

# Tom J. Wilson

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University of Exeter  
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## PROFESSIONAL WORK

*Senior Research Fellow*, University of Exeter, 2024-

*Postdoctoral Research Fellow*, University of Exeter, 2020-2023

Awarded two STFC grants

- Creation of software pipeline for cross-matching external photometric catalogues to LSST datasets as part of LSST:UK consortium
- Analysis of preliminary LSST datasets to ensure statistical robustness and correct for potential effects in datasets for scientific application
- Working within the Vera C. Rubin Observatory commissioning team on verifying and validating telescope astrometry, and ensuring that astrometric uncertainties produced by the LSST pipeline match observations

*Postdoctoral Researcher*, Space Telescope Science Institute, 2018-2019

STScI Director's Discretionary Research Fund

- Analysis and optimisation of supernovae survey for future *Roman* Space Telescope observing strategies
- Involved solving maximisation problem of information content analysis, and robust statistical analysis of the fitting and modelling of supernovae lightcurves
- Software development for `photutils`, an `astropy`-affiliated python package, focussing on analysis tools for PSF photometry
- Analysis of *Hubble* images for supernovae as part of the BUFFALO treasury program

## EDUCATION

*PhD in Physics*, University of Exeter, 2013-2018 — Supervisor: Prof. Tim Naylor

Awarded STFC PhD Studentship

- Explored the effects of blended stars on the astrometric and photometric properties of stars in crowded Galactic fields
- Characterisation of photometric catalogues by angular resolution and survey completeness explored, allowing for quantitative comparisons of the crowding suffered
- Analysed the effect crowding has on the *WISE* catalogue

*Master's Dissertation*, University of Exeter, 2012-2013 — Supervisor: Prof. Tim Naylor

- Analysis of young stellar cluster ages using the radiative-convective gap as a distance and extinction independent variable
- Analysis of the initial mass function, exploring effects of age/distance on masses in stellar clusters
- Characterised the effect the choice of magnitudes used in a colour-colour diagram has on the interstellar extinction-age dependency, determining the optimal CCD for age independent extinction derivations for low mass young pre-main-sequence stars

*College Summer Internship*, University of Exeter, 2012 — Supervisor: Dr Jennifer Hatchell

Awarded University College Studentship

- Work on the construction of temperature and dust  $\beta$  maps from JCMT 450 $\mu$ m and 850 $\mu$ m observations, supplemented with *Herschel* data, and analysis of NGC1333

*MPhys in Physics with Astrophysics*, First Class Honours, University of Exeter, 2009-2013

## SOFTWARE ENGINEERING

Developer for the `astropy photutils` package

- 8th highest contribution (2nd highest 2018-2020) to the community-driven, open source software
- Code tests and feature improvements, package maintenance and distribution, and documentation development

Lead developer of the `macauff` python package

- Development of computationally efficient and precise codebase to ensure accurate photometry and astrometry can be obtained for a set of cross-matched photometric catalogues
- Writing entire project end-to-end, including creation of continuous integration suite, documentation, and class-based python and fortran code

Other project highlights:

- Code for simulations of *Roman* Space Telescope supernovae lightcurves and characterisation efficiency
- Improvements to data reduction for JCMT observations, and writing of key data analysis pipeline

Main programming strengths: python (**astropy**), fortran (**openmp**), statistical analysis and application

## GRANTS AND AWARDS

2023, LINCC Frameworks Incubator Program, “Integrating Robust Cross-Matching from the LSST:UK into the LINCC Framework”, \$20,000  
2023-2025, Co-PI STFC Grant, “UK Involvement in LSST: Phase C (Exeter Component)”, £310,000  
2022, “Above and Beyond” Award, University of Exeter – extending second-year astrophysics lab experiments and converting from IRAF to Python  
2019-2023, Co-writer and lead researcher STFC Grant, “UK Involvement in LSST: Phase B (Exeter Component)”, £440,000

## FIRST-AUTHOR PUBLICATIONS

Wilson Tom J., Naylor T., in prep.; “Improvements to the Astrometric Uncertainty Function: Updated Algorithms for Astrometric Perturbations due to Unresolved Contaminants in Background-Dominated Sources and More Accurate Flux Contaminations”  
Wilson Tom J., 2023, RASTI, 2, 1; “Overcoming Separation Between Counterparts Due to Unknown Proper Motions in Catalogue Cross-Matching”  
Wilson Tom J., 2022, RNAAS, 6, 60; “A Parameterized Model for Differential Galaxy Counts at Any Wavelength”  
Wilson Tom J., 2021, RNAAS, 5, 265; “On the Use of Evidence and Goodness-of-Fit Metrics in Exoplanet Atmosphere Interpretation”  
Wilson Tom J., Naylor T., 2018, MNRAS, 481, 2148; “A Contaminant-Free Catalogue of *Gaia* DR2-*WISE* Galactic Plane Matches: Including the Effects of Crowding in the Cross-Matching of Photometric Catalogues”  
Wilson Tom J., Naylor T., 2018, MNRAS, 473, 5570; “Improving Catalogue Matching By Supplementing Astrometry with Additional Photometric Information”  
Wilson Tom J., Naylor T., 2017, MNRAS, 468, 2517; “The Effect of Unresolved Contaminant Stars on the Cross-matching of Photometric Catalogues”

## CO-AUTHOR PUBLICATIONS

Wilson A. J., Lakeland B. S., Wilson T. J., Naylor T., 2023, MNRAS, 521, 354; “A Naive Bayes Classifier for identifying Class II YSOs”  
Astropy Collaboration, ..., Wilson T. J., et al., 2022, ApJ, 935, 167; “The Astropy Project: Sustaining and Growing a Community-oriented Open-source Project and the Latest Major Release (v5.0) of the Core Package”  
Bruno G., Lewis N. K., Valenti J. A., Pagano I., Wilson T. J., et al., 2022, MNRAS, 509, 5030; “Hiding in Plain Sight: Observing Planet-Starspot Crossings with the *James Webb Space Telescope*”  
Bradley L., Sipőcz B., Robitaille T., Tollerud E., Vinícius Z., Deil C., Barbary K., Wilson T. J., et al., 2019-2022, 10.5281/zenodo.7419741; “astropy/photutils: v0.6 through v1.6.0”  
Lewis N. K., ..., Wilson T. J., et al., 2020, ApJL, 902, 19; “Into the UV: The Atmosphere of the Hot Jupiter HAT-P-41b Revealed”  
Wakeford H. R., Sing D. K., Stevenson K. B., Lewis N. K., Pirzkal N., Wilson T. J., et al., 2020, AJ, 159, 204; “Into the UV: A Precise Transmission Spectrum of HAT-P-41b Using Hubble’s WFC3/UVIS G280 Grism”  
Steinhardt C., ..., Wilson T. J., et al., 2020, ApJS, 247, 64; “The Buffalo HST Survey”  
Wakeford H. R., Wilson T. J., et al., 2019, RNAAS, 3, 7; “Exoplanet Atmosphere Forecast: Observers Should Expect Spectroscopic Transmission Features to be Muted to 33%”  
Wakeford H. R., Lewis N. K., Fowler J., Bruno G., Wilson T. J., et al., 2019, AJ, 157, 11; “Disentangling the Planet from the Star in Late-Type M Dwarfs: A Case Study of TRAPPIST-1g”  
Wakeford H. R., Sing D. K., Deming D., Lewis N. K., Goyal J., Wilson T. J., et al., 2018, AJ, 155, 29; “The Complete Transmission Spectrum of WASP-39b with a Precise Water Constraint”  
Rumble D., Hatchell J., Pattle K., Kirk H., Wilson T., et al., 2016, MNRAS, 460, 4150; “The JCMT Gould Belt Survey: Evidence for Radiative Heating and Contamination in the W40 Complex”  
Rees J., Wilson T., et al., 2016, IAUS, 314, 205; “The Age of Taurus: Environmental Effects on Disc Lifetimes”  
Hatchell J., Wilson T., et al., 2013, MNRAS, 429, 10; “The JCMT Gould Belt Survey: SCUBA-2 Observations of Radiative Feedback in NGC 1333”

## SCIENTIFIC TALKS & CONFERENCES

7 invited seminars, 6 invited conference talks,  
4 contributed seminars, 23 contributed conference talks, 5 contributed conference posters.  
October 2024, SMWL Science Collaboration, Invited Talk  
October 2024, Southampton, Invited Seminar

September 2024, LSST@Europe6, Contributed Talk  
 July 2024, Rubin Community Workshop 2024, LSST Science Collaborations Plenary, Invited Talk  
 July 2024, Rubin Community Workshop 2024, Stellar Science and Crowded Fields, Contributed Talk  
 July 2024, National Astronomy Meeting 2024, Invited Talk  
 March 2024, LINCC Tech Talk Series, Invited Talk  
 January 2024, Rubin Solar Neighborhood Ultracool Dwarfs Meeting, Contributed Talk  
 October 2023, LSST@Europe 5, Contributed Talk  
 August 2023, Rubin Project and Community Workshop 2023, Contributed Talk  
 July 2023, National Astronomy Meeting 2023, UK Involvement in LSST, Contributed Talk  
 July 2023, National Astronomy Meeting 2023, 10 years after Herschel, Contributed Talk  
 July 2023, National Astronomy Meeting 2023, Euclid exploitation in the UK, Contributed Talk  
 March 2023, 3rd TVS Software Workshop, Invited Talk  
 October 2022, LSST@Europe4, Contributed Talk  
 July 2022, National Astronomy Meeting 2022, Contributed Talk  
 July 2022, Cool Stars 21, Contributed Poster  
 June 2022, Asteroseismology MW-Gaia Workshop, Contributed Talk  
 June 2022, Bristol-Cardiff Joint Seminar Series, Invited Seminar  
 May 2022, Carnegie EPL, Invited Seminar  
 February 2022, University of Delaware, Invited Seminar  
 August 2021, Rubin Observatory Project and Community Workshop, Contributed Talk  
 July 2021, National Astronomy Meeting 2021, Contributed Talk  
 July 2021, National Astronomy Meeting 2021, Invited Talk  
 June 2021, Statistical Challenges in Modern Astronomy VII, Contributed Poster  
 May 2021, LSST:UK All-Hands Meeting, Invited Talk  
 May 2021, LSST:UK All-Hands Meeting, Contributed Talk  
 April 2021, UKEXOM 2021, Contributed Talk  
 April 2021, University of Exeter, Contributed Seminar  
 March 2021, Cool Stars 20.5, Contributed Poster  
 October 2020, RAS Specialist Meeting: TVS with Rubin Observatory, Contributed Talk  
 August 2020, Rubin Observatory Project and Community Workshop, Contributed Talk  
 July 2020, University of Exeter, Contributed Seminar  
 July 2019, Python in Astronomy 19, Contributed Talk  
 June 2019, STScI, HotSci@STScI Colloquia, Contributed Seminar  
 March 2019, STScI, Friday Science Coffee, Contributed Seminar  
 February 2019, STScI, TESS Data Workshop, Contributed Talk  
 February 2019, UNLV BUFFALO 2019 Meeting, Contributed Talk  
 May 2018, Exeter, First Year PhD Development Day, Invited Seminar  
 March 2018, Science with Precision Astrometry, Contributed Poster  
 September 2017, Cardiff Star Formation Workshop, Contributed Talk  
 July 2016, NASA Goddard Space Flight Center, Invited Seminar  
 June 2016, Cool Stars 19, Contributed Poster  
 April 2015, BECSS Bristol, Contributed Talk  
 March 2015, Milky Way Astrophysics from Wide-Field Surveys, Contributed Talk

## COMMITTEE & SERVICE

August 2023, Rubin Project and Community Workshop 2023 Crowded Fields Session, Science Organising Committee  
 May 2021, LSST:UK All-Hands Meeting, Local Organising Committee  
 June 2019, Hubble Support Scientist for Cycle 29 Time Allocation Committee  
 Peer review referee for AAS Journals and JOSS  
 LSST:UK Exec Group, ECR Representative, 2024-  
 Member of LSST Stars, Milky Way and Local Volume Science Collaboration (SMWLVSC)  
 Member of LSST SMWLVSC Crowded Stellar Field Task Force  
 Member of Vera C. Rubin Observatory SIT-Com Commissioning team (Astrometric and Crowded Field Science Units)

## TEACHING & OUTREACH EXPERIENCE

*Astrophysics Lab Re-Write Lead, 2021-*

- Spearhead updating of second year astrophysics lab course content
- Involves translating materials into a modern programming language
- Update pedagogy to ensure that students are engaging with the material in the most effective way

- Review course aims and opportunities for students to practice experimental analysis and programming skills developed in complementary modules

*Undergraduate Astrophysics Lab Demonstrator, 2013-2022*

- Assist in teaching of 20-30 second year undergraduates in the astrophysics portion of the lab
- Demonstrated use of UNIX commands, IRAF and Python, data reduction and analysis, & report writing
- Duties included report assessment and feedback
- Experiments included analysis of Cepheid variability periods, colour-magnitude diagrams, and optical spectroscopy

*Undergraduate Python Demonstrator, 2021*

- Teaching Python to approximately 30 second year undergraduates
- Demonstrating key Python and general programming skills, logical thinking, and problem solving
- Includes live assistance, technical support, and formal work marking and feedback

*Undergraduate Astrophysics Teaching Telescope Operator, 2013-2017*

- Lead undergraduate students in usage of the university's teaching telescope
- Teaching of telescope operation, as well as remote/automated capacities of ACP Scheduler
- Involved teaching an understanding of observation planning

*Undergraduate Physics Problem Tutor, 2013-2017*

- Assist in running first year undergraduate physics problems classes
- Involved organising homework sessions, managing approximately 140 students
- Provided guidance on a wide variety of problems, ranging from solid state physics to electromagnetism to astrophysics

*"Pint of Science" Event Organiser, 2013-2018*

- Co-organised the "Pint of Science" outreach events held in Exeter each year
- Events involve three nights of outreach talks from a selection of researchers, aimed at public engagement
- Included a host of responsibilities including deciding the themes for each nights' talks, inviting speakers, and organising event location
- Involved engaging with the community and answering questions from members of the public

*Observing At the James Clerk Maxwell Telescope, Hawaii, 2014*

- Experience at the JCMT as part of the JPS survey
- Involved telescope operation, data processing, and observation scheduling