

GDR Cophy

Tools Working Group

Activity Report | 2023–2025 & Plans for 2026

AI assisted

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WG Tools: mission & scope

Born in 2016 as part of Action Dark Energy · now an independent GDR Cophy Working Group

Raise awareness of new tools & methodology developed across the French cosmology community — **from large software stacks to Mathematica notebooks, including table top experiments.**

Meetings once a year

Lectures are **recorded** and put on the website
Exercice & notebooks on the indico

DON'T FORGET TO REGISTER YOUR FAVORITE TOOLS HERE (it takes <1min):



cophy-tools.iap.fr

Topics that we covered



Cosmological observables generation

Boltzmann solvers, simulations, forward modeling



Data analysis estimators

Power spectra, higher-order statistics



Inference techniques

MCMC, Machine Learning, minimizers



Generation of validation data

Mock galaxy catalogs, mock CMB maps



Symbolic computation

Cosmological context tools

Three Editions: 2023–2025

2023

June 5th-7th, 2023
IAP, Paris

Three lectures:

- CLASS · MontePython (N. Schöneberg)
- N-body simulations (C. Stahl)

Contributions

2024

November 18th–20th
IAP, Paris

Series of lectures

JAX focused + other frameworks:

- Intro to JAX (J-E Campagne)
- HPC/MultiGPU with JAX (W. Kabalan)
- Differentiable likelihood for CMB (L. Balkenhol)
- Implicit Likelihood for Cosmology w/ LTU-ILI (D. Bartlett)
- Numpyro (H. S. Onfroy)
- Lensing (J. Zehgal)

Contributions

2025

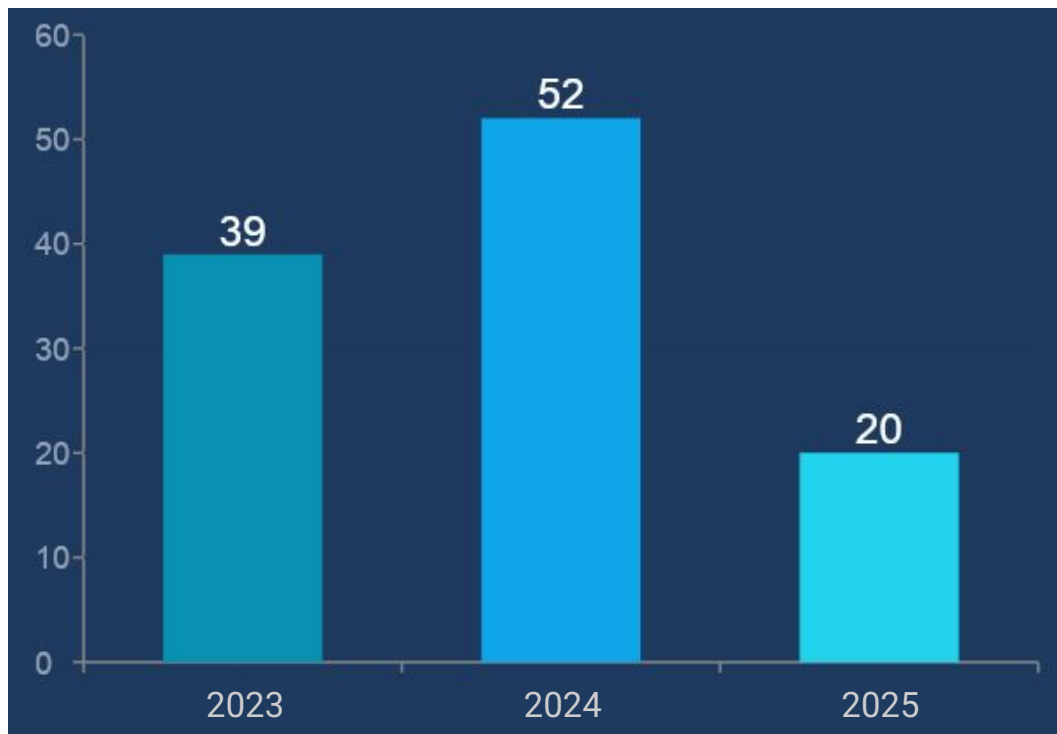
November 3rd–4th
LAM, Marseille

Three big lectures:

- Photo-z (LePhare, M. Treyer, R. Shirley, O. Ilbert)
- Strong lensing
 - Intro (R. Gavazzi)
 - LensTool (M. Limousin)
 - Inversions in Julia (R. Gavazzi)
 - LensTool Python ecosystem (E. Jullo)
- Manticore simulation dataset (G. Lavaux)

Contributions

Attendance: Trends & Context



Paris editions

Higher attendance when held at IAP (Paris hub effect)

2025 dip

Province venue + possible scheduling tensions with Action Dark Energy (same week)+more specific subjects as well

Preparing next edition

Trying to find a free-er slot (without too much overlaps); Will attempt a broad appeal again

What worked well



2023 – Hands-on tutorials

CLASS/MontePython/N-body simulation sessions were highly practical. Recordings posted online. Format well received by researchers.



2024 – JAX & PyTorch in cosmology

Dedicated session on differentiable programming received very positive feedback. Strong attendance (52 participants).



Format – mix of talks + hands-on

The blend of conceptual lectures followed by practical sessions has been the key differentiator of this WG.



Support to community

Free registration (thanks to GDR Cophy) ensures junior community members can participate.

Preparing Edition 2026

When: early December 2026

Where: IAP, Paris

Format: Talks + hands-on sessions

Planned Topics (suggestions most welcome!)



Best practices for LLMs in cosmology

Using large language models as research tools: when, why, and how



GPU computing for simulations

·Dyablo · Shamrock · miniRAMSES -
Radiative transfer with ATON/RAMSES—
hands-on sessions



Statistical methods for CMB

Modern inference techniques for CMB data analysis (used in Planck, SPT, ACT, SO,...)

Summary

- 3 editions (2023–2025) · 111 total registrations · consistent hands-on format
- 2026: IAP Paris · Dec 2026 · LLMs for cosmology, GPU simulations, CMB statistics
- Asks: calendar coordination, maybe public call for idea, engage theorists, experimentalist & observers

Thank you – and see you in December 2026!

