Léo Vacher

PHD Student in cosmology

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About me

After a master's degree in particle physics and cosmology at the University Grenoble-Alpes, I am currently a PHD student at the Institut de recherche en astrophysique et planétologie (IRAP) in Toulouse since 2020.

My research interests are centered on observational cosmology, gravitation theory and galactic astrophysics. In this framework, I am an active member of the $LiteBIRD$ and the $Euclid$ collaborations.

Research interests

Cosmology, astrophysics, cosmic microwave background, foregrounds, LiteBIRD, interstellar medium, observational probes of inflation , fundamental constants stability, tests of the Einstein's equivalence principle and foundations of general relativity and gauge theories.

Education

since 2020	Ph.D. candidate in Cosmology and Astrophysics *Ongoing*	Toulouse
since 2021	M.Sc. Logic, Philosophy and History of sciences *Ongoing*	Université de Lorraine
2018-2020	M.Sc. Subatomic Physics and Cosmology *With high honors, second*	Université Grenoble-Alpes
2018-2020	Magisterium of fundamental physics *With high honors, valedictorian*	Université Grenoble-Alpes
2015-2018	B.Sc. Fundamental Physics *With high honors, valedictorian*	Université Clermont-Auvergne

Publications with major contributions

2022 — Generative Models of Multi-channel Data from a Single Example – Application to Dust Emission
Bruno Régaldo-Saint Blancard, Erwan Allys, Constant Auclair, François Boulanger, Michael Eickenberg, François Levrier, Léo Vacher, Sixin Zhang
arXiv:2208.03538

2022 — Constraints on extended Bekenstein models from cosmological, astrophysical, and local data
Léo Vacher, João F. Dias, Nils Schöneberg, C. J. A. P. Martins, Samy Vinzl, Savvas Nesseris, Guadalupe Cañas-Herrera, Matteo Martinelli
arXiv:2207.03258

2022 — Dust polarization spectral dependence from Planck HFI data. Turning point on CMB polarization foregrounds modelling
Alessia Ritacco, François Boulanger, Vincent Guillet, Jean-Marc Delouis, Jean-Loup Puget, Jonathan Aumont, Léo Vacher
arXiv:2206.07671

2022 — High precision modeling of polarized signals: moment expansion method generalized to spin-2 fields
L. Vacher, J. Chluba, J. Aumont, A. Rotti, L. Montier.
arXiv:2205.01049

2022 — Probing Cosmic Inflation with the $LiteBIRD$ Cosmic Microwave Background Polarization Survey
$LiteBIRD$ collaboration.
arXiv:2202.02773

2022 — Moment expansion of polarized dust SED: a new path towards capturing the CMB B-modes with $LiteBIRD$
L. Vacher, J. Aumont, L. Montier, S. Azzoni, F. Boulanger,M. Remazeilles (for the $LiteBIRD$ collaboration)
arXiv:2111.07742 A&A 10.1051/0004-6361/202142664

2019 — Astrophysical and local constraints on string theory: runaway dilaton models
C.J.A.P. Martins, L. Vacher
arXiv:1911.10821 Phys.Rev. D 100, 123514 -2019

Languages

German

Portuguese

English

French

References

- J. Aumont (IRAP)
- L. Montier (IRAP)
- F. Boulanger (LPENS)
- C.J.A.P. Martins (CAUP)

Toolbox

- Coding languages: Python, C.
- Data analysis: emcee, MontePython, Cobaya, getdist, scipy, mpfit, lmfit
- Cosmological analysis: CLASS, Pymaster, X-Pol, CAMB
- Instrumental/foreground analysis: healpy, toast, litebird-sim, fgbuster, Pysm2 and Pysm3
- Symbolic calculations: mathematica, sympy
- Redacting: LateX, Office

Teaching

2020-2023 PHD Teaching assistant — Université Paul Sabatier

- Tutorials and problem solving:
  - Thermodynamics (L2): 45 hours
  - Astrophysics (L3): 12 hours
  - Newtonian point mechanics (L1): 15 hours
- Labs:
  - Mechanics (L1): 21 hours
  - Electrocinetics (L1): 18 hours
- Student projects:
  - Interviews for professional project module (L2)
  - Light and colors (L1): 18 hours (Supervision and evaluation of interdisciplinary student projects)

2020-2023 Internship supervisions — Université Paul Sabatier

- N. Gentil (L2 - 7 months) - Far Side Lobes asymmetries.
- S. Vinzl (L2 - 7 months) - Extended Bekenstein model

since 2022 Author for the website Yolonomy
Teaching and outreach in physics

2021 Marker for the PLANCKS-2021 event, cosmology session — Porto
International competition for bachelor and masters students

2017-2018 Employee of the «Insignis» association — Clermont-Ferrand
Weekly or holiday lessons of mathematics with classes of six students secondary to high school

2016-2021 Yearly interventions in high-school — Clermont-Ferrand
Discussion in class of philosophy about research in modern physics

Outreach and associative activities

2021 Writing article for the web-journal «explorer»:
«$LiteBIRD$ en quête des premières fractions de secondes de l'Univers.»
Scientific journalism

2021 Writing short article for the web-journal «pulsar #41»:
« A General Relativity Workbook by Thomas A. Moore»
Academic book review

2021 Writing article for the web-journal «explorer»:
«$LiteBIRD$ en quête des premières fractions de secondes de l'Univers.»
Scientific journalism

2021-2023 Animator for the association «UPS in space» — Toulouse
active member: Astronomical observations and public talks

2021-2023 Animator for the association «UniverSciel» — Toulouse
animations related to astronomy in schools and astronomical observations events

2021-2022 Animator for the association «les étoiles brillent pour tous» — Toulouse
Science outreach in public places having difficult access to education (hospitals, penitentiary structures . . .).

2019 Interventions in primary school: "questions and answers about the Universe" — Lyon
Ecole primaire Jules Verne Caluire et Cuire

2018 Animator for the astronomy association «campus des étoiles» Clermont-Ferrand
Leading of public astronomical observations, science outreach.