Dominic Anstey

Research Associate

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Education

University of Cambridge *Cambridge, UK*

PhD in Physics *2018 - 2022*

- Thesis Title: "Data Analysis in Global 21cm Experiments: Physically Motivated Bayesian Modelling Techniques"
- Supervisor: Dr. Eloy de Lera Acedo
- This PhD was part of a reseach project entitled the 'Radio Experiment for the Analysis of Cosmic Hydrogen' ('REACH') under PIs Dr Eloy de Lera Acedo (University of Cambridge) and Dr Dirk de Villiers (Stellenbosch University)

University of Cambridge *Cambridge, UK*

MSci in Natural Sciences: Physics *2017 - 2018*

- First Class
- This degree involved performing an independent research project entitled 'Designing a Radio Telescope for Observing the Transient Sky', supervised by Professor Paul Alexander

University of Cambridge *Cambridge, UK*

BA Undergraduate Degree in Natural Sciences *2014 - 2017*

- 2014-2015: Second Class Division 1
- 2015-2016: First Class
- 2016-2017: First Class

Professional Experience

2022-present	**Postdoctoral Research Associate**, Dept. of Physics, University of Cambridge
2018-2022	**Undergraduate Practical Laboratory Demonstrator**, Dept. of Physics, University of Cambridge

Publications

Published

D. Anstey, E. de Lera Acedo, W. Handley. 2023 *Use of Time Dependent Data in Bayesian Global 21cm Foreground and Signal Modelling*. Monthly Notices of the Royal Astronomical Society, 520(1): 850-865.

E. Shen, **D. Anstey**, E. de Lera Acedo, A. Fialkov. 2022. *Bayesian Data Analysis for Sky-averaged 21-cm Experiments in the Presence of Ionospheric Effects*. Monthly Notices of the Royal Astronomical Society, 515(3): 4565-4573.

E. de Lera Acedo, D.I.L. de Villiers, N. Razavi-Ghods, W. Handley, A. Fialkov, A. Magro, **D. Anstey**, H.T.J. Bevins, R. Chiello, J. Cumner, A.T. Josaitis, I.L.V. Roque, P.H. Sims, P. Alexander, G. Bernardi, S. Carey, J. Cavillot, W. Croukamp, J.A. Ely, T. Gessey-Jones, Q. Gueuning, R. Hills, G. Kulkarni, R. Maiolino, P. D. Meerburg, S. Mittal, J.R. Pritchard, E. Puchwein, A. Saxena, K.H. Scheutwinkel, E. Shen, O. Smirnov, M. Spinelli, K. Zarb-Adami. 2022 *The REACH radiometer for detecting the 21-cm hydrogen signal from redshift z ≈ 7.5-28*. Nature Astronomy, 6: 984-998.

J. Cumner, E. de Lera Acedo, D.I.L. de Villiers, **D. Anstey**, C.I. Kolitsidas, B. Gurdon, N. Fagnoni, P. Alexander, G. Bernardi, H.T.J. Bevins, S. Carey, J. Cavillot, R. Chiello, C. Craeye, W. Croukamp, J.A. Ely, A. Fialkov, T. Gessey-Jones, Q. Gueuning, W. Handley, R. Hills, A.T. Josaitis, G. Kulkarni, A. Magro, R. Maiolino, P.D. Meerburg, S. Mittal, J.R. Pritchard, E. Puchwein, N. Razavi-Ghods, I.L.V. Roque, A. Saxena, K.H. Scheutwinkel, E. Shen, P.H. Sims, O. Smirnov, M. Spinelli, K. Zarb-Adami. 2022. *Radio antenna design for sky-averaged 21 cm cosmology experiments: the REACH case*. Journal of Astronomical Instrumentation, 11(1): 2250001-2058.

D. Anstey, J. Cumner, E. de Lera Acedo, W. Handley. 2022. *Informing antenna design for sky-averaged 21-cm experiments using a simulated Bayesian data analysis pipeline*. Monthly Notices of the Royal Astronomical Society, 509(4): 4679-4693.

E. Shen, **D. Anstey**, E. de Lera Acedo, A. Fialkov, W. Handley. 2021. *Quantifying ionospheric effects on global 21-cm observations*. Monthly Notices of the Royal Astronomical Society, 503(1): 344-353.

D. Anstey, E. de Lera Acedo, W. Handley. 2021. *A general Bayesian framework for foreground modelling and chromaticity correction for global 21 cm experiments*. Monthly Notices of the Royal Astronomical Society, 506(2): 2041-2058.

Accepted for Publication

J. Pattison, **D. Anstey**, E. de Lera Acedo. *Modelling A Hot Horizon in Global 21 cm Experimental Foregrounds.*

In Review

N. Razavi-Ghods, I. L. V. Roque, S. H. Carey, J. A. Ely, W. Handley, A. Magro, R. Chiello, T. Huang, P. Alexander, **D. Anstey**, G. Bernardi, H. J. T. Bevins, J. Cavillot, W. Croukamp, J. Cumner, E. de Lera Acedo, D. I. L. de Villiers, A. Fialkov, T. Gessey-Jones, Q. Gueuning, A. T. Josaitis, G. Kulkarni, S. A. K. Leeney, R. Maiolino, P. D. Meerburg, S. Mittal, M. Pagano, S. Pegwal, C. Pieterse, J. R. Pritchard, A. Saxena, K. H. Scheutwinkel, P. Scott, E. Shen, P. H. Sims, O. Smirnov, M. Spinelli, K. Zarb-Adami. *Receiver design for the REACH global 21-cm signal experiment.*

M. Pagano, P. Sims, A. Liu, **D. Anstey**, W. Handley, E. de Lera Acedo. *A General Bayesian Framework to Account for Foreground Map Errors in Global 21-cm Experiments.*

In Prep

C. Kirkham, **D. Anstey**, E.de Lera Acedo. *A Bayesian Method to Mitigate the Effects of Unmodelled Time-Varying Systematics for 21-cm Cosmology Experiments.*

E. Shen, **D. Anstey**, E. de Lera Acedo, A, Fialkov. *FlexKnot as a Generalised Model of the Sky-Averaged 21-cm Signal at* $z \sim 6 - 30$.

D. Anstey, S. A. K. Leeney. *Enhanced Bayesian RFI Excision and Transient Flagging Using Likelihood Reweighting.*

Awards, Fellowships, & Grants

2018-2022	**STFC Doctoral Training Program Studentship**, Science and Technology Facilities Council
2018	**College Prize**, Peterhouse, Cambridge
2016-2018	**Robert Slade Scholar in Natural Sciences**, Peterhouse, Cambridge

Conferences & Presentations

Invited Talks

October 2022. **Tata Institute of Fundamental Research India, 'State of the Universe Seiminar'. Invited Talk**. Online. *'Detecting the First Stars with REACH and Bayesian Statistics'*.

January 2022. **ETH Zurich, Invited Talk**. Online. *'Detecting the First Stars Using 21-cm Cosmology'*.

Contributed Presentations

September 2023. **6th Global 21cm Workshop**. Trieste, Italy. Oral Presenter, *'Efficient Bayesian Modelling of Time Dependent RFI and Transient RFI in 21cm Experiments'.*

August 2023. **XXXV General Assembly and Scientific Symposium (GASS) of the International Union of Radio Science (Union Radio Scientifique Internationale-URSI)**. Sapporo, Japan. Oral Presenter, *'Modelling Beam Uncertainties in Global 21cm Experiments through Bayesian Data Analysis.'*

June 2023. **Kavli Institute of Cosmology Focus Meeting on Astrostatistics & Astro-Machine Learning**. Cambridge, UK. Oral Presenter, *'Time-sensitive Anomaly Flagging through Likelihood Reweighting'*.

October 2022. **5th Global 21-cm Workshop**. Berkeley, California, USA / Online. Oral Presenter, *'Parameterised Modelling of Antenna Beams for Global 21cm Experiments'*.

May 2022. **'The Early Universe (from Cosmic Dawn through the First Galaxies to the End of Reionization)', Kavli Science Focus Meeting.** Cambridge UK. Oral Presenter, 'Improving Foreground Modelling in Global 21cm Cosmology using Time-Dependant Data'.

April 2022. **'Observational and Theoretical 21-cm Cosmology', Kavli Science Focus Meeting.** Cambridge UK. Oral Presenter, 'Parameterised antenna modelling in Global 21cm Cosmology'.

December 2021. **Science at Low Frequencies VIII**. Online. Oral Presenter, *'An Update on the REACH experiment and its Bayesian Data Analysis Pipeline'*.

October 2021. **4th Global 21-cm Workshop**. Boulder, Colorado, USA / Online. Oral Presenter, *'Constraining Foreground Models Using Time- and Antenna- Dependent Data'*.

August 2021. **XXXIV General Assembly and Scientific Symposium (GASS) of the International Union of Radio Science (Union Radio Scientifique Internationale-URSI)**. Rome, Italy / Online. Oral Presenter, *'Using Bayesian data analysis to model systematics and inform experiment design in Global 21cm experiments'*.

March 2021. **SKA Science Conference, "A precursor view of the SKA Sky"**. Online. Poster Presenter, *'Modelling foregrounds and chromaticity via Bayesian data analysis'*. D. Anstey, W. Handley, E. de Lera Acedo.

October 2020. **3rd Global 21-cm Workshop**. Cambridge, UK / Online. Oral Presenter, *'An Update on the REACH Analysis Pipeline and its Uses in Experimental Design'*.

November 2019. **Cavendish Graduate Student Conference**. Cambridge, UK. Oral Presenter, *'Detecting the first stars with REACH: Data analysis via physics-rooted models'*.

October 2019. **2nd Global 21cm Workshop**. Montreal, Canada. Oral Presenter, *'Bayesian data analysis for REACH'*.

Chaired Sessions

September 2023. **6th Global 21cm Workshop**. Trieste, Italy. Discussion Panelist

September 2023. **6th Global 21cm Workshop**. Trieste, Italy. Session Chair.

August 2023. **XXXV General Assembly and Scientific Symposium (GASS) of the International Union of Radio Science (Union Radio Scientifique Internationale-URSI)**. Sapporo, Japan. Session Chair

October 2022. **5th Global 21-cm Workshop**. Berkeley, California, USA / Online. Session Chair.

Other Attended Conferences

November 2021. **Cavendish Graduate Student Conference**. Cambridge, UK / Online. Participant.

November 2020. **Cavendish Graduate Student Conference**. Cambridge, UK / Online. Participant.

November 2018. **Cavendish Graduate Student Conference**. Cambridge, UK. Participant.

Teaching Experience

June 2023 - August 2023	**Xinyue Pan**, Undergraduate Research Opportunities Programme (UROP) Supervisor	*University of Cambridge, Cambridge, UK*
October 2022 - present	**Christian Kirkham**, PhD Supervisor	*University of Cambridge, Cambridge, UK*
October 2022 - present	**Joe Pattison**, PhD Supervisor	*University of Cambridge, Cambridge, UK*
October 2018 - June 2022	**Natural Sciences Tripos 1A**, Laboratory Demonstrator - Assisting Undergraduate students with practical laboratory classes	*University of Cambridge, Cambridge, UK*

Research Experience

University of Cambridge - Dept of Physics *Cambridge, UK*

Advisor: Dr. Eloy de Lera Acedo *July. 2022 - present*

- Research Associate in SKA simulations
- Description: The Square Kilometre Array (SKA) is a very large scale radio telescope currently under design and construction. I perform computer simulations of the SKA1-LOW phased array/interferometer instrument in order to assist its development and construction.

University of Cambridge - Dept of Physics *Cambridge, UK*

Advisor: Dr. Eloy de Lera Acedo *Oct. 2018 - 2022*

- PhD Thesis: "Data Analysis in Global 21cm Experiments: Physically Motivated Bayesian Modelling Techniques"
- Description: The hydrogen 21cm emission line can used to probe the epochs of the early universe, primarily the Cosmic Dawn and Epoch of Reionisation. I developed methods for reliably identifying signals of the hydrogen 21cm line from beneath large foreground signals and chromatic distortions of the antenna, for use in the experiment REACH (Radio Experiment for the Analysis of Cosmic Hydrogen). I also applied these methods on simulated data to help guide the design of the antenna used in REACH.

University of Cambridge - Dept of Physics *Cambridge, UK*

Advisor: Prof. Paul Alexander *2017-2018*

- MSci Dissertation: "Designing a Radio Telescope for Observing the Transient Sky"
- Description: I studied what was a relatively recently discovered astrophysical phenomenon known as Fast Radio Bursts (FRB) and produced a possible design for a radio telescope optimised for the detection of FRBs in order to help achieve sufficiently accurate and numerous measurements to make reliable identifications of their properties.

Outreach & Professional Development

Service and Outreach

February 2023	**Development in Africa with Radio Astronomy (DARA) 2023 Workshop**, Lecturer	*University of Stellenbosch*
September 2019	**Physics at Work 2019**, Volunteer Presenter	*University of Cambridge*

Conference Committees

6th Global 21-cm Workshop, 2023, Organising Committee Member.

3rd Global 21-cm Workshop, 2020, Local Organising Committee Member.

Cavendish Graduate Student Conference, 2020, Organising Committee Chair.

References

Dr Eloy de Lera Acedo	**University of Cambridge**, ed330@cam.ac.uk
Dr Will Handley	**University of Cambridge, Kavli Institute of Cosmology**, wh260@cam.ac.uk