

# ADRIAN E. BAYER

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📍 New York Metropolitan Area, USA

## EDUCATION

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**University of California, Berkeley, USA** 2018–2023  
Ph.D. Physics Thesis adviser: Uroš Seljak

**University of Cambridge, UK** 2017–2018  
Master of Advanced Study, Mathematics

**Imperial College London, UK** 2013–2017  
MSci Physics with Theoretical Physics Thesis adviser: Fay Dowker  
Graduated top of the cohort (approx. 250 students).

## ACADEMIC APPOINTMENTS

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**Princeton University, USA** 2023–  
Postdoctoral Researcher Adviser: David Spergel

**Simons Foundation, USA** 2023–  
Guest Researcher Adviser: David Spergel

**The University of Tokyo (Kavli IPMU), Japan** 2022  
Visiting Researcher (3 months) Adviser: Jia Liu

**Massachusetts Institute of Technology, USA** 2016  
Undergraduate Researcher (2 months) Adviser: Lindley Winslow

**Imperial College London, UK** 2015  
Undergraduate Researcher (3 months) Adviser: Henrique Araújo

## HONORS AND AWARDS

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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

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- 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](#)]
- 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](#)]
- 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](#)]

4. 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]
5. **Bayer, A. E.**, A. Banerjee, and U. Seljak. “Beware of fake  $\nu$ ’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]
6. 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]
7. **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]
8. **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]
9. **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]
10. **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]
11. 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

<b>Center for Data Driven Discovery (CD3), Kavli IPMU, University of Tokyo, Japan</b> The CD3 x Simons Foundation workshop: AI-driven discovery in physics and astrophysics “Cosmological Field-Level Inference with Microcanonical Langevin Monte Carlo”	January 2024
<b>High Energy Accelerator Research Organization (KEK), Tsukuba, Japan</b> ML at HEP workshop “Extracting optimal information from upcoming cosmological surveys”	January 2024
<b>Center for Computational Astrophysics, Flatiron Institute, New York NY, USA</b> Debating the potential of machine learning for astronomical surveys (#2) – IAP/CCA Conference “Cosmological Field-Level Inference with Microcanonical Langevin Monte Carlo”	November 2023
<b>Imperial College London, London, UK</b> Seminar “Towards an Optimal Cosmological Detection of Neutrino Mass”	November 2023
<b>Monte Verità, Ascona, Switzerland</b> Hamers & Nails, Frontiers in Machine Learning in Cosmology, Astro & Particle Physics “Cosmological Field-Level Inference with Microcanonical Langevin Monte Carlo”	October 2023
<b>Hawaii Convention Center, Honolulu HI, USA</b> International Conference on Machine Learning (ICML), Workshop on Machine Learning for Astrophysics “Field-Level Inference with Microcanonical Langevin Monte Carlo”	July 2023
<b>Sexten Center for Astrophysics, Sexten, Italy</b> New Strategies For Extracting Cosmology From Future Galaxy Surveys Workshop “Field-Level Inference with Microcanonical Hamiltonian Monte Carlo”	July 2023

<b>Center for Computational Astrophysics, Flatiron Institute, New York NY, USA</b> Cosmic Connections Symposium “Field-Level Inference with Microcanonical Hamiltonian Monte Carlo”	May 2023
<b>Stanford University, Stanford CA, USA (zoom)</b> LSST Higher-Order Statistics Meeting “Super-Sample Covariance of Higher-Order Statistics”	January 2023
<b>Institute for Advanced Studies, Princeton NJ, USA</b> Cosmology Lunch “Towards Optimal Measurement of the Neutrino Mass using Large-Scale Structure”	December 2022
<b>Center for Computational Astrophysics, Flatiron Institute, New York NY, USA</b> Cosmology X Data Science Meeting “Towards Optimal Measurement of the Neutrino Mass using Large-Scale Structure”	December 2022
<b>University of Pennsylvania, Philadelphia PA, USA</b> CMB Meeting “Towards Optimal Measurement of the Neutrino Mass using Large-Scale Structure”	December 2022
<b>Université de Montréal, Montréal, Canada</b> Astronomie Speaker Series “Massive Neutrino Information in Large-Scale Structure and Field-Level Inference”	November 2022
<b>Vipolže, Slovenia</b> Berkeley Center for Cosmological Physics Summer Workshop “Massive Neutrino Information in Large-Scale Structure and Field-Level Inference”	July 2022
<b>The University of Tokyo (Hongo Campus), Tokyo, Japan</b> GPU Workshop “Cosmological simulations on GPU with tensorflow”	May 2022
<b>The University of Tokyo (Kavli IPMU), Kashiwanoha, Japan</b> APEC Seminar “Towards detecting neutrino mass using non-linear cosmic structure”	April 2022
<b>Kyoto University (Yukawa Institute for Theoretical Physics), Kyoto, Japan</b> Cosmology with Weak Lensing: Beyond the 2-pt Statistics “Detecting neutrino mass using nonlinear cosmic structure”	April 2022
<b>Institut d’Astrophysique de Paris, Paris, France</b> Journal Club – Uniers “Detecting neutrino mass using nonlinear cosmic structure”	February 2022
<b>Center for Computational Astrophysics, Flatiron Institute, New York NY, USA</b> Learn the Universe “The Look-Elsewhere Effect”	August 2021
<b>Pennsylvania State University, State College PA, USA</b> Statistical Challenges in Modern Astronomy VII “The Look-Elsewhere Effect from a Unified Bayesian and Frequentist Perspective”	June 2021
<b>University of Cambridge (Kavli Institute for Cosmology), Cambridge, UK</b> 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**

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**Neutrino Mass from Cosmology: Measuring the Mass of a Needle in a Haystack**      November 2023

Astronomy on Tap, Trenton NJ, USA

## **OUTREACH**

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

Berkeley Compass Mentor (2022)

Adopt-a-Physicist Mentor (2020)

## **REFEREEING**

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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)