

Lennart Balkenhol

Curriculum Vitae

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RESEARCH INTERESTS

- Cosmology: phenomenology and data analysis
- Cosmic microwave background anisotropies
- Cosmological structure formation
- Analysis methods in astrophysics and cosmology
- Machine learning applications in cosmology
- Cosmological concordance

EDUCATION & POSITIONS

POSTDOCTORAL FELLOW Institut d'Astrophysique de Paris Advisor: Dr. Silvia Galli Project: NEUCosmoS (ERC consolidator grant)	03/2023 - 02/2026
DOCTOR OF PHILOSOPHY University of Melbourne Thesis: Constraining Cosmology with SPT-3G Advisory Committee: Christian Reichardt, Rachel Webster, Raymond Volkas	06/2019 - 01/2023
MASTER OF SCIENCE IN PHYSICS University of Melbourne Advisor: Christian Reichardt	02/2017 - 12/2018
BACHELOR OF SCIENCE WITH HONOURS IN PHYSICS WITH ASTROPHYSICS University of Sussex Advisor: Robert E. Smith	09/2013 - 06/2016

PROFESSIONAL ACTIVITIES AND RESPONSIBILITIES

Member of the SPT-3G Collaboration	Since 2019
<ul style="list-style-type: none">• Led the high-level analysis of the first SPT-3G power spectrum, including writing the likelihood software, carrying out the MCMC analysis, and interpreting cosmological results.• Engaged in ongoing data analysis efforts and planning future cosmological analyses.• Organised and chaired high-level analysis section of collaboration meeting.	
Organiser of the cosmology journal club, University of Melbourne	2020 - 2022
Telescopes in schools volunteer, University of Melbourne	2018 - 2022

SKILLS

- Programming: Python (Advanced), Objective-C (Intermediate), Fortran (Intermediate), C (Basic), HTML & CSS (Basic), Unix scripting (Basic)
- Technical: MCMC sampling (Cobaya, CosmoMC, MontePython, BlackJAX, flowMC), cosmological theory codes and emulators (CAMB, CLASS, CosmoPower, Capse.jl), JAX, HEALPix, pip distribution, supercomputing using CPUs and GPUs
- Other: Data Visualisation, Signal Processing, Statistical Interpretation
- Language: German (native), English (fluent), French (B1)

AWARDS AND SCHOLARSHIPS

2022 Dr Albert Shimmins Postgraduate Writing-Up Award
2021 Laby PhD Travelling Scholarship
2019 Melbourne Research Scholarship
2019 Melbourne University Sport Full Blue
2017 International Postgraduate Coursework Scholarship
2016 Andrew J. Symonds Memorial Award
2013 Scholar of the German National Academic Foundation

TEACHING

TEACHING ASSISTANT

University of Melbourne

- Introduction to Life, Earth and Universe 2021
- From the Solar System to the Cosmos 2020
- Physics first year laboratory 2017-2020, 2022

TEACHING ASSISTANT

University of Sussex

- Introduction to scientific Python programming 2015-2016

PROFESSIONAL EXPERIENCE

DATA ANALYST

Crypton Capital

96 Pelham St, Carlton VIC 3053, Australia

08/2018-06/2019

DEVELOPMENT INTERN

Touch Fantastic

Werks Central, 15-17 Middle Street, Brighton BN1 1AL, United Kingdom

08/2018-06/2019

INTERESTS

FENCING

- University of Melbourne Elite Athlete Scholarship (2017 - 2022).
- Awarded Melbourne University full blue award (2019).
- Achieved podium results at German, British, and Australian national competitions.
- British coaching qualification.
- Australian referee accreditation.
- Volunteered as University of Sussex Fencing Club secretary (2015-2016).

PRESENTATIONS AT SCIENTIFIC CONFERENCES

* = Talk; Inv. = Invited talk; Sem. = Seminar

- * December 2023, Colloque National CMB-France, Institut Astrophysique de Paris, France — *'candl: CMB Analysis with a Differentiable Likelihood'*
- Sem. October 2023, Laboratoire Univers et particules de Montpellier, France — *'A Differentiable Likelihood for CMB Data Analysis'*
- * 2023 September, Cosmo23, Instituto de Física Teórica, Spain — *'SPT-3G 2018 TT/TE/EE Power Spectrum and Future Likelihood'*
- Sem. 2023 March, Simons Observatory maps2cell working group — *'SPT-3G 2018 TT/TE/EE Power Spectrum'*
- Sem. 2023 March, Institut Astrophysique de Paris, France — *'Cosmic Microwave Background Power Spectrum Measurements from SPT-3G 2018 Data'*
- Inv. 2022 July, Intriguing Inconsistencies in the Growth of Structure over Cosmic Time, Sixten Center for Astrophysics, Italy — *'Constraints on Structure Growth from SPT-3G Power Spectrum Measurements'*
- Sem. 2022 July, Imperial College London, UK — *'Searching for Physics Beyond the Standard Model with Planck, SPT, and ACT data'*
- Sem. 2022 June, University of Cambridge, UK — *'Searching for Physics Beyond the Standard Model with Planck, SPT, and ACT data'*
- Sem. 2022 June, University of Sussex, UK — *'Searching for Physics Beyond the Standard Model with Planck, SPT, and ACT data'*
- Sem. 2022 June, Max Planck Institute for Astrophysics, Germany — *'Searching for Physics Beyond the Standard Model with Planck, SPT, and ACT data'*
- * 2022 June, Colloque National CMB-France, Institut Astrophysique de Paris, France — *'Searching for Physics Beyond the Standard Model with Planck, SPT, and ACT data'*
- Sem. 2022 February, Institut Astrophysique de Paris, France — *'Constraints on Cosmological Parameters from SPT-3G 2018'*
- * 2021 August, Cosmo21, University of Illinois, USA — *'Constraints on Cosmology from the SPT-3G 2018 EE/TE Power Spectra'*
- * 2021 July, ASA2021, University of Melbourne, Australia — *'Constraints on Cosmology from the SPT-3G 2018 EE/TE Power Spectra'*
- Inv. 2021 June, Six week summer webinar series on the growth of structure over cosmic time — *'CMB Measurements of the Growth of Structure from SPT'*
- Sem. 2021 May, University of Sussex, UK — *'Constraints on Cosmology from the SPT-3G 2018 EE/TE Power Spectra'*
- Sem. 2021 April, KIPAC Tea Talk, Stanford University, USA — *'Constraints on Λ CDM Extensions from the SPT-3G 2018 EE/TE Power Spectra and their Implications for the Hubble Constant'*
- * 2019 December, AIP Summer Meeting 2019, RMIT, Australia — *'Preparing Next-Generation CMB Experiments for Big Data Challenges Using Extreme Digitisation'*
- * 2018 June, ASA 2018, Swinburne University, Australia — *'Using Extreme Digitisation to Combat Data Challenges in CMB Observations'*

LIST OF PUBLICATIONS

328 total citations of published works, average of 23.4 per paper, h-index of 7, according to Inspire

1. *'A Measurement of the CMB Temperature Power Spectrum and Constraints on Cosmology from the SPT-3G 2018 TT/TE/EE Data Set'*
L. Balkenhol, D. Dutcher, A. Spurio Mancini, A. Doussot, K. Benabed, S. Galli, ... et al. [87 authors]
Submitted to Physical Review D, arXiv:2212.05642

2. '*Hints of Early Dark Energy in Planck, SPT, and ACT data: new physics or systematics?*'
T. Smith, M. Lucca, V. Poulin, G. Abellan, **L. Balkenhol**, K. Benabed, S. Galli, and R. Murgia
Physical Review D 106 (2022) 4, 043526
3. '*The Parameter-Level Performance of Covariance Matrix Conditioning in Cosmic Microwave Background Data Analyses*'
L. Balkenhol and C. L. Reichardt
Monthly Notices of the Royal Astronomical Society vol. 512 (2022), no. 3, pp.4394-4403
4. '*Consistency of Planck, ACT and SPT constraints on magnetically assisted recombination and forecasts for future experiments*'
S. Galli, L. Pogosian, K. Jedamzik, and **L. Balkenhol**
Physical Review D 105 (2022) 2, 023513
5. '*Constraints on Λ CDM extensions from the SPT-3G 2018 EE and TE power spectra*'
L. Balkenhol, D. Dutcher, . . . et al. [120 authors]
Physical Review D 104 (2021) 8, 083509
6. '*Measurements of the E -mode polarization and temperature-E -mode correlation of the CMB from SPT-3G 2018 data*'
D. Dutcher, **L. Balkenhol**, . . . et al. [121 authors]
Physical Review D 104 (2021) 2, 022003
7. '*Extreme digitization for ground-based cosmic microwave background experiments*'
L. Balkenhol and C. L. Reichardt
Monthly Notices of Royal Astronomical Society vol. 487 (2019), no. 3, pp. 3279–3287