

# Harry T. J. Bevins, M.Phys.

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## Employment

|                                 |  |
|---------------------------------|--|
| September 2023 - September 2026 | <b>Kavli Junior Research Fellowship</b> , Kavli Institute for Cosmology and Cavendish Astrophysics, University of Cambridge.   |
| April 2023 - September 2023     | <b>Post Doctoral Research Assistant</b> , Cavendish Astrophysics, University of Cambridge. Development of calibration techniques for 21-cm Cosmology experiments. Supervised by Dr Eloy de Lera Acedo. |
| June-August 2018                | <b>Summer Research Project:</b> Investigating estimates of the Cosmic Radio Background. Supervised by Prof. Anna Scaife and Dr Justin Bray. University of Manchester.                                  |

## Education

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|-------------------------------|--|
| October 2019 - September 2023 | <b>PhD in Physics</b> , Cavendish Astrophysics, University of Cambridge. Development and application of novel data analysis techniques for 21-cm Cosmology experiments. Supervised by Dr Eloy de Lera Acedo, Dr Will Handley and Dr Anastasia Fialkov.                                       |
| 2015 - 2019                   | <b>M.Phys. Physics with Astrophysics, 1<sup>st</sup> Class</b> , University of Manchester. Dissertation involved producing an updated estimate of the Cosmic Radio Background from observations and theory. Performed with I.C. Nițu and supervised by Prof. Anna Scaife and Dr Justin Bray. |
| 2008 - 2015                   | Churchdown School Academy, Gloucestershire.<br><b>A-Levels:</b> 3 A grades, <b>AS-levels:</b> 2 A grades, <b>GCSE:</b> 7 A* grades, 3 A grades and 1 B.<br>Highest GCSE and A-Level grades in year group.  |

## Publications

**Citations: 111, h-index: 7, as of May 2023**  
[arxiv.org/a/bevins\\_h\\_1](https://arxiv.org/a/bevins_h_1)  
[ADS Abstracts](#)

## First Author

|                |  |
|----------------|--|
| May 2023       | <b>H. T. J. Bevins</b> , W. J. Handley. <i>Piecewise Normalizing Flows</i> , arXiv:2305.02930.   |
| January 2023   | <b>H. T. J. Bevins</b> , S. Heimersheim, I. Abril-Cabezas, A. Fialkov, E. de Lera Acedo, W. J. Handley, S. Singh, R. Barkana. <i>Joint analysis constraints on the physics of the first galaxies with low frequency radio astronomy data.</i> , arXiv:2301.03298.  |
| November 2022  | <b>H. T. J. Bevins</b> , A. Fialkov, E. de Lera Acedo, W. J. Handley, S. Singh, R. Subrahmanyan, R. Barkana. <i>Astrophysical Constraints from the SARAS3 non-detection of the Cosmic Dawn Sky-Averaged 21-cm Signal</i> . <b>Nature Astronomy</b> , <a href="https://doi.org/10.1038/s41550-022-01825-6">https://doi.org/10.1038/s41550-022-01825-6</a> . |
| October 2022   | <b>H. T. J. Bevins</b> , W. J. Handley, P. Lemos, P. Sims, E. de Lera Acedo, A. Fialkov. <i>Marginal Bayesian Statistics Using Masked Autoregressive Flows and Kernel Density Estimators with Examples in Cosmology</i> . Physical Sciences Forum, Volume 5, Issue 1, proceedings to MaxEnt22, arXiv:2207.11457.   |
| May 2022       | <b>H. T. J. Bevins</b> , W. J. Handley, P. Lemos, P. Sims, E. de Lera Acedo, A. Fialkov, J. Alsing. <i>Removing the fat from your posterior samples with MARGARINE</i> , arXiv:2205.12841.   |
| April 2022     | <b>H. T. J. Bevins</b> , E. de Lera Acedo, A. Fialkov, W. J. Handley, S. Singh, R. Subrahmanyan, R. Barkana. <i>A comprehensive Bayesian re-analysis of the SARAS2 data from the Epoch of Reionization</i> , Monthly Notices of the Royal Astronomical Society, Volume 508, Issue 2, Pages 2923-2936, arXiv:2201.11531                                     |
| September 2021 | <b>H. T. J. Bevins</b> , W. J. Handley, A. Fialkov, E. de Lera Acedo and K. Javid. <i>GLOBALEMU: A novel and robust approach for emulating the sky-averaged 21-cm signal from the cosmic dawn and epoch of reionisation</i> , Monthly Notices of the Royal Astronomical Society, Volume 513, Issue 3, Pages 4507-4526, arXiv:2104.04336                    |
| April 2021     | <b>H. T. J. Bevins</b> , W. J. Handley, A. Fialkov, E. de Lera Acedo, L. J. Greenhill, D. C. Price, <b>MAXSMOOTH: rapid maximally smooth function fitting with applications to Global 21-cm cosmology</b> , Monthly Notices of the Royal Astronomical Society, Volume 502, Issue 3, Pages 4405-4425, arXiv:2007.14970                                      |
| November 2020  | I.C. Nițu, <b>H.T.J. Bevins</b> , J.D. Bray, A.M.M. Scaife, <i>An updated estimate of the cosmic radio background and implications for ultra-high-energy photon propagation</i> , Astroparticle Physics, 126, 102532, arXiv:2004.13596, <i>Shared First Authorship</i> .   |
| October 2020   | <b>H. T. J. Bevins</b> , <i>maxsmooth: Derivative Constrained Function Fitting</i> . Journal of Open Source Software, 5(54), 2596  |

## Contributing Author

|               |   |
|---------------|---|
| July 2022     | The REACH Collaboration. <i>The REACH radiometer for detecting the 21-cm hydrogen signal from redshift <math>z \approx 7.5 - 28</math></i> . <b>Nature Astronomy</b> , 6, 984–998 (2022). <a href="https://doi.org/10.1038/s41550-022-01709-9">https://doi.org/10.1038/s41550-022-01709-9</a> .<br><i>Section lead on Detection of Unknown Systematics.</i> |
| February 2022 | The REACH Collaboration. <i>Radio antenna design for sky-averaged 21 cm cosmology experiments: the REACH case</i> , Journal of Astronomical Instrumentation, Volume 11, Issue 1, arXiv:2109.10098.  |

## Talks

### Conference and Workshop Talks

|               |   |
|---------------|---|
| May 2023      | <i>Joint analysis constraints on the physics of the first galaxies with low frequency radio astronomy data</i> , A Multi-scale View of the EoR, KICC, University of Cambridge.  |
| February 2023 | <i>Machine Learning for 21-cm Cosmology</i> , Development in Africa with Radio Astronomy REACH Workshop, University of Stellenbosch.  |
| October 2022  | <i>Astrophysics from the SARAS3 non-detection of the global 21-cm signal</i> , 5th Global 21-cm Workshop, University of California Berkeley.  |
| July 2022     | <i>Marginal Bayesian Statistics with Masked Autoregressive Flows and Kernel Density Estimators</i> , 41st MaxEnt22 Conference, Institut Henri Poincaré, Paris.  |
| June 2022     | <i>globalemu: Novel and robust emulation of 21-cm signals from the Epoch of Reionization</i> , Special Session - Towards the SKA Observatory: Artificial Intelligence in Radio Astronomy, <b>European Astronomical Society Annual Meeting</b> , Valencia. |
| April 2022    | <i>Constraining the Astrophysics of the Early Universe using the SARAS Instrumentation</i> , Observational and Theoretical 21-cm Cosmology, Kavli Meeting, University of Cambridge  |
| March 2022    | <i>A comprehensive Bayesian re-analysis of the SARAS2 data from the Epoch of Reionization</i> , SAZERAC 21-cm Gulp (Online)   |
| January 2022  | <i>globalemu: A novel and robust approach to emulating the global 21-cm signal with neural networks</i> , SAZERAC-SIP: Learning the high-redshift universe (Online)   |
| December 2021 | <i>A Bayesian re-analysis of the sky-averaged 21-cm experimental data from SARAS2</i> , , Lightning talk, Science at Low Frequencies VIII (Online), University of Amsterdam   |
| October 2021  | <i>globalemu: novel and robust global 21-cm signal emulation</i> , 4th Global 21-cm Workshop (Online), University of Colorado   |
| December 2020 | <i>maxsmooth and its applications in science at low frequencies</i> , Lightning talk, Science at Low Frequencies VII (Online), University of Amsterdam  |
| October 2020  | <i>maxsmooth and its applications to 21-cm cosmology</i> , 3rd Global 21-cm Workshop (Online), University of Cambridge  |

### Internal Talks

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|---------------|---|
| October 2021  | <i>An extensive Bayesian re-analysis of the SARAS2 data from the Epoch of Reionization</i> , 21-cm Group Meeting (Online), Cavendish Astrophysics, University of Cambridge                              |
| February 2021 | <i>maxsmooth and Maximally Smooth Functions</i> , Internal Coffee Talk (Online), Cavendish Astrophysics, University of Cambridge  |
| February 2021 | <i>GlobalEmu: A novel and robust approach to emulating the Global 21-cm signal and applications to data from SARAS2</i> , 21-cm Group Meeting (Online), Cavendish Astrophysics, University of Cambridge |
| July 2020     | <i>maxsmooth: rapid maximally smooth function fitting with applications to 21-cm cosmology</i> , 21-cm Group Meeting, Cavendish Astrophysics, University of Cambridge                                   |
| May 2020      | <i>An updated estimate of the cosmic radio background and implications for ultra-high-energy photon propagation</i> , Internal Coffee Talk, Cavendish Astrophysics, University of Cambridge             |
| May 2020      | <i>An updated estimate of the cosmic radio background and implications for 21-cm Cosmology</i> , 21-cm Group Meeting, Cavendish Astrophysics, University of Cambridge                                   |

## Awards

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| Fitzwilliam Society Trust Research Fund 2022         | Financial support to help attend and present at the 5th Global 21-cm Workshop.                                 |
| Fitzwilliam College Student Opportunities Award 2022 | Financial support awarded to help attend and present at 41st MaxEnt22 Conference.                              |
| Fitzwilliam College Senior Scholarship 2022          | Financial support awarded in recognition of excellent academic achievements.                                   |
| Fitzwilliam College Senior Scholarship 2020          | Financial support awarded in recognition of resilience, hard work and achievements in PhD studies during 2020. |

## Posters Presentations

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|---------------|---|
| March 2021    | <a href="#">globalemu: A novel and robust approach for emulating the sky averaged 21-cm signal from the cosmic dawn and epoch of reionization</a> , A Precursor View of the SKA Sky, Virtual Conference |
| December 2019 | <a href="#">REACH: Radio Experiment for the Analysis of Cosmic Hydrogen</a> , Science At Low Frequencies VI, Arizona State University   |
| November 2019 | <a href="#">REACH: Radio Experiment for the Analysis of Cosmic Hydrogen</a> , Cavendish Graduate Conference, University of Cambridge  |

## Peer Review

One paper for the Journal of Open Source Software and one paper for Advances in Space Research (see [Web of Science](#)).

## In the Media

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|---------------|--|
| November 2022 | <a href="#">Non-detection of key signal allows astronomers to determine what the first galaxies were – and weren't – like</a> . Press release for SARAS3 astrophysical constraints from the University of Cambridge. See also an article in <a href="#">The Independent</a> and <a href="#">Altmetric</a> for a summary of other articles. |
| July 2022     | <a href="#">Astronomers develop novel way to ‘see’ first stars through fog of early Universe</a> . Press release for the REACH mission paper lead by Eloy de Lera Acedo. See <a href="#">Altmetrics</a> for a summary of other articles.   |

## Teaching

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|---------------------------|---|
| October 2021 - April 2022 | <b>Demonstration of Part IA Scientific Computing</b> for 32 hours, University of Cambridge.     |
| October - December 2020   | <b>Part II Relativity Supervision</b> of 16 students, University of Cambridge.                  |
| July - August 2020        | <b>Formative Marking of Part II Relativity Papers</b> for 56 students, University of Cambridge. |
| October - December 2019   | <b>Part II Relativity Supervision</b> of 6 students, University of Cambridge.                   |

## Computational Skills

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|-------------|---|
| Programming | Experienced: Python                                 |
| Markup      | Experienced: LATEX                                  |
| Languages   | Intermediate: HTML, CSS, reStructuredText, Markdown |

## Software

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| <a href="#">margarine</a>     | Main author and maintainer: Posterior Sampling and Marginal Bayesian Statistics.                   |
| <a href="#">globalemu</a>     | Main author and maintainer: Robust and fast emulation of the Global 21-cm signal.                  |
| <a href="#">maxsmooth</a>     | Main author and maintainer: Fast Derivative Constrained Function fitting.                          |
| <a href="#">anesthetic</a>    | Contributor: Added feature to plot shaded confidence regions under 1D posterior probability plots. |
| <a href="#">arXivSearcher</a> | Main author and maintainer: Terminal based arXiv search tool.                                      |

## Conference Organisation

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|---|---|
| <b>6th Global 21-cm Workshop</b><br>September 2023          | Member of the Science Organising Committee, Trieste   |
| <b>National Astronomical Meeting</b> July 2023              | Member of Science Organising Committee for the session “21-cm Cosmology: Current Status, Challenges and Prospects”, Cardiff University. |
| <b>Cavendish Graduate Conference</b> November 2021          | Member of Organising Committee, Cavendish Astrophysics, University of Cambridge.  |
| <b>3<sup>rd</sup> Global 21-cm Workshop</b><br>October 2020 | Member of Local Organising Committee, Cavendish Astrophysics, University of Cambridge.  |