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.

2. **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.

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.

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.

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.

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.

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.

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.

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.

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.

Presentations, conferences and graduate schools

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

Academic teaching

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

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

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". 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.	*Porto*
2016-2018	**Insignis**, Weekly group lessons of mathematics from secondary to high school.	*Clermont-Fd*
2016-2021	**High-school interventions**, Discussion in class of philosophy about modern physics.	*Clermont-Fd*
2016-2021	**Primary school interventions.**, Introduction to astronomy.	*Lyon*

Associative activities

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

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».