhancement and study

Swiss Plasma Center - EPFL BibTeX — **Feb 2024 – July 2024**
Intern — *Lausanne, Switzerland*
- Machine Learning Characterization of Plasma Turbulence in the TCV Tokamak, HPC on LEONARDO, and CUWA code
- Co-authored: *Nonlinear effects in Fluctuation SPR* in IOP Journal

IMS - Intégration Matériaux Systèmes — **July 2023**
Intern — *Bordeaux, France*
- SNN networks study and GUI implementation

LKB - LPENS BibTeX — **Sep 2023 – Feb 2024**
Project — *Paris, France*
- NV centers in diamond, practical project
- Characterization of NV center's orientation in diamond

IBENS - ENS Biology Institute — **Sep 2023 – Feb 2024**
Project — *Paris, France*
- Spikesorting pipelines, working on Lussac

IPGG - Institut Pierre-Gilles de Gennes — **May 2023**
Project — *Paris, France*
- Electro-Osmosis Filtration with nano-membrane
- Study of the Hysteresis in the flow

Relevant Courses

Computational Statistical Physics — **2024**
- *Ralf. Evraers*, **ENSL**

Computational Fluid Dynamics — **2024**
- *G. Laibre, E. Levèque, A. Venaille*, **ENSL**

Computational Quantum Many Body — **2024**
- *T.Roscilde, F.Mezzacapo*, **ENSL**

Scientific Software Development — **2024**
- *A.Farnudi, E.Ghobadpour*, **ENSL**

Machine Learning — **2024**
- *N. Pustelnick, J.Tachella*, **ENSL**

Numerical Methods for PDEs — **2023**
- *G.Legendre*, **ENS**

ML preparatory Week — **2023**
- *Zaccharie Ramzi, Hugo Richard*, **PSL**

Technical Skills and Interests

This section is not an evaluation of my skills, but rather a summary of my interests and projects, and how much i have worked on them.

Programming Languages & Tools

Languages

Hobbies & Interests

Personal Projects | Contribution

Computational Statistical Physics Overview | *Python* | BibTeX — **2024**
- Study of Hamiltonian dynamics, Thermostating effect, Finite size effect, thermodynamic integration
- Achievements: Ising model, Lennard-Jones model

Western intensification processes simulations | *Python* | BibTeX — **2024**
- Global view of the Stommel and Munk models; stability analysis of numerical schemes
- Arakawa Jacobian, unstable friction, low and high non-linear regime study

Long time Overturn Study in the second phase of the moon cooling | *Python* | BibTeX — **2024**
- Simulated unstable convection processes identified by L.Collin

- Overturning circulation analysis with thermal profiles and Rayleigh number variation

CGBD contributions | *Pybind11, Python, C++* | **2024**
- Pybind implementation of the Coarse-Grain Bacterial DNA Simulator (CGBD)
- Achievements: Built a Python/C++ library with extended CI, documentation, and tests

Study of Poincaré Waves | *Python* | BIBTEX **2023 – 2024**
- Solving equatorial Shallow Water Equation using Chebyshev Spectral Method
- Achievements: Decomposition into Rossby waves and Kelvin wave modes

Generating Realistic Matter Fields for Cosmological Simulations (ML) | *PyTorch, Globus* | **2023 – 2024**
- CNN and diffusion network models using Quijote and CAMELS datasets
- Achievements: Generating 2D samples of matter fields

Hydrodynamics and Mechanics Simulations | *Comsol, Python* | **2021 – 2022**
- Optimization of Von Karman Street for energy harvesting
- Achievements: Built an optimized generator using induction and Von Karman Streets

SpikeWizard Package | *Python, pip, Sphinx* | **2023 – 2024**
- SciPy pipeline for automated fitting: spikewizard.readthedocs.io
- Achievements: Python package for spikesorting and fitting (plus documentation)

ThemeChanger (in development) | *Python, bs4* | **2023 – 2024**
- K-Neighbors algorithm for color detection and matching
- Achievements: Automated color matching in images and files

VsCode Theme | *Python, VSCode Marketplace* | **2023 – 2024**
- Built 3 themes for VSCode using the ThemeChanger package