

#### PH.D IN ASTROPHYSICS AND COSMOLOGY

Institut de recherche en astrophysique et planétologie (IRAP). Toulouse, France
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## Postdoctoral appointments \_\_\_\_\_

#### International School for Advanced Studies (SISSA)

Trieste, Italy Since 2023

RESEARCH FELLOW

• Data analysis for Cosmic Microwave Background studies

## Education \_\_\_\_

Université Paul Sabatier Toulouse, France

#### DOCTOR OF PHILOSOPHY (Ph.D), ASTROPHYSICS AND COSMOLOGY

2020-2023

Mention

- Thesis: Understanding the Galactic polarized signal in the quest for new fundamental physics in the Cosmic Microwave Background
- Supervisors: Dr. J. Aumont and Dr. L. Montier

Université de Lorraine Nancy, France

#### MASTER'S DEGREE, LOGIC, PHILOSOPHY AND HISTORY OF SCIENCES

2021 - present

• Thesis project: Investigating the ontology of classical and quantum gauge theories.

# Université Grenoble-Alpes

Grenoble, France

MAGISTER AND MASTER'S DEGREE, SUBATOMIC PHYSICS AND COSMOLOGY

2018 - 2020

- With high honors (très bien)
- ullet master thesis: Modeling the spectral complexity of CMB Galactic foregrounds in the quest of primordial B-modes (IRAP, Toulouse)
- magister internship: Characterizing the turbulent CO emission of Molecular clouds (IPAG, Grenoble)
- master 1 internship: Astrophysical and local tests of Einstein's equivalence principle and string theory (CAUP, Porto)

#### Université Clermont Auvergne

Clermont-Fd, France

### BACHELOR DEGREE, FUNDAMENTAL PHYSICS

2015 - 2018

- With high honors (très bien)
- Internship: spin chains and quantum algebra: Introduction to coordinate and algebraic Bethe Ansatz, to solve the Heisenberg XXX and XXZ Hamiltonians (LAPTh, Annecy)

### Publications \_\_\_\_

- 1. N. Schöneberg, **L. Vacher**, J. D. F. Dias, M. M. C. D. Carvalho, C. J. A. P. Martins. 2023. News from the Swampland Constraining string theory with astrophysics and cosmology. Submitted to JCAP. Preprint available at arXiv:2307.15060.
- 2. U. Fuskeland et al. (including **L. Vacher**). 2023. Tensor-to-scalar ratio forecasts for extended LiteBIRD frequency configurations. Submitted to A&A. Preprint available at arXiv:2302.05228.
- 3. **L. Vacher**, N. Schöneberg, J. F. Dias, C. J. A. P. Martins, F. Pimenta. 2023. Runaway dilaton models: improved constraints from the full cosmological evolution. Submitted to Phys.Rev. D. Preprint available at arXiv:2301.13500.
- 4. The LiteBIRD collaboration (including **L. Vacher**). Sensitivity Modeling for LiteBIRD. 2022. Journal of Low Temperature Physics.
- 5. **L. Vacher**, J. Aumont, F. Boulanger, L. Montier, V. Guillet, A. Ritacco, J. Chluba. 2022. Frequency dependence of the thermal dust E/B ratio and EB correlation: insights from the spin-moment expansion. Submitted to A&A. Preprint available at arXiv:2210.14768.

- 6. **L. Vacher**, J. F. Dias, N. Schöneberg, C. J. A. P. Martins, S. Vinzl, S. Nesseris, G. Cañas-Herrera, M. Martinelli. 2022. Constraints on extended Bekenstein models from cosmological, astrophysical, and local data. Phys.Rev. D 106,083522. Preprint available at arXiv:2207.03258.
- 7. The LiteBIRD collaboration (including **L. Vacher**). 2022. Optical Characterization of OMT-Coupled TES Bolometers for LiteBIRD. Journal of Low Temperature Physics.
- 8. B. Régaldo-Saint Blancard, E. Allys, C. Auclair, F. Boulanger, M. Eickenberg, F. Levrier, **L. Vacher**, S. Zhang. 2022. Generative Models of Multi-channel Data from a Single Example Application to Dust Emission. ApJ:10.3847/1538-4357/aca538. Preprint available at arXiv:2208.03538.
- 9. A. Ritacco, F. Boulanger, V. Guillet, J.M. Delouis, J.L. Puget, J. Aumont, **L. Vacher**. 2022. Dust polarization spectral dependence from Planck HFI data. Turning point on CMB polarization foregrounds modelling. A&A:10.1051/0004-6361/202244269. Preprint available at arXiv:2206.07671.
- 10. **L. Vacher**, J. Chluba, J. Aumont, A. Rotti, L. Montier. 2022. High precision modeling of polarized signals: Moment expansion method generalized to spin-2 fields. A&A: 10.1051/0004-6361/202243913. Preprint available at arXiv:2205.01049.
- 11. The LiteBIRD collaboration (including **L. Vacher**). 2022. Probing Cosmic Inflation with the LiteBIRD Cosmic Microwave Background Polarization Survey. Submitted to PTEP. Preprint available at arXiv:2202.02773.
- 12. **L. Vacher**, J. Aumont, L. Montier, S. Azzoni, F. Boulanger, M. Remazeilles (for the LiteBIRD collaboration). 2022. Moment expansion of polarized dust SED: a new path towards capturing the CMB *B*-modes with LiteBIRD. A&A: 10.1051/0004-6361/202142664. Preprint available at arXiv:2111.07742.
- 13. P. Vielva et al. (including **L. Vacher**). 2022. Polarization angle requirements for CMB B-mode experiments. Application to the LiteBIRD satellite. JCAP 2022(04):029. Preprint available at arXiv:2202.01324.
- 14. N. Krachmalnicoff et al. (including **L. Vacher**). 2022. In-flight polarization angle calibration for LiteBIRD: blind challenge and cosmological implications. JCAP 2022(01):039. Preprint available at arXiv:2111.09140.
- 15. C.J.A.P. Martins and **L. Vacher**. 2019. Astrophysical and local constraints on string theory: runaway dilaton models. Phys.Rev. D 100, 123514. Preprint available at arXiv:1911.10821.

# Presentations, conferences and summer schools \_\_\_\_\_

- 1. Talk. 2023. From the Galaxy to the Big-Bang. Banyuls, France.
- 2. Talk and Organization Comitee (LOC). 2023. Ibericos. Ponte de Lima, Portugal.
- 3. Talk. 2022. Galactic science and CMB foregrounds Workshop. Tenerife, Spain.
- 4. Talk and Organization comitee (LOC), 2022. LiteBIRD F2F meeting, Okayama University, Japan.
- 5. Talk. 2022. CMB france #4. IAP, France.
- 6. Talk. 2022. Pan-Experiment Galactic Science Group. Online.
- 7. Talk. 2022. Cosmology session of the 56th Rencontres de Moriond. La Thuile, Italy. Proceedings: arXiv:2203.07246.
- 8. Talk. 2022. PHD Day. IRAP, France. First prize for best oral presentation.
- 9. Talk. 2022. CMB France #3. IAP, France.
- 10. Talk. 2021. IJUP, Universidade do Porto, Portugal. Best oral communication in "Maths, Physics & Astronomy".
- 11. Summer School. 2021 and 2022. Euclid Summer School, France.
- 12. Summer School. 2021. "Fundamental cosmology from the ELT and space". Angra do Heroísmo, Açores, Portugal.
- 13. Talk. 2021. CMB france #2. IAP, France.
- 14. Talk. 2021. Ibericos. Universidade de Coimbra, Portugal.
- 15. Talk. 2021. Theory of Gravitation and Variation in Cosmology. CIRM, Marseille, France.
- 16. Talk. Cosmo21. University of Illinois, USA.
- 17. Talk. 2021. PHD Day. IRAP, France. Second prize for best oral presentation.
- 18. Poster. 2021. Fall LiteBIRD S2S meeting. Online.
- 19. Talk. 2020. CMB france #1. IAP, France.
- 20. Organization comitee (LOC). 2019. IAU Symposium #352. IAU Symposium. Viana do Castelo, Portugal.

## Academic teaching\_ Jury member for the DU: "parcours spéciaux", Jury (4 h). Université Paul Sabatier. 2023 2023 Fluid mechanics (L2/L3), Tutorials (14 h). Université Paul Sabatier. 2023 **Geometrical optics (L1)**, Tutorials (18 h). Université Paul Sabatier. 2022 Astrophysics (L3), Tutorials (12 h). Université Paul Sabatier. Thermodynamics (L2), Tutorials (45h). Université Paul Sabatier. 2021, 2022 2021 Point Mechanics (L1), Tutorials (15h). Université Paul Sabatier. 2021 **Light** & colors (L1), Tutorials (18h). Université Paul Sabatier. 2021, 2022 Mechanics & Electrokinetics (L1), Lab (40h). Université Paul Sabatier. Student advising \_\_\_\_\_ 2022-2023 J. Delhomelle, undergraduate (L2), Université Paul Sabatier. 6 months. 2020-2021 S. Vinzl, undergraduate (L2), Université Paul Sabatier. 7 months. 2021-2022 N. Gentil, undergraduate (L2), Université Paul Sabatier. 7 months. Collaborations \_\_\_\_\_ LiteBIRD collaboration. Active member of systematics and foregrounds joint study groups and Galactic project study **Euclid consortium.** Active member of work package #10 of the theoretical cosmology working group. Grants and project fundings \_\_\_\_\_ 2022 H2020-RISE Grant. P.I.: G. Patanchon., Funding for a 1 month travel grant to Okayama University, Japan 2021 FCT-Grant: #2022.04048.PTDC. "Phi from the Sky". Pl: C.J.A.P. Martins., Universidade do Porto, Portugal 2020-2023 National PHD Grant - SDU2E, Université Paul Sabatier Outreach and services \_\_\_\_\_ NON ACADEMIC TEACHING ACTIVITIES PLANCKS21, Marker for the international competition, cosmology session. Porto 2016-2018 **Insignis**, Weekly group lessons of mathematics from secondary to high school. Clermont-Fd High-school interventions, Introducing the challenges of modern physics in classes of 2016-2021 Clermont-Fd philosophy. 2016-2021 **Primary school interventions.**, Introduction to astronomy. Lyon **ASSOCIATIVE ACTIVITIES** 2020-2022 Les étoiles brillent pour tous, Public science outreach (hospitals, prisons ...). Toulouse **UniverSciel**, Animations related to astronomy in schools. Toulouse 2020-2023 2020-2023 **UPS in space**, Astronomical observations and public talks. Toulouse 2018 Le campus des étoiles, Public astronomical observations, science outreach. Clermont-Fd

## Yolonomy, Co-Founder of the website. Teaching and outreach in physics. 2021-today Exploreur, Web article: LiteBIRD en quête des premières fractions de secondes de 2021

Pulsar #41, Book review. « A General Relativity Workbook by Thomas A. Moore». 2021

WRITINGS