

Clara Vergès

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Research interests

I am a cosmologist working at the interface between instrumentation and data analysis. I work on the search for the primordial B-modes signal in CMB polarisation, a smoking gun for cosmic inflation. My focus is on calibration and systematics in the context of analysis of multi-frequency, multi-component data sets. I have 5+ years of experience working on CMB experiments, from receiver characterisation to low- and high-level data analysis and simulations of instrumental systematic effects.

Education & Academic appointments

Current position.....

Center for Astrophysics | Harvard & Smithsonian **2020 – present**
Harvard Postdoctoral Fellow

Education.....

Université Paris Cité **2017 – 2020**
PhD in Cosmology

Dissertation: *Searching for cosmological B-modes in the presence of astrophysical contaminants and instrumental effects*, with Radek Stompor and Josquin Errard at AstroParticle and Cosmology laboratory

ISAE-Supaéro & Université Paul Sabatier **2016 – 2017**
M.S. – Double degree in Astrophysics and Aerospace Engineering

Master thesis: *Novel readout electronics for CMB experiments*, with Matt Dobbs at McGill University

École polytechnique **2013 – 2016**
B.S.(Physics) & M.S. (Astrophysics)

Senior thesis: *Looking for SZ effect in ALMA data*, with Paola Andreani at European Southern Observatory

Lycée Henri IV **2011 – 2013**
B.S. (years 1 & 2) – Mathematics, Physics & Chemistry

Two-year intensive preparation for national competitive entrance exams to French top engineering schools

Professional service

Collaboration membership.....

CMB-Stage 4 **2021 – present**
Small Aperture Telescopes (SATs) and Systematics working groups

BICEP/Keck **2020 – present**
Calibration & Systematics lead

POLARBEAR/Simons Array, Simons Observatory **2017 – 2020**
Low-ell BB and Systematics working groups

Leadership & Representation	
Harvard CMB group meeting	2021 – present
<i>Organisation of weekly meetings with local and invited speakers</i>	
La Sphinx	2017 – present
<i>École polytechnique alumni group with a focus on social and environmental issues</i>	
Université Paris Cité – Physics Department Board	2018 – 2020
<i>Student elected representative</i>	
APC Laboratory – Cosmology Journal Club	2018 – 2020
<i>Organisation of bi-weekly meetings</i>	

Mentoring, Teaching & Outreach

Mentoring

- Annie Polish, graduate student (Harvard University), 2022 – present
- Brodi Elwood, graduate student (Harvard University), 2022 – present
- Will Golay, NSF REU intern (University of Iowa), 2022 – present
- Christos Giannakopoulos, PhD candidate (University of Cincinnati), 2021 – present
- James Cornelison, PhD candidate (Harvard University), 2020 – present
- Maroua Benhatchi, junior thesis student (Université Paris Cité), 2019

Teaching

- Qualification for holding entry-level professor positions in France issued by the French Ministry of Higher Education and Research (*Qualification aux fonctions de Maître de Conférence*), based on teaching record and teaching statement, issued 2021
- Physics for pre-med students, Université Paris Cité, 2019
- Computer Science 101, Université Paris Cité, 2019
- Private tutor for high-school students from underprivileged background, 2015 – 2020

Outreach

- CMB-Stage 4 Saturday Space Science Series, 2022
- Skype a Scientist, 2022
- An Evening in Science, Loomis Chaffee School, 2022
- Physics content editor for *Fête le Savoir!* (science outreach for all ages), 2017 – present
- Camp counsellor for *Universciel* (astronomy outreach for children), 2018 – 2020
- Board member of *SpaceUp France*, 2016 – 2018
- Building a portable cloud chamber for science fairs, École polytechnique, 2014 – 2015

Talks

Invited talks & Seminars

- *Cosmology Talks Mini-workshop on parity violation* – Guest expert, online, November 2022
- *Beam calibration and systematics: from BICEP/Keck to future CMB experiments* – Kavli IPMU, July 2022

- *Updated Constraints on Primordial Gravitational Waves using Planck, WMAP, and BICEP/Keck Observations through the 2018 Observing Season* – Center for Astrophysics, April 2022
- *New Constraints on Primordial Gravitational Waves using Planck, WMAP, and BICEP/Keck Observations through the 2018 Observing Season* – CMB France Workshop, Institut d'Astrophysique de Paris, November 2021
- *Impact of instrumental systematic effects on component separation and large scale B-modes measurements* – CMB Calibration and systematics focus workshop, Kavli IPMU, December 2020
- *A framework for performance forecasting of the parametric component separation in the presence of systematic effects* – LiteBIRD France Day, June 2020
- *Probing Universe's first light: Looking for inflation with the new generation of CMB polarisation experiments* – ESO, June 2020

Contributed talks.....

- *Beam calibration campaign requirements to control temperature-to-polarisation leakage for CMB-Stage 4* – From Planck to the future of the CMB, INFN Ferrara, May 2022
- *A framework for performance forecasting of the parametric component separation in the presence of systematic effects* – B-modes from Space workshop, MPA, December 2019
- *Instrumental systematic effects for the new generation of CMB polarisation experiments* – Young French Physicists annual meeting, organised by the French Physics Society (SFP), Collège de France, November 2018

Posters.....

- *New Algorithms for Characterizing the Beams of Next-Generation CMB Experiments* (with Will Golay) – AAS Winter Meeting, January 2023 (submitted)
- *Control of beam systematics and temperature-to-polarisation leakage: From BICEP/Keck demonstrated performance to forecasts for CMB-S4* – Rencontres de Moriond, January 2022
- *Latest results, current data-analysis and upcoming upgrades of the POLARBEAR experiment* – CosmoGold IAP 2019 : The golden age of cosmology from Planck to Euclid, June 2019

Selected publications

- [1] J. Cornelson, C. Vergès, and the BICEP/Keck collaboration. “Improved polarization calibration of the BICEP3 CMB polarimeter at the South Pole”. In: *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XI*. Vol. 12190. SPIE, 2022, p. 121901X. DOI: [10.1117/12.2620212](https://doi.org/10.1117/12.2620212). URL: <https://doi.org/10.1117/12.2620212>.
- [2] The BICEP/Keck Collaboration. “Improved Constraints on Primordial Gravitational Waves using Planck, WMAP, and BICEP/Keck Observations through the 2018 Observing Season”. In: *Phys. Rev. Letters* 127.15, 151301 (Oct. 2021), p. 151301. DOI: [10.1103/PhysRevLett.127.151301](https://doi.org/10.1103/PhysRevLett.127.151301). arXiv: [2110.00483](https://arxiv.org/abs/2110.00483) [astro-ph.CO].
- [3] C. Vergès, J. Errard, and R. Stompor. “Framework for analysis of next generation, polarized CMB data sets in the presence of Galactic foregrounds and systematic effects”. In: *Phys. Rev. D* 103 (6 Mar. 2021), p. 063507. DOI: [10.1103/PhysRevD.103.063507](https://doi.org/10.1103/PhysRevD.103.063507). URL: <https://link.aps.org/doi/10.1103/PhysRevD.103.063507>.
- [4] M. H. Abitbol ... C. Vergès et al. “The Simons Observatory: gain, bandpass and polarization-angle calibration requirements for B-mode searches”. In: *Journal of Cosmology and Astroparticle Physics* 2021.05 (May 2021), p. 032. DOI: [10.1088/1475-7516/2021/05/032](https://doi.org/10.1088/1475-7516/2021/05/032). URL: <https://doi.org/10.1088/1475-7516/2021/05/032>.

- [5] M. Rouble, ..., and C. Vergès. “Transformer-Coupled TES Frequency Domain Readout Prototype”. In: *Journal of Low Temperature Physics* 199.3-4 (Feb. 2020), pp. 780–788. DOI: [10.1007/s10909-020-02376-8](https://doi.org/10.1007/s10909-020-02376-8).

Complete list appended

References

John M. Kovac

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Additional references available upon request

Publication list

Clara Vergès

Publications in reverse chronological order – See also [arXiv](#) - [ADS](#) - [Google Scholar](#) - [ORCID](#)

- [1] BICEP/Keck Collaboration et al. “BICEP / Keck XVII: Line of Sight Distortion Analysis: Estimates of Gravitational Lensing, Anisotropic Cosmic Birefringence, Patchy Reionization, and Systematic Errors”. In: *arXiv e-prints*, arXiv:2210.08038 (Oct. 2022), arXiv:2210.08038. arXiv: [2210.08038](#) [[astro-ph.CO](#)].
- [2] BICEP/Keck Collaboration et al. “BICEP / Keck XVI: Characterizing Dust Polarization Through Correlations with Neutral Hydrogen”. In: *arXiv e-prints*, arXiv:2210.05684 (Oct. 2022), arXiv:2210.05684. arXiv: [2210.05684](#) [[astro-ph.GA](#)].
- [3] J. Cornelson et al. “Improved polarization calibration of the BICEP3 CMB polarimeter at the South Pole”. In: *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XI*. Vol. 12190. Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series. Aug. 2022, p. 121901X. DOI: [10.1117/12.2620212](#). arXiv: [2207.14796](#) [[astro-ph.IM](#)].
- [4] D. C. Goldfinger et al. “Thermal testing for cryogenic CMB instrument optical design”. In: *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XI*. Vol. 12190. Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series. Aug. 2022, p. 121901V. DOI: [10.1117/12.2629490](#). arXiv: [2208.02755](#) [[astro-ph.IM](#)].
- [5] A. Soliman et al. “2022 upgrade and improved low frequency camera sensitivity for CMB observation at the South Pole”. In: *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XI*. Vol. 12190. Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series. Aug. 2022, p. 1219014. DOI: [10.1117/12.2628058](#). arXiv: [2208.01080](#) [[astro-ph.IM](#)].
- [6] BICEP/Keck Collaboration et al. “BICEP/Keck XV: The BICEP3 Cosmic Microwave Background Polarimeter and the First Three-year Data Set”. In: *Astrophysical Journal* 927.1, 77 (Mar. 2022), p. 77. DOI: [10.3847/1538-4357/ac4886](#). arXiv: [2110.00482](#) [[astro-ph.IM](#)].
- [7] BICEP/Keck Collaboration et al. “BICEP/Keck XIV: Improved constraints on axionlike polarization oscillations in the cosmic microwave background”. In: *Phys. Rev. D* 105.2, 022006 (Jan. 2022), p. 022006. DOI: [10.1103/PhysRevD.105.022006](#). arXiv: [2108.03316](#) [[astro-ph.CO](#)].
- [8] A. Schillaci et al. “BICEP Array: 150 GHz detector module development”. In: *arXiv e-prints*, arXiv:2111.14785 (Nov. 2021), arXiv:2111.14785. arXiv: [2111.14785](#) [[astro-ph.IM](#)].

- [9] Marion Dierickx et al. “Plastic Laminate Antireflective Coatings for Millimeter-wave Optics in BICEP Array”. In: *arXiv e-prints*, arXiv:2111.14751 (Nov. 2021), arXiv:2111.14751. arXiv: [2111.14751](https://arxiv.org/abs/2111.14751) [[astro-ph.IM](#)].
- [10] BICEP/Keck Collaboration et al. “Improved Constraints on Primordial Gravitational Waves using Planck, WMAP, and BICEP/Keck Observations through the 2018 Observing Season”. In: *Phys. Rev. Letters* 127.15, 151301 (Oct. 2021), p. 151301. DOI: [10.1103/PhysRevLett.127.151301](https://doi.org/10.1103/PhysRevLett.127.151301). arXiv: [2110.00483](https://arxiv.org/abs/2110.00483) [[astro-ph.CO](#)].
- [11] Maximilian H. Abitbol et al. “The Simons Observatory: gain, bandpass and polarization-angle calibration requirements for B-mode searches”. In: *Journal of Cosmology and Astroparticle Physics* 2021.5, 032 (May 2021), p. 032. DOI: [10.1088/1475-7516/2021/05/032](https://doi.org/10.1088/1475-7516/2021/05/032). arXiv: [2011.02449](https://arxiv.org/abs/2011.02449) [[astro-ph.CO](#)].
- [12] Clara Vergès, Josquin Errard, and Radek Stompor. “Framework for analysis of next generation, polarized CMB data sets in the presence of Galactic foregrounds and systematic effects”. In: *Phys. Rev. D* 103.6, 063507 (Mar. 2021), p. 063507. DOI: [10.1103/PhysRevD.103.063507](https://doi.org/10.1103/PhysRevD.103.063507). arXiv: [2009.07814](https://arxiv.org/abs/2009.07814) [[astro-ph.CO](#)].
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- [15] Polarbear Collaboration et al. “A Measurement of the Degree-scale CMB B-mode Angular Power Spectrum with POLARBEAR”. In: *Astrophysical Journal* 897.1, 55 (July 2020), p. 55. DOI: [10.3847/1538-4357/ab8f24](https://doi.org/10.3847/1538-4357/ab8f24). arXiv: [1910.02608](https://arxiv.org/abs/1910.02608) [[astro-ph.CO](#)].
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- [18] Y. Chinone et al. “Results of gravitational lensing and primordial gravitational waves from the POLARBEAR experiment”. In: *Journal of Physics Conference Series*. Vol. 1468. Journal of Physics Conference Series. Feb. 2020, p. 012007. DOI: [10.1088/1742-6596/1468/1/012007](https://doi.org/10.1088/1742-6596/1468/1/012007).
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- [23] Simons Observatory Collaboration et al. “The Simons Observatory: science goals and forecasts”. In: *Journal of Cosmology and Astroparticle Physics* 2019.2, 056 (Feb. 2019), p. 056. DOI: [10.1088/1475-7516/2019/02/056](https://doi.org/10.1088/1475-7516/2019/02/056). arXiv: [1808.07445](https://arxiv.org/abs/1808.07445) [astro-ph.CO].
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