Corentin Cadiou

Postdoc

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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

Analysis

YT | PYNBODY | Python

Programming

Fortran | C++ | Linux

Research experience

2022–now **Post-doctoral research** — Lund, Sweden
With Prof. Agertz on the role of angular momentum in the formation of galactic disks.

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 70 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 **(PI) The role of mergers in shaping Milky-Way galaxies** — LUMI
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** — DiRAC
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** — DiRAC
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) — DiRAC
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 — PRACE
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 — CINES
Co-investigator 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 **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 7 Master's students. The work of the students in bold led to a submitted paper: 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.

Publication list

I have published **7** articles as lead or co-lead author in MNRAS and A&A, highlighted below (☆). I also contributed to **10** other articles. My papers have been cited **500** times (h-index of 11 as of 24th January 2024), source: NASA/ADS.

1. "**Evolution of cosmic filaments in the MTNG simulation**", Galárraga-Espinosa, **Cadiou**, Gouin, White, Springel, Pakmor, Hadzhiyska, Bose, Ferlito, Hernquist, Kannan, Barrera, Delgado & Hernández-Aguayo, in press *in Astronomy and Astrophysics, doi: 10.1051/0004-6361/202347982* (2024).
2. "**Probing cosmology via the clustering of critical points**", Shim, Pichon, Pogosyan, Appleby, **Cadiou**, Kim, Kraljic & Park, *in Monthly Notices of the Royal Astronomical Society, doi: 10.1093/mnras/stae151*, (2024).
3. ☆ "**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).
4. "**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).
5. ☆ "**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).
6. ☆ "**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).
7. ☆ "**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).
8. "**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).
9. "**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).
10. "**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).
11. "**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).
12. ☆ "**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).
13. "**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).
14. ☆ "**Accurate tracer particles of baryon dynamics in the adaptive mesh refinement code Ramses**", **Cadiou**, Dubois & Pichon, *in Astronomy and Astrophysics, 621, A96*, (2019).
15. "**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).
16. "**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).
17. ☆ "**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).

Visiting programs, schools and conferences

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

— **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 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 National Astronomy Meeting (NAM) — Warwick, UK

06/2022 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