

ADRIAN E. BAYER

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 New York Metropolitan Area, USA

EDUCATION

University of California, Berkeley, USA
Ph.D. Physics

2018–2023

Thesis adviser: Uroš Seljak

University of Cambridge, UK
Master of Advanced Study, Mathematics

2017–2018

Imperial College London, UK
MSci Physics with Theoretical Physics
Graduated top of the cohort (approx. 250 students).

2013–2017

Thesis adviser: Fay Dowker

ACADEMIC APPOINTMENTS

Princeton University, USA
Postdoctoral Researcher

2023–

Adviser: David Spergel

Simons Foundation, USA
Guest Researcher

2023–

Adviser: David Spergel

The University of Tokyo (Kavli IPMU), Japan
Visiting Researcher (3 months)

2022

Adviser: Jia Liu

Massachusetts Institute of Technology, USA
Undergraduate Researcher (2 months)

2016

Adviser: Lindley Winslow

Imperial College London, UK
Undergraduate Researcher (3 months)

2015

Adviser: Henrique Araújo

HONORS AND AWARDS

Outstanding Graduate Student Instructor Award, University of California, Berkeley, 2022

Berkeley Distinguished Graduate Fellows Video Prize (\$1,000 grant), University of California, Berkeley, 2019

The Berkeley Fellowship, University of California, Berkeley, 2018

Abdus Salam Undergraduate Prize, Imperial College London, 2017

Governors' MSci Prize in Physics, Imperial College London, 2017

Ken Allen Prize, Imperial College London, 2016

Winton Capital Prize for Outstanding Performance in Second Year Physics, Imperial College London, 2015

EPSRC Summer Vacation Bursary (£2,200 grant), Engineering and Physical Sciences Research Council, 2015

BIBLIOGRAPHY

- Robnik, J., **A. E. Bayer**, M. Charisi, Z. Haiman, A. Lin, and U. Seljak. “Periodicity significance testing with null-signal templates: reassessment of PTF’s SMBH binary candidates”. In: (July 2024). arXiv: [2407.17565](https://arxiv.org/abs/2407.17565) [[astro-ph.GA](#)]
- Bayer, A. E.**, Y. Zhong, Z. Li, J. DeRose, Y. Feng, and J. Liu. “The HalfDome Multi-Survey Cosmological Simulations: N-body Simulations”. In: (July 2024). arXiv: [2407.17462](https://arxiv.org/abs/2407.17462) [[astro-ph.CO](#)]
- Bayer, A. E.**, J. Liu, C. D. Kreisch, and A. Pisani. “The Significance of Void Shape: Neutrino Mass from Voronoi Void-Halos?” In: (May 2024). arXiv: [2405.12302](https://arxiv.org/abs/2405.12302) [[astro-ph.CO](#)]
- Bayer, A. E.**, U. Seljak, and C. Modi. “Field-Level Inference with Microcanonical Langevin Monte Carlo”. In: *40th International Conference on Machine Learning*. July 2023. arXiv: [2307.09504](https://arxiv.org/abs/2307.09504) [[astro-ph.CO](#)]

5. **Bayer, A. E.**, C. Modi, and S. Ferraro. “Joint velocity and density reconstruction of the Universe with nonlinear differentiable forward modeling”. In: *J. Cosmology Astropart. Phys.* 2023.6, 046 (June 2023), p. 046. DOI: [10.1088/1475-7516/2023/06/046](https://doi.org/10.1088/1475-7516/2023/06/046). arXiv: [2210.15649](https://arxiv.org/abs/2210.15649) [[astro-ph.CO](#)]
6. **Bayer, A. E.**, J. Liu, R. Terasawa, A. Barreira, Y. Zhong, and Y. Feng. “Super-sample covariance of the power spectrum, bispectrum, halos, voids, and their cross covariances”. In: *Phys. Rev. D* 108.4 (2023), p. 043521. DOI: [10.1103/PhysRevD.108.043521](https://doi.org/10.1103/PhysRevD.108.043521). arXiv: [2210.15647](https://arxiv.org/abs/2210.15647) [[astro-ph.CO](#)]
7. Ding, Z., C.-H. Chuang, Y. Yu, L. H. Garrison, **A. E. Bayer**, Y. Feng, C. Modi, D. J. Eisenstein, M. White, A. Variu, C. Zhao, H. Zhang, J. Meneses Rizo, D. Brooks, K. Dawson, P. Doel, E. Gaztanaga, R. Kehoe, A. Krolewski, M. Landriau, N. Palanque-Delabrouille, and C. Poppett. “The DESI N-body Simulation Project - II. Suppressing sample variance with fast simulations”. In: *MNRAS* 514.3 (Aug. 2022), pp. 3308–3328. DOI: [10.1093/mnras/stac1501](https://doi.org/10.1093/mnras/stac1501). arXiv: [2202.06074](https://arxiv.org/abs/2202.06074) [[astro-ph.CO](#)]
8. **Bayer, A. E.**, A. Banerjee, and U. Seljak. “Beware of fake ν ’s: The effect of massive neutrinos on the nonlinear evolution of cosmic structure”. In: *Phys. Rev. D* 105.12, 123510 (June 2022), p. 123510. DOI: [10.1103/PhysRevD.105.123510](https://doi.org/10.1103/PhysRevD.105.123510). arXiv: [2108.04215](https://arxiv.org/abs/2108.04215) [[astro-ph.CO](#)]
9. Kreisch, C. D., A. Pisani, F. Villaescusa-Navarro, D. N. Spergel, B. D. Wandelt, N. Hamaus, and **A. E. Bayer**. “The GIGANTES Data Set: Precision Cosmology from Voids in the Machine-learning Era”. In: *ApJ* 935.2, 100 (Aug. 2022), p. 100. DOI: [10.3847/1538-4357/ac7d4b](https://doi.org/10.3847/1538-4357/ac7d4b). arXiv: [2107.02304](https://arxiv.org/abs/2107.02304) [[astro-ph.CO](#)]
10. **Bayer, A. E.**, U. Seljak, and J. Robnik. “Self-calibrating the look-elsewhere effect: fast evaluation of the statistical significance using peak heights”. In: *MNRAS* 508.1 (Nov. 2021), pp. 1346–1357. DOI: [10.1093/mnras/stab2331](https://doi.org/10.1093/mnras/stab2331). arXiv: [2108.06333](https://arxiv.org/abs/2108.06333) [[astro-ph.IM](#)]
11. **Bayer, A. E.**, F. Villaescusa-Navarro, E. Massara, J. Liu, D. N. Spergel, L. Verde, B. D. Wandelt, M. Viel, and S. Ho. “Detecting Neutrino Mass by Combining Matter Clustering, Halos, and Voids”. In: *ApJ* 919.1, 24 (Sept. 2021), p. 24. DOI: [10.3847/1538-4357/ac0e91](https://doi.org/10.3847/1538-4357/ac0e91). arXiv: [2102.05049](https://arxiv.org/abs/2102.05049) [[astro-ph.CO](#)]
12. **Bayer, A. E.**, A. Banerjee, and Y. Feng. “A fast particle-mesh simulation of non-linear cosmological structure formation with massive neutrinos”. In: *J. Cosmology Astropart. Phys.* 2021.1, 016 (Jan. 2021), p. 016. DOI: [10.1088/1475-7516/2021/01/016](https://doi.org/10.1088/1475-7516/2021/01/016). arXiv: [2007.13394](https://arxiv.org/abs/2007.13394) [[astro-ph.CO](#)]
13. **Bayer, A. E.** and U. Seljak. “The look-elsewhere effect from a unified Bayesian and frequentist perspective”. In: *J. Cosmology Astropart. Phys.* 2020.10, 009 (Oct. 2020), p. 009. DOI: [10.1088/1475-7516/2020/10/009](https://doi.org/10.1088/1475-7516/2020/10/009). arXiv: [2007.13821](https://arxiv.org/abs/2007.13821) [[physics.data-an](#)]
14. Tomás, A., H. M. Araújo, A. J. Bailey, **A. Bayer**, E. Chen, B. López Paredes, and T. J. Sumner. “Study and mitigation of spurious electron emission from cathodic wires in noble liquid time projection chambers”. In: *Astroparticle Physics* 103 (Dec. 2018), pp. 49–61. DOI: [10.1016/j.astropartphys.2018.07.001](https://doi.org/10.1016/j.astropartphys.2018.07.001). arXiv: [1801.07231](https://arxiv.org/abs/1801.07231) [[physics.ins-det](#)]

SELECTED TALKS

University of Chicago, Chicago IL, USA Simons Observatory Collaboration Meeting “CMB x LSS with the HalfDome Simulations”	July 2024
Mediterranean Institute for Life Sciences, Split, Croatia Cosmology in the Adriatic – From PT to AI “Cosmology in the Adriatic with Adrian: from field-level inference to joint analyses”	July 2024
Università degli Studi di Catania - Dipartimento di Fisica e Astronomia, Catania, Italy International Conference on Machine Learning for Astrophysics – 2nd Edition “Extracting optimal information from cosmological surveys with field-level inference and joint analyses”	July 2024
Sexten Center for Astrophysics, Sexten, Italy New Strategies For Extracting Cosmology From Future Galaxy Surveys Workshop – 2nd Edition “The HalfDome CMB x LSS Simulations”	July 2024
Aspen Center for Physics, Aspen CO, USA Fundamental Physics in the Era of Big Data and Machine Learning “Physics-based sampling”	June 2024

Grand Arsenal, Chania, Greece	May 2024
COSMO21: Statistical Challenges in 21st Century Cosmology	
“Towards an Optimal Cosmological Detection of Neutrino Mass with Joint Analyses and Field-Level Inference”	
Stanford University, Stanford CA, USA	April 2024
Cosmology Seminar	
“Towards an Optimal Cosmological Detection of Neutrino Mass with Field-Level Inference”	
Yale University, New Haven CT, USA	April 2024
Cosmology Seminar	
“Towards an Optimal Cosmological Detection of Neutrino Mass with Field-Level Inference”	
Center for Computational Astrophysics, Flatiron Institute, New York NY, USA	March 2024
Cosmology X Data Science Meeting	
“The HalfDome CMB x LSS Simulations”	
The Center for Cosmology and Particle Physics, New York University, NY, USA	March 2024
Astrophysics and Relativity Seminar	
“Towards an Optimal Cosmological Detection of Neutrino Mass with Field-Level Inference”	
Center for Data Driven Discovery (CD3), Kavli IPMU, University of Tokyo, Japan	January 2024
The CD3 x Simons Foundation workshop: AI-driven discovery in physics and astrophysics	
“Cosmological Field-Level Inference with Microcanonical Langevin Monte Carlo”	
High Energy Accelerator Research Organization (KEK), Tskuba, Japan	January 2024
ML at HEP workshop	
“Extracting optimal information from upcoming cosmological surveys”	
Center for Computational Astrophysics, Flatiron Institute, New York NY, USA	November 2023
Debating the potential of machine learning for astronomical surveys (#2) – IAP/CCA Conference	
“Cosmological Field-Level Inference with Microcanonical Langevin Monte Carlo”	
Imperial College London, London, UK	November 2023
Seminar	
“Towards an Optimal Cosmological Detection of Neutrino Mass”	
Monte Verità, Ascona, Switzerland	October 2023
Hamers & Nails, Frontiers in Machine Learning in Cosmology, Astro & Particle Physics	
“Cosmological Field-Level Inference with Microcanonical Langevin Monte Carlo”	
Hawaii Convention Center, Honolulu HI, USA	July 2023
International Conference on Machine Learning (ICML), Workshop on Machine Learning for Astrophysics	
“Field-Level Inference with Microcanonical Langevin Monte Carlo”	
Sexten Center for Astrophysics, Sexten, Italy	July 2023
New Strategies For Extracting Cosmology From Future Galaxy Surveys Workshop	
“Field-Level Inference with Microcanonical Hamiltonian Monte Carlo”	
Center for Computational Astrophysics, Flatiron Institute, New York NY, USA	May 2023
Cosmic Connections Symposium	
“Field-Level Inference with Microcanonical Hamiltonian Monte Carlo”	
Stanford University, Stanford CA, USA (zoom)	January 2023
LSST Higher-Order Statistics Meeting	
“Super-Sample Covariance of Higher-Order Statistics”	
Institute for Advanced Studies, Princeton NJ, USA	December 2022
Cosmology Lunch	
“Towards Optimal Measurement of the Neutrino Mass using Large-Scale Structure”	
Center for Computational Astrophysics, Flatiron Institute, New York NY, USA	December 2022
Cosmology X Data Science Meeting	
“Towards Optimal Measurement of the Neutrino Mass using Large-Scale Structure”	

University of Pennsylvania, Philadelphia PA, USA CMB Meeting “Towards Optimal Measurement of the Neutrino Mass using Large-Scale Structure”	December 2022
Université de Montréal, Montréal, Canada Astronomie Speaker Series “Massive Neutrino Information in Large-Scale Structure and Field-Level Inference”	November 2022
Vipolže, Slovenia Berkeley Center for Cosmological Physics Summer Workshop “Massive Neutrino Information in Large-Scale Structure and Field-Level Inference”	July 2022
The University of Tokyo (Hongo Campus), Tokyo, Japan GPU Workshop “Cosmological simulations on GPU with tensorflow”	May 2022
The University of Tokyo (Kavli IPMU), Kashiwanoha, Japan APEC Seminar “Towards detecting neutrino mass using non-linear cosmic structure”	April 2022
Kyoto University (Yukawa Institute for Theoretical Physics), Kyoto, Japan Cosmology with Weak Lensing: Beyond the 2-pt Statistics “Detecting neutrino mass using nonlinear cosmic structure”	April 2022
Institut d’Astrophysique de Paris, Paris, France Journal Club – Univers “Detecting neutrino mass using nonlinear cosmic structure”	February 2022
Center for Computational Astrophysics, Flatiron Institute, New York NY, USA Learn the Universe “The Look-Elsewhere Effect”	August 2021
Pennsylvania State University, State College PA, USA Statistical Challenges in Modern Astronomy VII “The Look-Elsewhere Effect from a Unified Bayesian and Frequentist Perspective”	June 2021
University of Cambridge (Kavli Institute for Cosmology), Cambridge, UK KICC 10th Anniversary Symposium “Look Elsewhere” (poster)	September 2019

TEACHING

Bayesian Data Analysis and Machine Learning for Physical Sciences
Graduate Student Instructor, UC Berkeley, 2021

Python for Physics
Teaching Assistant, Imperial College London, 2016

MENTORING

James Sunseri (Graduate Student), Princeton University
Project: Information Content of the Cosmic Web (co-advised with Jia Liu)

Yici Zhong (Graduate Student), The University of Tokyo
Project: HalfDome Cosmological Simulations for Stage IV Surveys (co-advised with Jia Liu)

Malika Golshan (Undergraduate Student), UC Berkeley
Project: Can AI reliably learn neutrino physics from N-body simulations? (co-advised with Vanessa Böhm)

OUTREACH TALKS

Neutrino Mass from Cosmology: Measuring the Mass of a Needle in a Haystack November 2023
Astronomy on Tap, Trenton NJ, USA

OUTREACH

Astronomy on Tap (Trenton), Host and Organizer (2023, 2024)

Berkeley Compass Mentor (2022)

Adopt-a-Physicist Mentor (2020)

REFEREEING

The Astrophysical Journal (ApJ)

Machine Learning and the Physical Sciences, Neural Information Processing Systems (NeurIPS)

Journal of Cosmology and Astroparticle Physics (JCAP)

Astrophysical Journal Letters (ApJL)

Monthly Notices of the Royal Astronomical Society (MNRAS)

Machine Learning for Astrophysics Workshop, International Conference on Machine Learning (ICML)