Dr Ian Harrison

Personal Details

Nationality: UK
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School of Physics and Astronomy,
Cardiff University,
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Employment

from Apr 2025	Lecturer, *Cardiff University*
Feb 2024 - Mar 2025	Research Fellow, *Cardiff University*
Sep 2021 - Jan 2024	Research Associate, *Cardiff University*
May 2021 - Aug 2021	Postdoctoral Research Assistant, *University of Oxford*
Oct 2013 - Apr 2021	Research Associate, *The University of Manchester*

- with Professor Sarah Bridle *Jul 2018 - Apr 2021*
- with Professor Michael Brown *Oct 2013 - Jul 2018*

Visiting Positions

Apr 2021 - Present	Visiting Researcher, *The University of Manchester*
Jul 2018 - Apr 2021	Postdoctoral Research Fellow (Visiting), *University of Oxford*

Education

Oct 2010 - Sep 2013	**Cardiff University**, PhD in Astrophysics Thesis: *'Cosmology with Extreme Galaxy Clusters'* Supervisor: Professor Peter Coles
Oct 2006 - Jun 2010	**Imperial College London**, MSci Physics with Theoretical Physics (First class with Honours)

Research Profile

- Theoretical and observational cosmologist working across multiple wavebands: Cosmic Microwave Background (CMB), optical, radio, gravitational waves.
- Focus on cross-correlations between probes and novel, open data analysis.
- Co-lead of LT (Likelihood and Theory) working group for the Simons Observatory CMB experiment.
- World expert on weak lensing cosmology with radio data.
- Extensive experience of optical weak lensing and photometric redshift estimation.
- Expert on inference from images and visibilities with next generation radio telescopes.
- Extensive experience of Bayesian and ML-enhanced data analysis methods.
- Strongly committed to setting new standards for open and reproducible scientific software.
- Strong record of scientific service, research student supervision, lecturing and public engagement.

Leadership

Co-lead, Simons Observatory LT (Likelihood and Theory) Working Group. Co-leader of the group (∼10 people) developing the SOLikeT likelihood code for producing SO science results, with a particular focus on cross-correlations between probes. — 2022 - present

Member, UK SKAO Science Committee. Member of the UKSKAOSC group (∼10 people) acting as a liason between the UK science community and the SKAO organisation constructing and operating the telescope. — 2023 - present

Chair, SKAO weak lensing Focus Group. Leadership of the group (∼10 people) developing the scientific case and techniques for weak lensing surveys with the Square Kilometre Array, with significant interaction with the organisation building the telescope and on commensality with other science cases (co-chair before 2020). — 2015 - present

Core Team member, SKAO Cosmology Science Working Group. Core Team (∼10 people) member co-ordinating the full working group (∼100 people) making the cosmology science case for the Square Kilometre Array.	2015 - present
SuperCLASS *e*-MERLIN Legacy Survey. Lead multiple analysis efforts and regularly chair telecons and coordinate publications within the collaboration (∼30 people).	2013 - present
Founding member, SkyPy forward modelling collaboration. Developing international collaboration (currently ∼10 people) to create a coherent and open software framework for forward modelling of astrophysical data across multiple wavelengths.	2019 - present
Early Career Scientist Representative, DES. Representative for early career scientists within the Dark Energy Survey collaboration, organising seminars, workshops and collaboration meeting events.	2018 - 2021
Instigator, Oxford VR Public Engagement Programme. Instigated programme of virtual reality development in the Department of Physics. Wrote successful funding proposal, purchased and co-ordinated use of equipment and organise and delivered workshops on VR for public engagement.	2018 - 2020

Professional Experience

Mentorship: DES Collaboration Mentor Scheme (2020-2021); BBSTEM Mentor Scheme (2022 – present).
Meeting organisation: RAS Specialist Discussion Meeting 2024 (Organiser); NAM 2023 (SOC); DES Collaboration Meetings (2021, 2020); NAM 2021, EWASS/NAM 2018 (session co-organiser); STFC Astronomy Summer School 2017 (LOC); Techniques for Radio Weak Lensing 2014 (LOC/SOC chair).

Grant proposal reviews: STFC Small Award (2023); ERC Synergy Grant (2020); RAS Fellowships (2017).

Journal reviews: PASP (2017 – present); MNRAS (2012 – present); OJAp (2022 – present); JCAP (2023 – present); ApJ (2023 – present).

Time allocation reviews: DiRAC HPC resource (2020 – present); *e*-MERLIN radio telescope (2014).

Invited Talks

Invited Conference Talks

CASTLE Cosmology Synergies Meeting, Tagliolo, Italy (2018)

Invited Seminars/Colloquia

University of Durham, UK (October 2023); ETH Zurich, Switzerland (March 2022); University of Sussex, UK (December 2020); Durham University, UK (August 2020); University College London, UK (Feb 2020); AEI Hannover, Germany (May 2019); Queen Mary University of London, UK (May 2019); MSSL, University College London, UK (Feb 2018); Royal Observatory Edinburgh, UK (Jan 2018); Queen Mary University of London, UK (Nov 2017); ICG Portsmouth, UK (Nov 2018); SKA Organisation, Cape Town, South Africa (Nov 2015); University of Sussex, UK (Nov 2013); Bristol University, UK (May 2013); BIPAC, University of Oxford, UK (Feb 2012)

Contributed talks and posters at over 20 other national and international conferences since 2011.

Funding Awards

2019	Oxford PER Seed Fund *Virtual Reality in Astronomy Outreach* (Co-PI, GBP2800)
2015	SKA Astrocompute in the Cloud *Batch Visibility Simulations for RadioGREAT* (Co-PI, USD5400)
2015	RadioNet WP3 *RadioGREAT Collaboration Meeting* (Co-PI, EUR2000)
2014	RadioNet WP4 *Techniques for Radio Weak Lensing Meeting* (Co-PI, EUR2000)

Collaboration membership

CMB: Simons Observatory (SO); Atacama Cosmology Telescope (ACT)

Optical: Dark Energy Survey (DES, Builder status)

Radio: SKAO Cosmology Science Working Group; SKAO Gravitational Waves Science Working Group; SuperCLASS (e-MERLIN legacy survey); MIGHTEE, MeerKLASS (MeerKAT legacy surveys)

Cross-waveband: SkyPy (astrophysics forward modelling collaboration)

Teaching Experience

Deputy Module Organiser, PX1224: Computational Skills for Problem Solving, Cardiff. Assist delivery and administration of first year undergraduate practical computing course. — 2023 - present

Lecturer, Physics Postgraduate Lectures, Cardiff. Developed and delivered postgraduate course on Statistics and Data Analysis. 6 hours of lectures to ∼30 students. — Spring 2023

Lecturer, Summer Institute at Oriel College, Oxford. Developed and delivered a final year undergraduate-level course on cosmology. 12 hours of lectures to ∼30 students. **Student feedback rating of 4.71/5 (94%)** — Aug 2019

Lecturer, JBCA Autumn Computing Sessions. Developed and delivered two lectures on Bayesian methods in cosmology for ∼20 PhD students. — 2018 - 2020

Teaching Assistant. Laboratory demonstrator for computing and maths classes for physics undergraduates. — 2010 - 2016

Student Supervision

	PhD students
2018 - 2021	Juan Pablo Cordero Garayar, *Redshift distribution uncertainty in weak lensing cosmology* (now postdoc)
2016 - 2020	Thomas Hillier, *Advances in Radio Weak Lensing*
2014 - 2017	Ben Tunbridge, *Combining Optical and Radio Weak Gravitational Lensing*
	MSc students
2022 - 2023	Adline Braggs, *Polarisation Images of a Weak Lensing Galaxy Super Cluster*
2021 - 2022	Abhishek Karkola & Marc Vina Bertran (now PhD), *Updating Gravitaional Wave Constraints on Modified Gravity*
2015 - 2016	Nialh McCallum, *Contaminating Radio Weak Lensing with AGN* (since PhD)
	Undergraduate summer project students
2017	Max Thapa, *Virtual Reality in Astronomy Outreach*
2016	James Stringer, *A Model Interferometer for SKA Outreach* (since PhD)
2014	Susana Fernandez, *Shape Measurement in Radio Images*
2013	Chris Lovell, *The Largest Voids in the Universe* (now Fellow)

Public Engagement

Over 25 public engagement science events (co-ordination, content creation and delivery) since 2009, including TV appearance (BBC Newsround) and multiple high-profile podcast (Jodcast, Pythagorean Astronomy) appearances. Lead development of two outreach activities: VR Universe and Physical Pynterferometer interferometry demonstrator, including developing VR training programme for researchers to develop future activities.

Publication Record

Total publications/inc. preprints: 72/80, First and joint first author: 11
Highest cited paper: 260, highest cited first author: 57, h-index: 33
Source: SAO/NASA Astrophysics Data System (ADS)
`https://bit.ly/ianh_ads`

Notes on papers:
Large collaboration papers for which I am in the alphabetised tier of authors are counted in citation statistics but not listed individually here.

2023

Shaikh, S. and **Harrison, I.** et al. (Dual corresponding authorship), MNRAS submitted. arXiv:2309.04412
Cosmology from Cross-Correlation of ACT-DR4 CMB Lensing and DES-Y3 Cosmic Shear

Madhavacheril, M. S., et al inc. **Harrison, I.**, MNRAS accepted. arXiv:2304.05203
The Atacama Cosmology Telescope: DR6 Gravitational Lensing Map and Cosmological Parameters

Qu, F. J., et al inc. **Harrison, I.**, MNRAS accepted. arXiv:2304.05202
The Atacama Cosmology Telescope: A Measurement of the DR6 CMB Lensing Power Spectrum and its Implications for Structure Growth

Lovell, C. C., **Harrison, I.**, Harikane, Y., Tacchella, S., Wilkins, S. M., MNRAS 518 2511 (2023). arXiv:2208.10479
Extreme Value Statistics of the Halo and Stellar Mass Distributions at High Redshift: are JWST Results in Tension with ΛCDM?

Myles, J., and Gruen, D. et al inc. **Harrison, I.**, MNRAS 519 1792 (2023). arXiv:2210.03130
Mapping variations of redshift distributions with probability integral transforms

2022

Cordero, J. P. and **Harrison, I.** et al. (Dual corresponding authorship), MNRAS 511 2170 (2022). arXiv:2109.09636
Dark Energy Survey Year 3 results: Marginalisation over redshift distribution uncertainties using ranking of discrete realisations

Hartley, W. G., Choi, A., Amon, A., Gruendl, R. A., Sheldon, E., **Harrison, I.**, Bernstein, G. M., Sevilla-Norba, I., Yanny, B., Eckert, K., Diehl, H. T. et al, MNRAS 509 3547 (2022). arXiv:2012.12824
Dark Energy Survey Year 3 Results: Deep Field Optical + Near-Infrared Images and Catalogue

2021

Amara, A. et al (SkyPy Collaboration inc. **Harrison, I.**), Journal of Open Source Software 6 3056 (2021). arXiv:2109.06172
SkyPy: A Package for Modelling the Universe

Lemos, P. et al. inc. **Harrison, I.**, MNRAS 505 6179 (2021). arXiv:2012.09554
Assessing tension metrics with Dark Energy Survey and Planck data

Gatti, M., Sheldon, E., Amon, A., Becker, M., Troxel, M., Choi, A., Doux, C., MacCrann, N., Navarro Alsina, A., **Harrison, I.**, Gruen, D., Bernstein, G., Jarvis, M., Secco, L. F., Ferte, A., Shin, T., McCullough, J., Rollins, R. P., Chen, R., Chang, C., Pandey, S., Tutusaus, I., Prat, J., Elvin-Poole, J., Sanchex, C. et al, MNRAS 504 4312. arXiv:2011.03408
Dark Energy Survey Year 3 Results: Weak Lensing Shape Catalogue

Baker, T. and **Harrison, I.**, (Joint first authorship) JCAP 01 068 (2021). arXiv:2007.13791
Constraining Scalar-Tensor Modified Gravity with Gravitational Wave and Large Scale Structure Surveys

Jarvis, M., Bernstein, G. M., Amon, A., Davis, C., Léget, P. F., Bechtol, K., **Harrison, I.**, Gatti, M., Roodman, A. et al, MNRAS 501 1282 (2021). arXiv:2011.03409
Dark Energy Survey Year 3 Results: Point-Spread Function Modeling

2020

Gatti, M. et al. inc. **Harrison, I.**, MNRAS 498 4060 (2020). arXiv:1911.05568
Dark Energy Survey Year 3 results: cosmology with moments of weak lensing mass maps - validation on simulations

Tessore, N. and **Harrison, I.**, OJA 3 6 (2020). arXiv:2003.11558
Source Distributions of Cosmic Shear Surveys in Efficiency Space

Harrison, I., Brown, M. L., Tunbridge, B., Thomas, D. B., Hillier, T., Thomson, A. P., Whittaker, L. et al., MNRAS 495 1737 (2020). arXiv:2003.01736
SuperCLASS – III. Weak lensing from radio and optical observations in Data Release 1

Manning, S. M. et al. inc. **Harrison, I.**, MNRAS 495 1724 (2020). arXiv:2003.01735
SuperCLASS – II: Photometric Redshifts and Characteristics of Spatially-Resolved uJy Radio Sources

Battye, R. A., Brown, M. L., Casey, C. M., **Harrison, I.**, Jackson, N. J., Smail, I., Watson, R. A. et al., MNRAS 495 1706 (2020). arXiv:2003.01734
SuperCLASS – I. The Super CLuster Assisted Shear Survey: Project overview and Data Release 1.

Bacon, D. J., Battye, R. A., Bull, P., Camera, S., Ferreira, P. G., **Harrison, I.**, Parkinson, D., Poutsidou, A., Santos, M. G., Wolz, L. et al., PASA 37 e007 (2020). arXiv:1811.02743
Cosmology with Square Kilometre Array Phase 1 – Red Book 2018: Technical specifications and performance forecasts

Weltman, A. et al. inc. **Harrison, I.**, PASA 37 e002 (2020). arXiv:1810.02680
Fundamental physics with the Square Kilometre Array

2019

Hillier, T., Brown, M. L., **Harrison, I.**, Whittaker, L., MNRAS 488 5420 (2019). arXiv:1810.01220
Radio Weak Lensing with 3 GHz JVLA COSMOS Observations

Cunnington, S., **Harrison, I.**, Pourtsidou, A., Bacon, D., MNRAS 482 3341 (2019). arXiv:1805.04498
HI Intensity Mapping for Clustering-Based Redshift Estimation

Rivi, M., Lochner, M., Balan, S. T., **Harrison, I.**, Abdalla, F. B., MNRAS 482 1096 (2019). arXiv:1805.06799
Radio Galaxy Shape Measurement with Hamiltonian Monte Carlo in the Visibility Domain

Bonaldi, A., Bonato, M., Galluzzi, V., **Harrison, I.**, Massardi, M., Kay, S., De Zotti, G., Brown, M. L., MNRAS 482 2 (2019). arXiv:1805.05222
The Tiered Radio Extragalactic Continuum Simulation (T-RECS)

2018

Bull, P., **Harrison, I.**, Huff, E., ASP 517, 7, 803 (2018). arXiv:1806.08339
Weak gravitational lensing with CO galaxies

Riseley, C. J., SuperCLASS Collaboration inc. **Harrison, I.**, MNRAS 474 5598 (2018). arXiv:1711.11199
AMI-LA Observations of the SuperCLASS Super-cluster

2017

Camera, S., **Harrison, I.**, Bonaldi, A., Brown, M. L., MNRAS 464 4747 (2017). arXiv:1606.03451
SKA Weak Lensing III: Added Value of Multi-Wavelength Synergies for the Mitigation of Systematics

2016

Bonaldi, A., **Harrison, I.**, Camera, S., Brown, M. L. (Joint first authorship), MNRAS 463 3686 (2016). arXiv:1601.03947
SKA Weak Lensing II: Simulated Performance and Survey Design Considerations

Harrison, I., Camera, S., Zuntz, J., Brown, M. L., MNRAS 463 3674 (2016). arXiv:1601.03947
SKA Weak Lensing I: Cosmological Forecasts and the Power of Radio-Optical Cross-Correlations

Tunbridge, B., **Harrison, I.**, Brown, M. L., MNRAS 463 3339 (2016). arXiv:1607.02875
Radio-Optical Shape Correlations in the COSMOS Field

Riseley, C. J., Scaife, A. M. M., Hales, C., **Harrison, I.**, SuperCLASS Collaboration, MNRAS 462, 917 (2016). arXiv:1607.04056
Deep observations of the Super-CLASS super-cluster at 325 MHz with the GMRT: the low-frequency source catalogue

2015

Patel, P., **Harrison, I.**, Makhathini, S., Abdalla, F. B., Bacon, D. J., Brown, M. L., Jarvis, M., Smirnov, O., PoS AASKA14 30 (2015). arXiv:1501.03892
Weak Lensing Simulations for the SKA

Brown, M. L., Abdalla, F. B., Bacon, D. J., Bridle, S., Camera, S., **Harrison, I.**, Jarvis, M., Joachimi, B., Kitching, T. D., Metcalf, R. B., Miller, L., Patel, P., Pourtsidou, A., Takahashi, K., Zuntz, J. A., PoS AASKA14 23 (2015). arXiv:1501.03828
Weak Gravitational Lensing with the Square Kilometre Array

2013

Harrison, I., Hotchkiss, S., JCAP 07 022 (2013). arXiv:1210.4369
A Consistent Approach to Falsifying ΛCDM with Rare Galaxy Clusters

2012

Harrison, I., Coles, P., MNRAS 421, L19 (2012). arXiv:1111.1184
Testing Cosmology with Extreme Galaxy Clusters

2011

Harrison, I., Coles, P., MNRAS 418, L20 (2011). arXiv:1108.1358
Exact Extreme Value Statistics and the Halo Mass Function

Preprints and Technical Notes

SkyPy Collaboration inc. **Harrison, I.**, Zenodo (2020). `http://doi.org/10.5281/zenodo.3947746`
SkyPy: A Package for Modelling the Universe (Version v0.2)

Harrison, I., Brown, M. L., SKA ECP150007 (2015). arXiv:1507.06639
Gridded Visibilities to Enable Precision Cosmology with Radio Weak Lensing

Harrison, I., Lochner, M., Brown, M. L. arXiv:1704.08278
Redshifts for galaxies in radio continuum surveys from Bayesian model fitting of HI 21-cm lines