Dr Hannah Willett

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Profile

I am a keen experimentalist with a passion for research that can change our understanding of the universe and have a positive impact on society. The breadth and depth of my scientific experience is considerable, due to both my degree in Natural Sciences and the variety of research projects I have undertaken. During my doctoral studies at the University of York, UK, I worked with the York Linear Plasma Device, a high-vacuum plasma physics experiment, using a range of diagnostic methods (Langmuir probes, optical emission spectroscopy and fast-frame imaging). In particular, I designed and assembled a custom diagnostic instrument for use on this machine. The data analysis methods for my doctoral research focused on statistical and frequency analysis, using both Matlab and PYTHON. Additionally, I have worked with astronomical databases, and tools for analysing superconducting crystals and their composition. My experiences have given me the ability to work effectively in the laboratory, both as an independent researcher and as part of scientific collaborations. I am a proficient writer and oral communicator; I have produced numerous scientific reports and presentations, and have excelled both as a teaching assistant and as an exhibit host at multiple public outreach events. I take great pride in the quality of all my work, paying meticulous attention to detail and accuracy.

Employment and education

MeriEducation, Pasadena, CA   2018–2021
Master-level tutor for academic studies and test preparation in maths and science.

Physics tutor (self-employed)   2018
Private tutor for undergraduate students needing additional support in introductory college physics courses.

University of York, UK (Fusion Centre for Doctoral Training)   2013–2018
Ph.D. in Plasma Physics and Fusion Energy   ***Supervisor:*** *Professor Kieran Gibson*
'Applications of linear plasma device studies to the improvement of power injection and handling in tokamaks'

St. Catharine's College, University of Cambridge, UK   2009–2013
B.A. (Hons.) and M.Sci. in Natural Sciences   First class (ranked third in the year)
Specialisation: Experimental and Theoretical Physics.

Research and laboratory experience

University of York, UK   2013–2018
Doctoral research
Study of plasma physics relevant to tokamak divertors using the York Linear Plasma Device. Diagnostic techniques: Langmuir probes, optical emission spectroscopy, fast-frame camera imaging. Data analysis: PYTHON.

Australian National University   2015–2018
Doctoral research collaboration
Collaboration with Dr. Cormac Corr, working on the Magnetised Plasma Interaction Experiment (MAGPIE). Diagnostic techniques: Langmuir probes, laser photodetachment. Data analysis: Matlab.

University of York, UK   2014–2017
Teaching Assistant roles
TA for undergraduate physics laboratory classes in electronics and solid-state physics, including an experiment to determine semiconductor band gaps by measuring the absorption of near-infrared wavelengths.

University of Cambridge, UK   2013
Masters project
Project title: Crystal growth of rare earth-based cuprate superconductors
Project with Dr. Suchitra Sebastian on the growth of rare earth-based high temperature superconductors. Diagnostic techniques: SQUID magnetometer, scanning electron microscopy, energy-dispersive X-ray spectroscopy.

University of Leicester, UK   **2012**
Summer Undergraduate Research Experience programme
Project title: Further *Swift* follow-up of unidentifed X-ray sources in the *XMM-Newton* Slew Survey
6 week data analysis project with Dr. Rhaana Starling, working to identify astronomical sources observed in the slew survey of the *XMM-Newton* satellite.

California Institute of Technology   **2011**
Summer Undergraduate Research Fellow
Project title: Spectroscopic analysis of a plasma for an astrophysical jet experiment
10 week experimental and theoretical project with Prof. Paul Bellan, studying the properties of a plasma source with optical emission spectroscopy in order to improve the ionisation fraction of the plasma produced.

Laboratory skills

Operation and maintenance of high vacuum systems.

Instrument design and assembly (Langmuir probe array).

Diagnostic instrument control with a range of specialised computer software.

Experienced in the use of Langmuir probes, optical emission spectroscopy, high-speed imaging

Experience working with Class 4 lasers.

Familiarity with the use of SQUID magnetometers, scanning electron microscopy, energy-dispersive X-ray spectroscopy

Problem solving and troubleshooting to improve experimental operation.

Procurement of parts and supplies.

Familiarity with technical documents for assembly and maintenance of laboratory equipment.

Computing skills

PYTHON for data analysis applications (including matplotlib.pyplot, scipy.signal and scipy.interpolate packages; numpy FFT routines).

Matlab (data analysis applications, including curve fitting, spectral analysis, plotting routines).

Basic knowledge of LabVIEW, C++, IDL, Solid Edge and HTML.

Word processing, spreadsheet and presentation applications.

Windows and Linux operating systems.

Awards

Postgraduate

Nominated for the Teaching Assistant of the Year departmental award	*2017*
PPCF/EPS/IUPAP poster prize (43rd EPS Conference on Plasma Physics)	*2016*
EPL Presentation Award (43rd IOP Plasma Physics Group Spring Conference)	*2016*
Environmental Sustainability and Resilience Research Theme Champion's Early Career Researcher travel grant (University of York)	*2016*
Postgraduate Award for Outstanding Contribution to Outreach (University of York)	*2016*

Undergraduate

V.L.M. Lairmore prize in Physics (St Catharine's College)	*2013*
Skerne (1745) Scholarship and Book Prize (St Catharine's College)	*Yearly, 2010–2013*
Two-year Misys Charitable Foundation Scholarship	*2010*

Publications

Santoso J, **H V Willett** and C S Corr 2018. High density negative hydrogen ion production in a high power pulsed helicon discharge. *Plasma Sources Science and Technology* **27** 10LT03.

Willett H V, J Santoso, C S Corr and K J Gibson 2017. Negative ion studies on the RF plasma device MAGPIE. *Europhysics Conference Abstracts* **41F** P2.402.

Wright A J, **H V Willett** et al. 2017. The implementation of *binding blocks* in the classroom. *Physics Education* **52** 054001.

Willett H V, K J Gibson and P K Browning 2016. The role of plasma instabilities in the onset of detachment in the York Linear Plasma Device. *Europhysics Conference Abstracts* **40A** P2.042.

My work at the University of Leicester contributed to the following paper:

Starling R L C et al. 2017. Characterization of AGN from the *XMM-Newton* Slew Survey. *Monthly Notices of the Royal Astronomical Society* **468**(1) 378–388.

Conference presentations

59th APS Division of Plasma Physics meeting	*Poster*	*2017*
44th EPS Conference on Plasma Physics	*Poster*	*2017*
58th APS Division of Plasma Physics meeting	*Poster*	*2016*
43rd EPS Conference on Plasma Physics	*Prize-winning poster*	*2016*
43rd IOP Plasma Physics conference	*Prize-winning poster*	*2016*
European FuseNet Association PhD Event	*Poster*	*2015*
Fusion CDT conferences	*Talks and posters*	*2013–2017*
University of York internal student conferences	*Talks and posters*	*2013–2017*

Additional courses and training

Solid Edge Online Training   **Ongoing**
Solid Edge courses
Self-paced online 'Fundamentals' courses.

National STEM Learning Centre, UK   **2020**
'Inspiring Young People in STEM'
Series of four online short courses, focusing on developing and delivering STEM-based outreach activities for young people.

NI Online Training   **2020**
LabVIEW courses
LabVIEW Core 1, Core 2 and Core 3, and 'Data Acquisition using NI-DAQmx and LabVIEW'.

EPFL, Lausanne, Switzerland   **2014**
'Plasma diagnostics in basic plasma physics devices and tokamaks: From principles to practice'
Week-long theoretical and experimental course, mainly focusing on Langmuir and magnetic probes.

Universities of York, Oxford, Manchester, Liverpool and Durham, UK   **2013–2014**
Fusion Centre for Doctoral Training courses
Variety of experimental, computational and theoretical modules, covering plasma physics, materials science and diagnostic techniques for nuclear fusion applications (both magnetic and inertial confinement).

Communication skills

Technical communication

Technical writing
Project reports, scientific abstracts and publications, doctoral thesis.

Conference presentations
Oral and poster presentations at internal, national and international conferences, winning two poster prizes.

Fusion CDT representative
Selected to present talks and host facility tours for programme advisory board meetings and visiting academics.

Teaching roles
Extremely positive feedback from my roles as a private tutor (primary school students to undergraduates) and as a teaching assistant for undergraduate courses.

Outreach and public engagement

Secondary school talks
Informal talks and discussion sessions with groups of 15–20 A Level physics students, introducing them to the concept of fusion energy.

Sun Dome (host, presenter)
Fusion energy outreach project *Groups of 1–20, all ages*
This public engagement exhibit introduces schoolchildren and the general public to the concept of plasmas and fusion energy using a short film, question and answer sessions, and interactive demonstrations.

***Binding blocks* (host, presenter)**
Nuclear physics outreach project, fusion section leader *Groups of 1–60, all ages*
This exhibit/teaching tool introduces schoolchildren and the general public to the chart of nuclides using an interactive 3D building block model. I have used this chart to present the concept of fusion energy to secondary school teachers, and in an introductory video for the *binding blocks* YouTube channel (linked from my website).

Additional skills

Organisation

Independent approach to time management, prioritising tasks to meet deadlines for e.g. conferences.
Effective team member in planning and executing collaborative experiments.
Experience with managing and analysing large amounts of scientific data.

Teamwork and leadership

Collaborations with colleagues at York and around the world.
Numerous roles as Captain, President and Secretary of student clubs and societies.

References

Available on request.