

Paul James Wright

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RESEARCH SUMMARY	<p>My research interests are in solar and stellar physics, and my Ph.D. research has concentrated on one of the unsolved problems in Heliophysics – the coronal heating problem. During my Ph.D. I have gained expertise in numerous time-series analysis techniques and methods for recovering the differential emission measure (an ill-posed inverse problem) from a wide range of spectroscopic and narrowband data. I am a member of the <i>NuSTAR</i> Heliophysics working group and I led the analysis of the first solar flare observed by the <i>NuSTAR</i> hard X-ray <i>astrophysics</i> imaging spectrometer. I have also developed a stellar flare detection algorithm based on the observations obtained by the <i>Kepler</i> space telescope to determine the superflare rate of the Sun.</p>	
EDUCATION	<p>University of Glasgow, Glasgow, UK 2014 – present</p> <p>Ph.D. Solar Physics Thesis Topic: <i>The Energetics of Small Flares and Brightenings</i> Advisers: Dr Iain G. Hannah, Dr Alexander MacKinnon</p> <p>University of Southampton, Southampton, UK 2010 – 2014</p> <p>MPhys Astrophysics with a year abroad First-class honours (1:1) Adviser: Professor Malcolm Coe</p> <p>Smithsonian Astrophysical Observatory, Cambridge, MA, USA 2013 – 2014</p> <p>MPhys Astrophysics with a year abroad Thesis Topic: <i>The Superflare Rates of Solar-Like Stars</i> Advisers: Dr Steven H. Saar, Dr Jeremy J. Drake</p>	
CURRENT ACADEMIC APPOINTMENT	<p>Affiliate Staff Member, University of Glasgow 2017 – present</p> <p>SUPA School of Physics and Astronomy</p> <ul style="list-style-type: none">Using the EBTEL hydrodynamics code to model light curves from coronal loops. The parameter space of these simulations will be constrained by observations obtained during the <i>NuSTAR</i> heliophysics campaign, and these simulations will be used to test a variety of analysis techniques.	
PREVIOUS ACADEMIC APPOINTMENTS	<p>Researcher, NASA Frontier Development Lab (FDL) 2018</p> <p>SETI Institute/NASA Ames Research Center, Mountain View, CA</p> <p>Project: <i>Predicting Solar Spectral Irradiance from SDO/AIA Observations</i></p> <ul style="list-style-type: none">A selective (12% acceptance rate) 8-week applied Artificial Intelligence accelerator established to tackle knowledge gaps useful to NASA’s science and exploration goals, and humanity.Implemented Deep Learning algorithms (Convolutional Neural Networks; CNNs) such as U-Net, AlexNet and ResNet to predict disk-integrated Solar Spectral Irradiance (SSI) observed by <i>SDO/EVE</i> (MEGS-A) from high-resolution <i>SDO/AIA</i> images which share a common latent space.Predicted MEGS-A SSI with median absolute relative discrepancies of less than 1.6% using a CNN augmented with a Multi-Layer Perceptron (MLP).Used a 1x1 CNN (equivalent to an MLP) to improve the computational speed for differential emission measure (DEM) inversion. Further improvement to the resulting DEMs were obtained by training a CNN to correct the DEMs to minimise the residual between observed and synthesized SSI.Received the NASA Frontier Development Lab “Contribution to Science” award.	

PREVIOUS
ACADEMIC
APPOINTMENTS
(CONT.)

- Post-Graduate Research Assistant, University of Glasgow** 2014 – 2017
SUPA School of Physics and Astronomy
Project: *The Energetics of Small Flares and Brightenings*
- Analysed observations of the Sun with *NuSTAR*, a telescope not designed for helio-physics. These observations are the most sensitive of their kind and have resulted in numerous, wide-ranging, highly-collaborative peer-reviewed publications.
 - Analysed non-flaring coronal time-series in pursuit of signatures of the coronal heating mechanism. Techniques included time-lag analysis (cross-correlation), Fourier analysis, wavelet analysis, and local intermittency measure (LIM).
 - Studied the temperature distribution of the solar atmosphere through the recovery of an ill-posed inverse problem (the differential emission measure, DEM) using techniques such as Tikhonov regularisation, Markov-chain Monte Carlo, Spline fitting, and Sparse Inversion (by Basis Pursuit).
 - The press-release image produced from the *NuSTAR* observations obtained for Wright *et al.* 2017 was published by numerous news outlets and is one of the five iconic images from *NuSTAR*'s first five years in space.
- Primary Collaborators: Dr Iain Hannah, Dr Alexander MacKinnon, Dr Hugh Hudson, Dr Paulo Simões
- Visiting Researcher, NASA Goddard Space Flight Center (GSFC)** 2016
Heliophysics Science Division
- Explored the possibility of implementing DEM maps in the *Helioviewer* project, and their usefulness as an input for various established time-series analysis techniques.
- Collaborators: Dr Nicholeen Viall, Dr Jack Ireland
- Research Scholar, Harvard-Smithsonian Center for Astrophysics (CfA)** 2013 – 2014
Solar and Stellar X-ray Group
Project: *The Superflare Rates of Solar-Like Stars*
- Designed and implemented a sophisticated stellar flare detection routine for long-cadence (30 mins) *Kepler* data obtained from a proprietary set of spectroscopically verified solar-type stars in three open clusters.
 - A preliminary report on this work had coverage by *Science* and the *Smithsonian Magazine*.
- Collaborators: Dr Steven Saar, Dr Søren Meibom, Dr Jeremy Drake, Dr José D. do Nascimento Jr, Dr Vinay Kashyap
- Summer Research Intern, University of Southampton** 2013
Astronomy Group
- Investigated the presence of double blue straggler sequences in globular clusters using Hubble Space Telescope (ACS, WFPC2) data.
- Collaborators: Dr Andrea Dieball

REFEREED
JOURNAL
PUBLICATIONS

- [1] Marsh, A. J., Smith, D. M., Glesener, L. *et al* 2017. *First NuSTAR Limits on Quiet Sun Hard X-Ray Transient Events*, *ApJ*, 849, 131
- [2] Wang, J., Simões, P. J. A., Jeffrey, N. L. S. *et al* 2017. *Observations of Reconnection Flows in a Flare on The Solar Disk*, *ApJL*, 847, L1
- [3] **Wright, P. J.**, Hannah, I. G., Grefenstette, B. W., *et al* 2017. *Microflare Heating of a Solar Active Region Observed with NuSTAR, Hinode/XRT, and SDO/AIA*, *ApJ*, 844, 132
- [4] Kuhar, M., Krucker, S., Hannah, I. G., *et al* 2017. *Evidence of Significant Energy Input in the Late Phase of a Solar Flare from NuSTAR X-ray Observations*, *ApJ*, 835, 6

FIRST AUTHOR PUBLICATIONS IN PREPARATION (WORKING TITLES)	[5] Wright, P. J. , MacKinnon, A., Hannah, I. G., and Simões, P. J. A. 2019. <i>Local Intermittency Measure: The Application to Active Region Light Curves</i>	
	[6] Wright, P. J. , Hannah, I. G., Viall, N. M., <i>et al</i> 2019. <i>The Thermal Time Evolution of Active Regions Determined by SDO/AIA</i>	
	[7] Wright, P. J. , Saar, S. H., Meibom, S., <i>et al</i> 2019. <i>The Age-Dependent Superflare Rates of G-Type Dwarfs In Three Kepler Clusters</i>	
	[8] Wright, P. J. , Saar, S. H., Meibom, S., <i>et al</i> 2019. <i>An Extension of The Age-Dependent Superflare Rates to F- and K-Type Dwarfs</i>	
CONFERENCES, WORKSHOPS, & SCHOOLS	Invited Oral Presentations	
	ISSI Team Meeting: Coronal Nanoflares, Bern, CH	2018
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	Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA	2014
	Oral/e-Poster Presentations	
	Living with a Star (SDO/LWS) Workshop, Ghent, Belgium	2018
	Solar Physics Division Meeting (SPD/AAS), Portland, OR, USA	2017
	Coronal Loops Workshop VIII, Palermo, Sicily, IT	2017
	Living with a Star (SDO/LWS) Workshop, Burlington, VT, USA	2016
	Hinode 10, Nagoya, JP	2016
	National Astronomy Meeting 2016, Nottingham, UK	2016
	Hinode 9, Belfast, UK	2015
	Glasgow-Cambridge Flare Workshop, Glasgow, UK	2015
	Poster Presentations	
	European Solar Physics Meeting (ESPM), Budapest, HU	2017
	Solar Physics Division Meeting (SPD/AAS), Portland, OR, USA	2017
	Living with a Star (SDO/LWS) Workshop, Burlington, VT, USA	2016
	Coronal Loops Workshop VII, Cambridge, UK	2015
	National Astronomy Meeting (NAM) 2015, Llandudno, UK	2015
	223rd AAS Meeting, National Harbor, MD, USA	2014
	Schools Attended	
	CESRA Radio Summer School 2015, Glasgow, UK	2015
	STFC Advanced Summer School in Solar Physics, Dundee, UK	2014
	Additional Conferences/Workshops Attended	
	NuSTAR Heliophysics Workshop (remote participation), Berkeley, CA, USA	2017
	SUPA Cormack Astronomy Meeting, Edinburgh, UK	2015
	Royal Astronomical Society Discussion Meeting: Results from IRIS, London, UK	2015
	SUPA Cormack Astronomy Meeting, Edinburgh, UK	2014
	1st Space Glasgow Research Conference, Glasgow, UK	2014
AWARDS AND GRANTS	University of Glasgow	
TOTAL: £7000	NASA Frontier Development Lab, Contribution to Science Award	2018
	Solar Physics Division Meeting (AAS/SPD) Student Poster Award	2017
	Solar Physics Division Meeting (AAS/SPD) Studentship Award	2017
	Coronal Loops Workshop VIII Travel Award	2017
	National Astronomical Observatory of Japan Travel Award	2016
	Hinode 9 Travel Award	2015
	European Space Agency/Cambridge Philosophical Society Travel Award	2015

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AWARDS AND GRANTS (CONT.)	University of Southampton	
	Research Scholarship	2013
	Summer Studentship Grant	2013
TEACHING	Coursera Inc.	
	“Data Scientists Toolbox” Community Mentor	2017 – present
	An invited mentor of a course in the Data Science specialisation offered by Johns Hopkins University.	
	University of Glasgow	
	Astronomy 1 Tutorial Demonstrator	2016 - 2017
	Supervised students, and marked first-year astronomy problem sets.	
	Astronomy 3/4 (Honours) Laboratory Demonstrator	2015 - 2016
	Demonstrated, supervised, and marked a number of final-year research projects covering topics such as asteroid light curves, and solar limb darkening.	
	Physics Pre-University Summer School	2015
	Taught at a pre-university school for students entering the first year of undergraduate education.	
MEMBERSHIPS	NuSTAR Heliophysics Working Group , Member	2015 – present
	International Space Science Institute (ISSI) , Young Scientist Member	2015 – present
	Member of Paola Testa’s ISSI Team: <i>New Diagnostics of Particle Acceleration in Solar Coronal Nanoflares from Chromospheric Observations and Modelling</i>	
	Royal Astronomical Society , RAS Fellow	2014 – present
COMMUNITY INVOLVEMENT	Nature Communications , Reviewer	2017 – present
	Glasgow Astronomy & Astrophysics Group Meeting , Organiser	2017
	CESRA Radio Summer School , Volunteer Organiser	2015
SCIENTIFIC OUTREACH	Glasgow Science Centre , Demonstrator	2016
	British Science Week , Demonstrator	2016
	Institute of Physics: Women and Girls in Science , Demonstrator	2016
	Scottish Television (STV) , Guest Presenter	2015
	World Wide Telescope , Ambassador	2013 – 2014
	BBC Stargazing Live , Demonstrator	2013
	So’ton Astrodome , Demonstrator	2012
	BBC Bang Goes The Theory Roadshow , Demonstrator	2012
	UK Solar Physics (UKSP) Nuggets , concise, easy-to-read science articles	
	84. The first <i>NuSTAR</i> microflare	2017
	Hinode/XRT Picture of the Week (XPOW)	
	The First Microflare Observations with <i>Hinode/XRT</i> & <i>NuSTAR</i>	2017
PERSONAL PROJECTS	ColourBlind , A repository for colour-blind-friendly colour tables.	

PROFESSIONAL DEVELOPMENT	<p>Coursera, Inc. (MOOC Platform)</p> <p>Using Coursera.org, a massive open online course (MOOC) platform, to take specialisations (a series of related courses plus a final capstone project) offered by accredited universities to further develop skills and understanding in a wide range of topics.</p> <p>Data Science, Johns Hopkins University 2017 – present Nine-course (plus capstone) introduction to data science.</p> <p>Mastering Software Development in R, Johns Hopkins University 2018 – present Four-course (plus capstone) specialisation providing rigorous training in R.</p>
TECHNICAL SKILLS:	<p><i>Computing</i>: IDL (5+ years), Python (2+ years), PyTorch, R, Bash, \LaTeX, PyCharm, IRAF, git (GitHub, Gitlab), Microsoft Office, Adobe Creative Cloud, Linux/Unix, Mac OSX, Microsoft Windows</p> <p><i>General</i>: Data Analysis, Data Visualisation, Interdisciplinary Collaboration, Public Speaking, Teaching, Writing (Technical & Lay)</p>