Thomas COLAS

APC, Université Paris Cité,
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Postdoctoral Researcher in QFT
and Theoretical Cosmology

Research interests: theoretical cosmology, effective field theories, open and non-equilibrium systems and QFT on curved spacetime

INSPIRE *Research Gate* *Website*

Research experience

- October 2023 –: Postdoc at APC (Université Paris Cité)

Supervisor: David Langlois, APC (Université Paris Cité)

- *Field*: non-equilibrium QFT, gravitation and theoretical cosmology
- *Topic*: Schwinger-Keldysh formalism, fluctuating hydrodynamics
- *Skills*: effective field theories and cosmological boostrap; Mathematica

- September 2023 – September 2026: Postdoc at DAMTP (University of Cambridge)

Supervisor: Enrico Pajer, DAMTP (University of Cambridge)

- *Field*: QFT and theoretical cosmology
- *Topic*: Open Effective Field Theories, Quantum information theory
- *Skills*: effective field theories and cosmological boostrap; Mathematica

- September 2020 – August 2023: Ph.D. Student at IAS (Université Paris Saclay)

Supervisors: Julien Grain, IAS (Université Paris Saclay) and Vincent Vennin, APC (Université de Paris)

- *Field*: Primordial cosmology
- *Topic*: Cosmological Open Quantum Systems, Quantum aspects of the early universe
- *Skills*: QFT on curved spacetime and non-equilibrium QFT; Mathematica

Thesis: "*Open Effective Field Theories for primordial cosmology: dissipation, decoherence and late-time resummation of cosmological inhomogeneities*" | *Jury*: *K. Noui, Y. Urakawa, N. Bartolo, C.P. Burgess, C. de Rham, M. Walschaers*

- February – July 2019: Short-Term Scholar at KIPAC (SLAC) and SITP (Stanford University)

Supervisor: Leonardo Senatore, KIPAC (SLAC) and SITP (Stanford University)

- *Field*: Theoretical and observational cosmology
- *Topic*: Effective Field Theory of Large Scale Structures
- *Skills*: cosmological parameters inference from LSS (SDSS/BOSS), multiprocessing for Python

- June 2018: Intern at the LPNHE – CNRS/IN2P3

Supervisor: Jean-Philippe Lenain, LPNHE (Sorbonne Université)

- *Field*: Astroparticle physics
- *Topic*: Gamma-Ray Blazar Spectra using H.E.S.S. II and Fermi
- *Skills*: work with data (H.E.S.S. II/Fermi), C++ programming and CCIN2P3 computing center

- November – December 2016: Employee at the Sociology Department of University of Tasmania

Supervisor: Adrian Franklin, University of South Australia

- *Field*: Science and Technology Studies
- *Topic*: Australian nationalism and the perception of feral species
- *Skills*: Controversy Mapping and Digital Humanities

List of publications

- Physics:

- S. Vareilles**, T. Colas**, J. Grain, F. Piazza, V. Vennin, " Universal CMB Phase Coherence from Single-Field Inflation" – arxiv:2609.03012
- S. Céspedes**, T. Colas**, "Stochastic inflation from a non-equilibrium renormalization group" – arxiv:2605.11096
- S. A. Salcedo**, T. Colas**, P. Suman, B. Zhang, J. Fergusson, E.P.S. Shellard, "Primordial non-Gaussianity constraints on dissipative inflation" – arXiv:2603.13473
- S. A. Salcedo**, T. Colas**, L. Dufner, E. Pajer, "Phenomenology of an Open Effective Field Theory of Dark Energy" – arXiv:2603.12321
- **T. Colas**, Z. Qin, X. Tong, "Open Effective Field Theory and the Physics of Cosmological Collider Signals" – JHEP 08 (2026) 032
- **T. Colas**, "Lectures on Open Effective Field Theories" – *Summer School the Disordered Universe 2025* – arxiv:2510.00140
- M. Piotrak**, T. Colas**, A. Alonso-Serrano, A. Serafini, "Quantum estimation of cosmological parameters" – JHEP 02 (2026) 199
- S. A. Salcedo**, T. Colas**, L. Dufner, E. Pajer, "An Open System Approach to Gravity" – JHEP 02 (2026) 241
- S. A. Salcedo**, T. Colas**, E. Pajer, "An Open Effective Field Theory for light in a medium" – JHEP 03 (2025) 138
- C. P. Burgess**, T. Colas**, R. Holman, G. Kaplanek, "Does decoherence violate decoupling?" – JHEP 02 (2025) 204
- **T. Colas**, J.Grain, G. Kaplanek, V. Vennin, "In-in formalism for the entropy of quantum fields in curved spacetimes" – JCAP 08 (2024) 047
- **T. Colas**, "Open Effective Field Theories for cosmology" – *Proceedings Moriond Cosmology 2024* – arxiv:2405.09639
- S. A. Salcedo**, T. Colas**, E. Pajer, "The Open Effective Field Theory of Inflation" – JHEP 10 (2024) 248
- C. P. Burgess**, T. Colas**, R. Holman, G. Kaplanek, V. Vennin, "Cosmic Purity Lost: Perturbative and Resummed Late-Time Inflationary Decoherence" – JCAP 08 (2024) 042
- **T. Colas**, C. de Rham, G. Kaplanek, "Decoherence out of fire: Purity loss in expanding and contracting universes" – JCAP 05 (2024) 025
- **T. Colas**, J. Grain, V. Vennin, "Quantum recoherence in the early universe" – EPL 142 (2023) 6, 69002
- **T. Colas**, J. Grain, V. Vennin, "Benchmarking the cosmological master equations" – Eur.Phys.J.C 82 (2022) 12, 1085
- **T. Colas**, J. Grain, V. Vennin, "Four-mode squeezed states: two-field quantum systems and the symplectic group Sp(4,R)" – Eur.Phys.J.C 82 (2022) 1, 6
- **T. Colas**, G. D'Amico, L. Senatore, P. Zhang, F. Beutler, "Efficient Cosmological Analysis of the

SDSS/BOSS data from the Effective Field Theory of Large-Scale Structure" – JCAP 06 (2020) 001

*My complete list of publications in physics is available on **my INSPIRE profile**.*

- Science and technology studies:

- A. Franklin, **T. Colas**, Chapter "Feral Tourism" in New Moral Natures in Tourism, Grimwood et al., Routledge Research, 2018

Academic references

- Vincent Vennin (LPENS): vincent.vennin@phys.ens.fr
- Enrico Pajer (DAMTP): enrico.pajer@gmail.com
- Clifford P. Burgess (Perimeter Institute): cburgess@perimeterinstitute.ca
- Claudia de Rham (Imperial College): c.de-rham@imperial.ac.uk

Education

- September 2017 – July 2020: Graduate Program in Theoretical Physics at the International Center for Fundamental Physics, Ecole Normale Supérieure, Paris, France
  - Master of Fundamental Physics obtained with *High Distinctions*

- September 2016 – July 2017: University of Tasmania, Hobart, Australia
  - One-Year Exchange passed with *High Distinctions*

- September 2014 – July 2017: Dual degree in Sciences and Social Sciences at Sciences Po Paris and Université Pierre et Marie Curie (Sorbonne University), Paris, France
  - Bachelor of Physics obtained with *High Distinctions*
  - Bachelor of Social Sciences obtained with *High Distinctions*

Teaching & Supervision

2023 – 2026 period (first postdoc):
- July 2025: Summer School – *the Disordered Universe* – Organizers: P. Benincasa, G. Pimentel
  - Lectures on Open Effective Field Theories: 5 * 1.5 hours lectures + 3 * 2.5 hours tutorials
  - along with: de Sitter physics (D. Anninos), disordered systems (T. Annous), amplitudes (A. McLeod)

- February – March 2025: **Guest Lecturer,** *Field Theory in Cosmology* at DAMTP, University of Cambridge

- 2023 – 2025: **Ph.D. co-supervision** in the context of 5 research projects involving 1st to 4th year Ph.D. students

2020 – 2023 period (Ph.D.):
- September 2020 – July 2022: undergraduate **lectures** and **tutorials** in physics and mathematics, 72h/year
  - Complex analysis, Linear Algebra, Vectorial Analysis
  - Thermodynamics

- Spring 2021: third year **undergraduate supervision** for interns in physics and mathematics, 8 weeks

Concours

- Chargé de Recherche CNRS 2026: Poste 05/02 – **Auditionné**
- Chargé de Recherche CNRS 2025: Poste 02/05, section 02 – **Admissible** – classé second

Academic commitment

- 2023 –: Reviewer for **peer-reviewed journals** in theoretical physics (Physical Review, JCAP, JHEP, General Relativity and Gravitation)

- 2021 – 2023 : **PhD representative** at the Physics Graduate School Council, Université Paris Saclay, France

Public outreach

- 14/01/2025: **Interview** with A. Wilkins for New Scientist — outreach article on quantum decoherence near black holes

- 12/10/2024: Main guest speaker, **podcast** Physics for Students — episode "***What is Quantum Field Theory***"

- 07/07/2023: Soirée Jeunes des 150 ans de la Société Française de Physique – outreach **event** featuring 4 content creators and more than a hundred participants – Sorbonne Université, Paris, France

Outreach material describing my research is available on ***my personal website***

Local Organising Committee

- July 2026 (in prep): Contours 2026 **Conference** – Effective Field Theories Meet the Schwinger–Keldysh Formalism – 50-60 people 5-day international conference bridging cosmology, black holes, holography and hydrodynamics – DAMTP, University of Cambridge, United Kingdom

- 2024 – : Cosmology Lunch **Seminar** series – Weekly event gathering more than 50 people from 3 institutions – DAMTP, University of Cambridge, United Kingdom

- January 2024: International Emerging Action **Workshop**: "Open Quantum Systems for Cosmology" – 30-people 3-day workshop with visitors from France and UK – DAMTP, University of Cambridge, United Kingdom

- May 2023: Seed **Meeting**: "Cosmological Open Quantum Systems" – 15-people 2-day workshop with visitors from France and UK – French Ambassy, London, United Kingdom

Recent conferences and workshops

- September 2026: *Particle Physics in the Early Universe*, Paris, France ***– invited speaker***

- June 2026: *Contours 2026*, Cambridge, UK ***– organizer***

- June 2026: *2026 Peyresq Spacetime Meeting*, Peyresq, France ***– invited speaker***

- April 2026: *Open Quantum Systems: Subatomic to Cosmic Scales*, MITP, Germany ***– invited speaker***

- February 2026: *Early Universe from Home*, online ***– invited speaker***

- December 2025: *Open Quantum Systems: from Quarks to the Cosmos*, Seattle, USA ***– invited speaker***

- December 2025: *Inflation 2025*, Paris, France ***– invited speaker***

- September 2025: *HoloUK,* Bristol, UK ***– invited speaker***

- July 2025: *Cosmology Beyond the Analytic Lamppost (CoBALt)*, Paris, France ***– invited speaker***

- June 2025: *2025 Peyresq Spacetime Meeting*, Peyresq, France ***– invited speaker***

- June 2025: *Gravitational Probes of the Early Universe*, London, UK ***– invited speaker***

- May 2025: *The Dawn of Gravitational Wave Cosmology*, Benasque, Spain ***– invited speaker***

- February 2025: *New Developments in Theoretical Cosmology*, London, UK ***– invited speaker***

- December 2024: *Cosmological Correlators in Taiwan*, Taipei, Taiwan ***– invited speaker***

- October 2024: *COSMO'24*, Kyoto, Japan

- October 2024: *DAMTP-LMU Meeting*, Cambridge, UK ***– invited speaker***

- April 2024: *Moriond Cosmology 2024*, La Thuile, Italy ***– invited speaker***

- September 2023: *Correlators in Cortona*, Cortona, Italy ***– invited speaker***

- May 2023: *Seed Meeting*, London, UK ***– organizer***

Recent invited talks

- October 2026: Theory Division, CERN, Genève, Switzerland

- April 2026: GW seminar, Max Planck Institute for Gravitational Physics (AIE Potsdam), Germany

- March 2026: Theory seminar, APC, Paris

- March 2026: QuRIOS collaboration seminar, Caltech, USA (online)

- March 2026: HEP group seminar, Ghent University, Belgium

- February 2026: Oxford Dalitz Seminar in Fundamental Physics, Oxford, UK

- February 2026: DGRAV seminar, APS seminar series, USA (online)

- February 2026: Padova cosmology journal club, Padova, Italy (online)

- January 2026: Queen Mary University, London, UK

- November 2025: INFN Sezione di Ferrara, Ferrara, Italy

- November 2025: Scuale Normale Superiore, Pisa, Italy

- October 2025: UvA Theoretical Cosmology group, Amsterdam, Netherlands

- October 2025: *Quantum Cosmology seminar series*, USA (online)

- September 2025: EPFL, Lausanne, Switzerland

- September 2025: Theory Division, CERN, Genève, Switzerland

- September 2025: ETH, Zurich, Switzerland

- September 2025: *Action Dark Energy webinar*, France (online)

- June 2025: Padova University, Padova, Italy (online)

- April 2025: Imperial College, London, UK

Languages

- **English**: Professional skills (Live in the UK, IELTS: 7,5 - C1; one year in Australia; six months in the USA)
- **French**: Mother tongue
- **Spanish**: Conversational skills