

PERSONAL DETAILS

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NATIONALITY: British

RESEARCH OVERVIEW

I am a cosmologist focusing on how surveys of large-scale structure can test our understanding of the Universe. Currently, my primary research field is HI intensity mapping where I investigate how we can constrain cosmological parameters in the presence of observational effects and systematics. Whilst I am working on pathfinder HI intensity mapping data, most of my work involves producing realistic simulations of survey data from which we can make forecasts and investigate the effects from systematics. I am also interested in the benefits to be gained from cross-correlations between optical surveys and HI intensity maps.

ACADEMIC POSITIONS

Oct 2019 - Dec 2021	Post-Doctoral Research Assistant QUEEN MARY UNIVERSITY OF LONDON Research Programme: Neutral Hydrogen intensity mapping with MeerKAT - funded by STFC grant ST/S000437/1 & UKRI Future Leaders Fellowship grant MR/S016066/1 Line Manager: Dr Alkistis Pourtsidou (Grant PI)
Dec 2021 - Apr 2022	Post-Doctoral Research Assistant THE UNIVERSITY OF EDINBURGH Research Programme: UKRI Future Leaders Fellowship grant MR/S016066/1 Line Manager: Dr Alkistis Pourtsidou (Grant PI)
Apr 2022 - Present	Post-Doctoral Research Associate THE UNIVERSITY OF MANCHESTER Research Programme: Mapping the cosmic web with neutral hydrogen during the era of the Square Kilometre Array - funded by the UKRI Future Leaders Fellowship grant Insert Grant Reference! Line Manager: Dr Laura Wolz (Grant PI)

EDUCATION

- Oct 2016 - Sep 2019 | Post-Graduate Research Student
Institute of Cosmology & Gravitation, UNIVERSITY OF PORTSMOUTH
PhD in Cosmology - 2019
Thesis: Synergies Between 21cm and Optical Redshift Surveys for Probing Large Scale Cosmic Structure
Supervisors: Prof David Bacon and Dr Alkistis Pourtsidou
- Oct 2012 - Jun 2016 | Undergraduate Student
UNIVERSITY OF SOUTHAMPTON
BSc (Hons) Physics - *First Class Honours*
BSc Final Year Project: Investigating the Shape of the Stellar-to-Halo Mass Relationship for Galaxies at a Range of Redshifts - Supervisor: Dr Francesco Shankar
- Summer 2015 | Summer Research Placement
Institute of Cosmology & Gravitation, UNIVERSITY OF PORTSMOUTH
Secured South East Physics Network (SEPnet) funding for an 8-week placement studying strong gravitational lensing, resulting in a [MNRAS publication](#).
Placement Supervisor: Dr Thomas Collett

PUBLICATIONS

17. [Detecting the power spectrum turnover with HI intensity mapping](#)
Cunnington, S., (2022)
MNRAS 512, Issue 2, May 2022, 2408–2425, arXiv:2202.13828
16. [Baryon acoustic oscillations from HI intensity mapping: the importance of cross-correlations in the monopole and quadrupole](#)
Rubiola, A., **Cunnington, S.**, Camera, S., (2021)
Submitted to MNRAS, arXiv:2111.11347
15. [Gaussian Process Regression for foreground removal in HI intensity mapping experiments](#)
Soares, P., Watkinson, C., **Cunnington, S.**, Pourtsidou, A., (2022)
MNRAS 510, Issue 4, March 2022, 5872–5890, arXiv:2105.12665
14. [HI constraints from the cross-correlation of eBOSS galaxies and Green Bank Telescope intensity maps](#)
Wolz, L., Pourtsidou, A., Masui, K., Chang, T.-C., ..., **Cunnington, S.** et al. (2022)
MNRAS 510, Issue 3, March 2022, 3495–3511, arXiv:2102.04946
13. [Measurements of the diffuse Galactic synchrotron spectral index and curvature from MeerKLASS pilot data](#)
Irfan, M. O., Bull, P., Santos, M. G., ..., **Cunnington, S.** et al., (2022)
MNRAS 509, Issue 4, February 2022, 4923–4939, arXiv:2111.08517
12. [HI intensity mapping correlation function from UNIT simulations: BAO and observationally induced anisotropy](#)
Avila, S., Vos-Ginés, B., **Cunnington, S.** et al, (2022)
MNRAS 510, Issue 1, February 2022, 292-308, arXiv:2105.10454
11. [SKAO HI Intensity Mapping: Blind Foreground Subtraction Challenge](#)
Spinelli, M., Carucci, I., **Cunnington, S.** et al., (2022)
MNRAS 509, Issue 2, January 2022, 2048–2074, arXiv:2107.10814
10. [The HI intensity mapping bispectrum including observational effects](#)
Cunnington, S., Watkinson, C., Pourtsidou, A., (2021)
MNRAS 507, Issue 2, October 2021, 1623–1639, arXiv:2010.02907
9. [21cm foregrounds and polarization leakage: a user’s guide on cleaning and mitigation strategies](#)
Cunnington, S., Irfan, M., Carucci, I., Pourtsidou, A., Bobin, J., (2021)
MNRAS 504, Issue 1, June 2021, 208–227, arXiv:2010.02907
8. [HI intensity mapping with MeerKAT: Calibration pipeline for multi-dish autocorrelation observations](#)
Wang, J., Santos, M., Bull, P., Grainge, K., **Cunnington, S.** et al. (2021)
MNRAS 505, Issue 3, May 2021, 3698-3721, arXiv:2011.13789
7. [Multipole expansion for HI intensity mapping experiments: unbiased parameter estimation](#)
Soares, P., **Cunnington, S.**, Pourtsidou, A., Blake, C., (2021)
MNRAS 502, Issue 2, January 2021, 2549–2564, arXiv:2008.12102
6. [The degeneracy between primordial non-Gaussianity and foregrounds in 21cm intensity mapping experiments](#)
Cunnington, S., Camera, S., Pourtsidou, A., (2020)
MNRAS 499, Issue 3, December 2020, 4054–4067, arXiv:2007.12126
5. [Multipole expansion for HI intensity mapping experiments: simulations and modelling](#)
Cunnington, S., Pourtsidou, A., Soares, P., Blake, C., Bacon, D., (2020)
MNRAS 496, Issue 1, July 2020, 415–433, arXiv:2002.05626
4. [Cosmology with Phase 1 of the Square Kilometre Array: Red Book 2018: Technical specifications and performance forecasts](#)
Square Kilometre Array Cosmology Science Working Group: Bacon, D., ..., **Cunnington, S.** et al. (2020)
Publ. Astron. Soc. Austral. 37, e007, March 2020, arXiv:1811.02743

3. [Impacts of Foregrounds on HI Intensity Mapping Cross-Correlations](#)
Cunnington, S., Wolz, L., Pourtsidou, A., Bacon, D., (2019)
MNRAS 488, Issue 4, October 2019, 5452–5472, arXiv:1904.01479
2. [HI Intensity Mapping for Clustering-Based Redshift Estimation](#)
Cunnington, S., Harrison, I., Pourtsidou, A., Bacon, D., (2019)
MNRAS 482, Issue 3, January 2019, 3341–3355, arXiv:1805.04498
1. [Observational Selection Biases in Time-Delay Strong Lensing and their Impact on Cosmography](#)
Collett, T., **Cunnington, S.**, (2016)
MNRAS 462, Issue 3, November 2016, 3255–3264, arXiv:1605.08341

COLLABORATIONS

In approximate descending order of active contribution

SKAO Cosmology SWG (2018 - Present)

- Co-lead for the Simulations working group, focusing on coordinating simulations for the cosmology collaboration. An active member of various focus groups within the collaboration. One of eight members developing an SKAO intensity mapping data challenge programme, the first of its kind. Contributed towards the SKAO 2018 Red Book.

MeerKLASS (2019 - Present)

- Focused on using the MeerKAT radio telescope to perform single-dish intensity mapping LSS surveys. Currently working on science verification data which is aiming to make cosmological detections in both cross- and auto-correlation, along with a host of other science goals.

Euclid (2018 - Present)

- Leading the 21cm-Euclid synergies sub-project within the Additional Probes Galaxy Clustering WP in Euclid. This has the potential to improve photometric redshift constraints and limit other systematics.

ACADEMIC TALKS PRESENTED

- Excluding presentations in collaboration telecons

Technical University of Athens - <i>Virtual Physics Colloquium</i>	19th May 21
SKAO: A Precursor View of the SKA Sky - <i>Virtual Conference</i>	18th Mar 21
SKA-Cosmology SWG Meeting - <i>Virtual Conference</i>	14th Jan 21
London Cosmology Discussion Meeting - <i>Virtual Conference</i>	19th Nov 20
SKA SWG Meeting - <i>École Normale Supérieure, Paris, France</i>	22nd Jan 20
Texas Symposium - <i>University of Portsmouth, Guildhall, Portsmouth, UK</i>	17th Dec 19
CoSyne: Cosmological Synergies - <i>Institut d'astrophysique de Paris, France</i>	11th Dec 19
Cosmology Seminar - <i>University of the Western Cape, South Africa</i>	29th Nov 19
SEPnet Student-Led Conference - <i>University of Southampton, UK</i>	4th Apr 19
Euclid UK Meeting - <i>University of Oxford, UK</i>	18th Dec 18
Cosmology Seminar - <i>Queen Mary University of London, UK</i>	7th Nov 18
Cosmology Seminar - <i>Institute of Cosmology & Gravitation, Portsmouth, UK</i>	24th Apr 18
EWASS/NAM 2018 - <i>Arena & Convention Centre (ACC), Liverpool, UK</i>	3rd Apr 18
SEPnet Student-Led Conference - <i>University of Southampton, UK</i>	22nd Mar 18
South Coast Cosmo - <i>Institute of Cosmology & Gravitation, Portsmouth, UK</i>	29th Nov 17
LSST:UK Multi-wavelength Workshop - <i>University of Cambridge, UK</i>	27th Sep 17

TEACHING & SUPERVISION

Paula S. Soares - <i>PhD Student, Queen Mary University of London</i> Assisting the supervision of PhD projects	Oct 2019 - Present
Isabelle Ye - <i>MSc Student, Queen Mary University of London</i> Assisting the supervision of Masters project	Feb 2021 - Aug 2021
Andrew Scullane - <i>MSc Student, Queen Mary University of London</i> Assisting the supervision of Masters project	Oct 2020 - Jan 2021

DEPARTMENTAL RESPONSIBILITIES

LSS Weekly Journal Club (<i>Queen Mary University of London</i>) - co-organiser	Apr 2021 - Present
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ASSESSMENT & REFEREEING

Referee for MNRAS

Feb 2020 - Present

TECHNICAL SKILLS

Coding Languages Python, C++, C, Fortran, MATLAB, Mathematica

OS and HPC Mac OS X and Unix/Linux operating systems. Regular experience with High Performance Computing (HPC) Clusters.

PUBLIC CODE

HI intensity mapping multipole expansion (*Python*) - Core Developer

→ github.com/IntensityTools/MultipoleExpansion - pipeline for measuring and modelling the HI intensity mapping power spectrum and its multipole decomposition. Provides example simulated data and investigates the impact from 21cm foreground removal and beam effects.

Gaussian Process Regression (GPR) for foreground removal (*Python*) - Contributing Developer

→ github.com/paulassoares/gpr4im - demonstrative toolkit of how GPR techniques can be used for foreground removal in HI intensity maps.

PUBLIC OUTREACH & VOLUNTEERING

- Astronomy on Tap Organiser (28th Feb 2018)
- Stargazing Live Portsmouth Volunteer (2017-2019)
- Student representative for Athena Swan Committee (2017-2019)
- Organiser for a series of University of Portsmouth Physics Staff v Students charity football matches (2017-2019)

Outreach Talks Presented:

East Sussex Astronomical Soc. - <i>Egerton Park, East Sussex, UK</i>	4th Jul 19
Chichester U3A Science Group - <i>Fishbourne Centre, West Sussex, UK</i>	24th Jun 19
The Local Group Astronomy Club - <i>Cooden Beach Hotel, East Sussex, UK</i>	12th Feb 19
Eastbourne Astronomical Soc. - <i>Willingdon Memorial Hall, East Sussex, UK</i>	6th Oct 18
Winchester Cafe Sci - <i>Winchester Discovery Centre, Hampshire, UK</i>	3rd Sep 18
The Local Group Astronomy Club - <i>Cooden Beach Hotel, East Sussex, UK</i>	8th May 18