

Léo Vacher

PH.D STUDENT IN ASTROPHYSICS AND COSMOLOGY

Institut de recherche en astrophysique et planétologie (IRAP). Toulouse, France

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Education

Université Paul Sabatier

Toulouse, France

DOCTOR OF PHILOSOPHY (PH.D), ASTROPHYSICS AND COSMOLOGY

2020 - present

- 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: Investigating the ontology of Gauge theories and the gauge interpretations of gravity

Université Grenoble-Alpes

Grenoble, France

MAGISTER AND MASTER'S DEGREE, SUBATOMIC PHYSICS AND COSMOLOGY

2018 - 2020

- With high honors

Université Clermont Auvergne

Clermont-Fd, France

BACHELOR DEGREE, FUNDAMENTAL PHYSICS

2015 - 2018

- With high honors

Publications

1. **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](https://arxiv.org/abs/2210.14768).
2. **L. Vacher**, J. F. Dias, N. Schöneberg, C. J. A. P. Martins, S. Vinz, 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](https://arxiv.org/abs/2207.03258).
3. The LiteBIRD collaboration. 2022. Optical Characterization of OMT-Coupled TES Bolometers for LiteBIRD. Journal of Low Temperature Physics.
4. 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. Submitted to ApJ. Preprint available at [arXiv:2208.03538](https://arxiv.org/abs/2208.03538).
5. 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. Submitted to A&A. Preprint available at [arXiv:2206.07671](https://arxiv.org/abs/2206.07671).
6. **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](https://arxiv.org/abs/2205.01049).
7. The LiteBIRD collaboration. 2022. Probing Cosmic Inflation with the LiteBIRD Cosmic Microwave Background Polarization Survey. Submitted to PTEP. Preprint available at [arXiv:2202.02773](https://arxiv.org/abs/2202.02773).
8. **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](https://arxiv.org/abs/2111.07742).
9. P. Vielva et al. 2022. Polarization angle requirements for CMB B-mode experiments. Application to the LiteBIRD satellite. JCAP 2022(04):029. Preprint available at [arXiv:2202.01324](https://arxiv.org/abs/2202.01324).
10. N. Krachmalnicoff et al. 2022. In-flight polarization angle calibration for LiteBIRD: blind challenge and cosmological implications. JCAP 2022(01):039. Preprint available at [arXiv:2111.09140](https://arxiv.org/abs/2111.09140).

11. 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](https://arxiv.org/abs/1911.10821).

Presentations, conferences and graduate schools

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

Academic teaching

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| 2023 | Fluid mechanics (L3) , Teaching Assistant (14 h). Université Paul Sabatier. |
| 2022 | Astrophysics (L3) , Teaching Assistant (12 h). Université Paul Sabatier. |
| 2021, 2022 | Thermodynamics (L2) , Teaching Assistant (45h). Université Paul Sabatier. |
| 2021 | Point Mechanics (L1) , Teaching Assistant (15h). Université Paul Sabatier. |
| 2021 | Light & colors (L1) , Teaching Assistant (18h). Université Paul Sabatier. |
| 2021, 2022 | Mechanics & Electrokinetics (L1) , Lab Assistant (40h). Université Paul Sabatier. |

Student advising

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| 2022-2023 | J. Delhomelle , L2, Université Paul Sabatier. 2 months. |
| 2020-2021 | S. Vinzl , L2, Université Paul Sabatier. 7 months. |
| 2021-2022 | N. Gentil , L2, Université Paul Sabatier. 7 months. |

Collaborations

LiteBIRD collaboration. Active member of systematics and foregrounds joint study groups and Galactic project study group.

Euclid consortium. Active member of work package #10 of the theoretical cosmology working group.

Grants and project fundings

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| 2022 | H2020-RISE Grant. P.I.: G. Patanchon. , 1 month Travel Grant to Okayama University, Japan |
| 2021 | FCT-Grant: #2022.04048.PTDC. "Phi from the Sky". PI: 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

2021	PLANCKS21 , Marker for the international competition, cosmology session.	<i>Porto</i>
2016-2018	Insignis , Weekly group lessons of mathematics from secondary to high school.	<i>Clermont-Fd</i>
2016-2021	High-school interventions , Discussion in class of philosophy about modern physics.	<i>Clermont-Fd</i>
2016-2021	Primary school interventions. , Introduction to astronomy.	<i>Lyon</i>

ASSOCIATIVE ACTIVITIES

2020-2022	Les étoiles brillent pour tous , Public science outreach (hospitals, prisons ...).	<i>Toulouse</i>
2020-2023	UniverSciel , Animations related to astronomy in schools.	<i>Toulouse</i>
2020-2023	UPS in space , Astronomical observations and public talks.	<i>Toulouse</i>
2018	Le campus des étoiles , Public astronomical observations, science outreach.	<i>Clermont-Fd</i>

WRITINGS

2021-today	Yolonomy , Co-Founder of the website. Teaching and outreach in physics.
2021	Exploreur , Web article: LiteBIRD en quête des premières fractions de secondes de l'Univers.
2021	Pulsar #41 , Book review. « A General Relativity Workbook by Thomas A. Moore ».