Corentin Cadiou

Assistant professor
Chargé de recherche

cake 16/09/1992

mars Male

globe French

envelope Institut d'Astrophysique de Paris (IAP)
98 bis boulevard Arago
75014 Paris, France

link cphyc.github.io

github github.com/cphyc

orcid 0000-0003- 2285-0332

phone +33 6 43 18 66 83

envelope corentin.cadiou@iap.fr

Science interests

galaxy formation
cosmic web
numerical simulations
cosmology

Languages

French (native)

English (C2)

German (B2)

Spanish & Swedish (A1)

Numerical skills

HPC

RAMSES | MPI | OpenMP | CUDA

Programming

Fortran | C++ | Linux

Research experience

2025–now ***Chargé de recherche* (Assistant Professor)** — IAP, France

2022–25 **Post-doctoral research** — Lund, Sweden
Working on the group of Prof. Agertz on the role of angular momentum in the formation of galactic disks. Start: 01/10/2022, end: 31/01/2025

2019–22 **Post-doctoral research** — UCL, London, UK
With Profs. Pontzen and Peiris, on ERC grant.

2016–19 **Post-graduate research** — IAP, Paris, France
Supervisors: C. Pichon and Y. Dubois.

Education

2019 **PhD in Astrophysics** — Sorbonne & IAP, Paris
"The impact of the large-scale structures of the Universe on dark matter halo and galaxy formation". Refereed by S. White and A. Dekel.

2016 **Master's degree (Master 2) in Astronomy and Astrophysics**
Univ. Paris Diderot, Paris Observatory, Paris, France

2015 Diploma of the École Normale Supérieure (ENS) — ENS, Paris
Major in physics, minor in Computer Sciences

2013 Bachelor's degree, Physics — Univ. Paris Diderot & ENS, Paris

Time allocations

Over my career, I have been **PI or co-I of projects securing 90 MCPU hr** (700,000€, assuming a price of 0.01€/CPU hr). My developments also enabled additional projects for a total of more than 100 MCPU hr.

2024 **(co-I) Harkonnens simulations**
20 MCPU hr allocation (Spanish national call). Suite of high-resolution simulations to support ESA's ARRAKIHS mission to investigate the nature of dark matter.

2024 **(PI) The role of mergers in shaping Milky-Way galaxies**
6 MCPU hr allocation (Swedish national call). Suite of high-resolution simulations focused on the role played by mergers in the formation of our galaxy.

2024 **(PI) How the cosmological environment drives galaxy properties**
3.6 MCPU hr allocation (local call). Suite of simulations to unravel the role played by the cosmological environment in setting the properties of galaxies.

2023–25 **(co-I) MEGATRON project**
Large 50 MCPU hr allocation (UK national call), 15th DiRAC call (PI: H. Katz). Extreme-resolution cosmological simulation focused on circum-galactic physics.

2021–22 **(PI) Angular momentum project**
9.7 MCPU hr allocation (UK national call), 13th DiRAC call. Demonstration of the feasibility of controlling the angular momentum of galaxies in a cosmological volume.

2021–24 EDGE Project ('code builder' status)
Automatically co-author of all publications that use my contributed code. 40 MCPU hr obtained (UK national call, PI: J. Read). Suite state-of-the-art simulations of dwarf galaxies.

2020–21 Obelisk simulation
Radiation-hydrodynamical cosmological simulation following the assembly of a proto-cluster. 50 MCPU hr obtained (Europe wide call, PI: M. Trebitsch).

2018–20 CINES computational time allocation
Co-I of a 2 MCPU hr subproject, 25 MCPU hr obtained (France national call, PI: M. Volonteri). Investigation on the role of cosmological accretion on angular momentum accretion.

Awards and recognitions

2023-24 **eSSENCE grant (100 000 €)** Lund University, Sweden

Research grant for the project: "Galaxy formation in the exascale era".

2023-24 **Fysiografen grant (12 000 €)** Lund University, Sweden

Research grant for the project: "The role of environment in driving galaxy spin".

2018 **NumFOCUS New Contributor Award**

In recognition of my contributions to the Yt project, the most widely-used Python package for analysing simulations.

2016–19 **ILP fellowship** (5000 € per annum)

2012–19 **ENS scholarship & ENS doctoral fellowship**, prestigious full stipends awarded nationwide to 20 fellows.

Responsibilities

— International collaborations & code development for open-science

2023–now **ARRAKIHS mission**

European Space Agency (ESA) space mission to shed light on the nature of dark matter, to be launched in 2030. Co-I of the Simulation Work Package to interpret the data.

2023–now **'Agora' collaboration**

Code comparison project aimed at finding which galaxy properties are robust predictions from the different models.

2022–now **'Ginea' collaboration** France

Collaboration to develop the next-generation cosmological simulation code (Dyablo, to supersede Ramses). Personal contributions include key insight into input/output formats and coupling with post-processing tools.

2019–24 Member of ERC GMGalaxies (2019–2022, PI: Pontzen).

2016–24 Member of ANR Spine (2016–2017, PI: Pichon) and SEGAL (2019-2024, PI: Pichon).

2017–now **Yt team member**, in charge of support of the Ramses code.

Yt is now the most widely used library to analyse astrophysical simulations. Personal contributions include support for the Ramses code, significant I/O performance improvements (× 100 faster for Ramses), community support.

— Community service

2022–now **Member of the EAS Advisory Committee on Sustainability**

The European Astronomical Society (EAS) Sustainability Advisory Committee aims to investigate, communicate, and make recommendations to the Council on sustainability matters related to astronomy and astrophysics.

2020–now **Reviewer for Astronomy and Astrophysics, Monthly Notices of the Royal Astronomical Society, Scipy's conference proceedings**

2016–21 Organizer of IAP pre-seminar and the 'Extragalactic Journal Club' IAP, Paris, France & UCL, London, UK

— Teaching and supervision

2020–24 **Master's student supervisions**

Supervision of 8 Master's students. The work of the students in bold led to a submitted paper: T. Chérel (Lund, Master 2, 25–26); E. Larsson (Lund, Master 2, 24–25); Z. Khurij (Lund, Master 2, 24–25); A. Storck (Lund, Master 2, 23–24); A.-M. Söderman (Lund, Master, 23–24); **Z. Kocjan** (UCL, MSc, 21–23); J. Warbrick (UCL, MSci, 20–21); **E. Pharabod** (Polytechnique, France, Master 2, 20–21).

2016–19 **Teaching Assistant** Sorbonne Université, Paris, France

Courses included: concept and methods of Physics at B.Sc. level (192 hours). Graded all written work, oral and final written exams and assisted with labs.

Outreach activities

2019–now **Outreach presentations in high-schools, museums, for the general public, for open house days.**

2020–22 **Host and co-founder of the "Astronomy on Tap" London satellite**

Fortnightly general public online presentations (online due to the pandemic, more than 4,600 views). Awarded £1,000 by UCL Astronomy department to carry our activities.

2020 Scientific expertise to translate the general public book 'A History of the Universe in 100 stars'.

2019	**Speaker at the "Pint of Science" festival**	Paris, France
2017–19	***Journée de la Science* (Open House days)**	Sorbonne Université, France

Presented activities of the IAP, set up and performed hand-based experiments.

Visiting programs, schools and conferences

k

So far, I have given **10 invited talks at conferences and seminars**, listed below. Poster presentations are highlighted as "newspaper".

— Invited talks

03/2023	⋆ Connecting Galaxies to Cosmology visiting Program	KITP, Santa Barbara, USA
10/2022	⋆ 10th Workshop on Cosmology and Structure Formation	KIAS, Seoul, South Korea
03/2022	⋆ Cosmic Cartography	*online*, Kavli IPMU, Kashiwa, Japan
01/2021	⋆ LCDM: Dark Matter In Cosmology	*online*, Monthly meeting of London-based cosmologists
11/2019	⋆ Yonsei-IAP Workshop	*online*
03/2019	⋆ Yt workshop	University of Illinois, Urbana, USA

— Invited seminars

04/2023	⋆ Kavli Institute for Theoretical Physics blackboard talk	KITP, Santa Barbara, USA

Prestigious talks intended to explain the science of one program to the other KITP program participants, locals, and scientists outside of a specialized field.

02/2022	⋆ Berkeley Cosmology Seminar	*online*, Berkeley, USA
11/2021	⋆ Oxford Cosmology Seminar	Oxford, UK

— Contributed talks

03/2024	Building Galaxies from Scratch	University of Vienna, Austria
01/2024	newspaper D-LOCKS Meeting	Technical University of Denmark, Copenhagen, Denmark
12/2023	New Simulations for New Problems in Galaxy Formation	Institut d'Astrophysique de Paris, France
08/2023	Santa Cruz Galaxy Workshop	University of California Santa Cruz, USA
07/2022	newspaper National Astronomy Meeting (NAM)	Warwick, UK
06/2022	newspaper EAS Meeting	Valencia, Spain
06/2022	Journées du PNCG (cosmology & galaxies)	Observatoire Astronomique de Strasbourg, France
09/2021	Ramses User Meeting	*online*, Strasbourg Observatory, France
07/2021	Scipy 21: data analysis and code development in Python (900 participants)	*online*
12/2020	RHytHM: ResearcH using Yt Highlights Meeting.	*online*
11/2020	KIAS Cosmology Workshop.	*online*
10/2019	KIAS Internal Workshop	KIAS, Seoul, South Korea
09/2018	West Coast Swings workshop	ICRAR, Perth, Australia
05/2018	SPIN(E) ANR Meeting	ROE, Edinburgh, UK
09/2017	SPIN(E) ANR Meeting	Agay, France
09/2017	Ramses User Meeting	Nice Observatory, Nice, France
09/2016	Ramses User Meeting	CRAL, Lyon, France

— Contributed seminars and journal clubs

12/2021	'FLAT' talk	Durham, UK
11/2021	Cosmology Journal Club	IAP, Paris, France
11/2021	Astrophysics Journal Club	Racah Institute of Physics, Jerusalem, Israel
10/2021	Galaxy Coffee	MPIA, Heidelberg, Germany
09/2021	Cambridge Cosmology Seminar	*online*, Institute of Astronomy, Cambridge, UK
12/2018	Journal club & visiting program	Astrophysics Department, Oxford, UK

04/2018	CRAL journal club	CRAL, Lyon, France
10/2017	KIAS journal club	KIAS, Seoul, South Korea
04/2017	CITA Journal Club	CITA, Toronto, Canada

Publication list

I have submitted **13** articles as lead or co-lead author (**11** already published in MNRAS and A&A). I also contributed to **14** other articles. My papers have been cited **652** times (h-index of 14 as of 17th January 2025), source: NASA/ADS.

— Submitted articles

1. "**RAMSES-yOMP: Performance Optimizations for the Astrophysical Hydrodynamic Simulation Code RAMSES**", Han, Dubois, Lee, Kim, **Cadiou** & Yi, *submitted to Monthly Notices of the Royal Astronomical Society*, (2024).
2. "**The Impact of Star Formation and Feedback Recipes on the Stellar Mass and Interstellar Medium of High-Redshift Galaxies**", Katz, Rey, **Cadiou**, Kimm & Agertz, *submitted to Monthly Notices of the Royal Astronomical Society*, (2024).
3. "**The causal effect of cosmic filaments on dark matter halos**", Storck, **Cadiou**, Agertz & Galárraga-Espinosa, *submitted to Monthly Notices of the Royal Astronomical Society*, (2024).
4. "**EDGE-INFERNO: Simulating every observable star in faint dwarf galaxies and their consequences for resolved-star photometric surveys**", Andersson, Rey, Pontzen, **Cadiou**, Agertz, Read & Martin, *submitted to Monthly Notices of the Royal Astronomical Society*, (2024).
5. "**How complex are galaxies? A non-parametric estimation of the intrinsic dimensionality of wide-band photometric data**", **Cadiou**, Laigle & Agertz, *submitted to Monthly Notices of the Royal Astronomical Society*, (2024).

— Published articles

1. "**Running with the bulls: The frequency of star-disc encounters in the Taurus star-forming region**", Winter, Benisty, Shuai, Dûchene, Cuello, Anania, **Cadiou** & Joncour, *in Astronomy and Astrophysics, 691, A43*, (2024).
2. "**The AGORA High-resolution Galaxy Simulations Comparison Project. IV. Halo and Galaxy Mass Assembly in a Cosmological Zoom-in Simulation at z ≤ 2**", Roca-Fàbrega, Kim, Primack, Jung, Genina, Hausammann, Kim, Lupi, Nagamine, Powell, Revaz, Shimizu, Strawn, Velázquez, Abel, Ceverino, Dong, Quinn, Shin, Segovia-Otero, Agertz, Barrow, **Cadiou**, Dekel, Hummels, Oh, Teyssier & AGORA Collaboration, *in The Astrophysical Journal, 968, 2, 125-154*, (2024).
3. "**Probing cosmology via the clustering of critical points**", Shim, Pichon, Pogosyan, Appleby, **Cadiou**, Kim, Kraljic & Park, *in Monthly Notices of the Royal Astronomical Society, 528, 2, 1604-1615*, (2024).
4. "**Hot gas accretion fuels star formation faster than cold accretion in high-redshift galaxies**", Kocjan, **Cadiou**, Agertz & Pontzen, *in Monthly Notices of the Royal Astronomical Society, 534, 1, 918-930*, (2024).
5. "**Estimating major merger rates and spin parameters ab initio via the clustering of critical events**", **Cadiou**, Pichon-Pharabod, Pichon & Pogosyan, *in Monthly Notices of the Royal Astronomical Society, 531, 1, 1385-1398*, (2024).
6. "**Evolution of cosmic filaments in the MTNG simulation**", Galárraga-Espinosa, **Cadiou**, Gouin, White, Springel, Pakmor, Hadzhiyska, Bose, Ferlito, Hernquist, Kannan, Barrera, Maria Delgado & Hernández-Aguayo, *in Astronomy and Astrophysics, 684, A63*, (2024).
7. "**Hot gas accretion fuels star formation faster than cold accretion in high redshift galaxies**", Kocjan, **Cadiou**, Agertz & Pontzen, *in American Astronomical Society Meeting Abstracts, 243, 306.02*, (2024).
8. "**Stellar angular momentum can be controlled from cosmological initial conditions**", **Cadiou**, Pontzen & Peiris, *in Monthly Notices of the Royal Astronomical Society, 517, 3, 3459-3469*, (2022).
9. "**Forecasts for WEAVE-QSO: 3D clustering and connectivity of critical points with Lyman-α tomography**", Kraljic, Laigle, Pichon, Peirani, Codis, Shim, **Cadiou**, Pogosyan, Arnouts, Pieri, Iršič, Morrison, Oñorbe, Pérez-Ràfols & Dalton, *in Monthly Notices of the Royal Astronomical Society, 514, 1, 1359-1386*, (2022).
10. "**Gravitational torques dominate the dynamics of accreted gas at z > 2**", **Cadiou**, Dubois & Pichon, *in Monthly Notices of the Royal Astronomical Society, 514, 4, 5429-5443*, (2022).
11. "**The causal effect of environment on halo mass and concentration**", **Cadiou**, Pontzen, Peiris & Lucie-Smith, *in Monthly Notices of the Royal Astronomical Society, 508, 1, 1189-1195*, (2021).
12. "**Angular momentum evolution can be predicted from cosmological initial conditions**", **Cadiou**, Pontzen & Peiris, *in Monthly Notices of the Royal Astronomical Society, 502, 4, 5480-5487*, (2021).
13. "**The clustering of critical points in the evolving cosmic web**", Shim, Codis, Pichon, Pogosyan & **Cadiou**, *in Monthly Notices of the Royal Astronomical Society, 502, 3, 3885-3911*, (2021).
14. "**EDGE: a new approach to suppressing numerical diffusion in adaptive mesh simulations of galaxy formation**", Pontzen, Rey, **Cadiou**, Agertz, Teyssier, Read & Orkney, *in Monthly Notices of the Royal Astronomical Society, 501, 2, 1755-1766*, (2021).

15. “**Tracing the simulated high-redshift circumgalactic medium with Lyman α emission**”, Mitchell, Blaizot, **Cadiou**, Dubois, Garel & Rosdahl, *in Monthly Notices of the Royal Astronomical Society, 501, 4, 5757-5776*, (2021).
16. “**The OBELISK simulation: Galaxies contribute more than AGN to H I reionization of protoclusters**”, Trebitsch, Dubois, Volonteri, Pfister, **Cadiou**, Katz, Rosdahl, Kimm, Pichon, Beckmann, Devriendt & Slyz, *in Astronomy and Astrophysics, 653, A154*, (2021).
17. “**When do cosmic peaks, filaments, or walls merge? A theory of critical events in a multiscale landscape**”, **Cadiou**, Pichon, Codis, Musso, Pogosyan, Dubois, Cardoso & Prunet, *in Monthly Notices of the Royal Astronomical Society, 496, 4, 4787-4822*, (2020).
18. “**Dense gas formation and destruction in a simulated Perseus-like galaxy cluster with spin-driven black hole feedback**”, Beckmann, Dubois, Guillard, Salome, Olivares, Polles, **Cadiou**, Combes, Hamer, Lehnert & Pineau des Forets, *in Astronomy and Astrophysics, 631, A60*, (2019).
19. “**Accurate tracer particles of baryon dynamics in the adaptive mesh refinement code Ramses**”, **Cadiou**, Dubois & Pichon, *in Astronomy and Astrophysics, 621, A96*, (2019).
20. “**Galaxies flowing in the oriented saddle frame of the cosmic web**”, Kraljic, Pichon, Dubois, Codis, **Cadiou**, Devriendt, Musso, Welker, Arnouts, Hwang, Laigle, Peirani, Slyz, Treyer & Vibert, *in Monthly Notices of the Royal Astronomical Society, 483, 3, 3227-3255*, (2019).
21. “**Galaxy evolution in the metric of the cosmic web**”, Kraljic, Arnouts, Pichon, Laigle, de la Torre, Vibert, **Cadiou**, Dubois, Treyer, Schimd, Codis, de Lapparent, Devriendt, Hwang, Le Borgne, Malavasi, Milliard, Musso, Pogosyan, Alpaslan, Bland-Hawthorn & Wright, *in Monthly Notices of the Royal Astronomical Society, 474, 1, 547-572*, (2018).
22. “**How does the cosmic web impact assembly bias?**”, Musso, **Cadiou**, Pichon, Codis, Kraljic & Dubois, *in Monthly Notices of the Royal Astronomical Society, 476, 4, 4877-4907*, (2018).