# Dr Hannah Willett

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## Profile

I am an experimental physicist with a passion for research that can change our understanding of the universe and have a positive impact on society. I have over four years of experience in a rapidly-growing, private fusion research and development company. I have had responsibility for the spectroscopic diagnostic systems on the ST40 experimental tokamak since October 2024, overseeing team growth to ensure full hardware and analysis capability. I am a proficient writer and oral communicator, and a dedicated advocate for STEM outreach and Equity, Diversity and Inclusion initiatives, both within the company and externally.

## Employment and education

**Senior Plasma Diagnostician, Tokamak Energy, UK** **2025–**
Promotion in-role in recognition of experience and achievements.

**Plasma Diagnostician - Spectroscopy, Tokamak Energy, UK** **2021–2025**
Responsible for spectroscopy diagnostic instrumentation and analysis on the ST40 experimental tokamak.

**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

**Tokamak Energy Ltd, UK** **2021–present**
Design, assembly, installation, calibration and maintenance of a range of spectroscopic diagnsotics on the ST40 experimental tokamak. Data processing and analysis in PYTHON.

**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

Optical emission spectroscopy, X-ray crystal spectroscopy, Langmuir probes, high-speed imaging.

Instrument design, assembly, calibration and maintenance.

Diagnostic instrument control with a range of specialised computer software.

Operation and maintenance of high vacuum systems.

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.

Project management, including 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

Lucy Scott Fund award to lead Tokamak Energy's sponsorship and volunteering efforts at the West Midlands Girl Tech 2026 outreach event *2025*

Merit award for leading Pride Month activities at Tokamak Energy *2025*

Tokamak Energy High Merit performance award *2025*

**Postgraduate**

Nominated for the Teaching Assistant of the Year departmental award *2017*

PPCF/EPS/IUPAP poster prize (43$^{rd}$ EPS Conference on Plasma Physics) *2016*

EPL Presentation Award (43$^{rd}$ 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

Tanabe H et al 2026. Ion and electron heating via magnetic reconnection during merging/compression plasma startup in ST40. *Nuclear Fusion* (accepted).

Asunta O et al 2026. Overview of ST40 results and future: expanding the physics basis of high-field spherical tokamaks. *Nuclear Fusion* **66** 116004.

Anastopoulos Tzanis M S et al 2025. Integrated modeling of ST40 hot ion plasmas using the TGLF transport model. *Plasma Physics and Controlled Fusion* **67** 055022.

McNamara S A M et al 2024. Overview of recent results from the ST40 compact high-field spherical tokamak. *Nuclear Fusion* **64** 112020.

Sertoli M et al 2024. From minimum-viable-products to full models: a step-wise development of diagnostic forward models in support of design, analysis and modelling on the ST40 tokamak. *Plasma Physics and Controlled Fusion* **66** 095011.

McNamara S A M et al 2023. Achievement of ion temperatures in excess of 100 million degrees Kelvin in the compact high-field spherical tokamak ST40. *Nuclear Fusion* **63** 054002.

Wood J, B Lomanowski, E Delabie, **H V Willett**, M Sertoli and J Varje 2023. Characterisation of ion temperature and toroidal rotation on the ST40 tokamak. *Journal of Instrumentation* **18** C03019.

**Willett H V**, D Osin, G Naylor, J Wood, B Lomanowski and M Sertoli 2023. TriWaSp: a multi-faceted visible spectroscopy diagnostic on the ST40 tokamak. *Journal of Instrumentation* **18** C03023.

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.

Lovell J et al 2018. A compact, smart Langmuir Probe control module for MAST-Upgrade. *Journal of Instrumentation* **12** C11008.

**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

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| 50$^{th}$ EPS Conference on Plasma Physics | *Poster* | *2024* |
| 6$^{th}$ International Conference Frontiers in Diagnostic Technologies | *Poster* | *2022* |
| 59$^{th}$ APS Division of Plasma Physics meeting | *Poster* | *2017* |
| 44$^{th}$ EPS Conference on Plasma Physics | *Poster* | *2017* |
| 58$^{th}$ APS Division of Plasma Physics meeting | *Poster* | *2016* |

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| 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

**PPL Training** **2026**
*Competent Person Confined Spaces*
Two-day training course for safe entry into confined spaces.

**The Active Bystander Training Company** **2026**
*Active Bystander training*
1-hour workshop on active bystander techniques for dealing with challenging situations.

**Tokamak Energy** **2025**
*Interview Skills and Unconscious Bias training*
1-hour internal seminar on methods for conducting interviews fairly.

**Institution of Occupational Safety and Health** **2025**
*Managing Safely*
Three-day course on leading health and safety in the workplace.

**Aurora** **2025**
*Laser Safety Awareness*
Nine-module online course for general optical and laser radiation safety awareness.

**Solid Edge Online Training** **2021**
*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

**Fusion Industry School** **2025 & 2026**
Invited to speak about "Diagnostics and Control" in the context of fusion, as part of a training programme for delegates from the emerging fusion industry and associated supply chain.

**Girl Tech West Midlands** **2026**
Led a group of six volunteers from Tokamak Energy to run workshops and participate in a careers panel and exhibition at a regional event organised by the Ahead Partnership, which showcased a range of careers in technological fields to an audience of Year 7–9 girls.

**Oxford Ideas Festival** **2022–present**
Volunteer on the Tokamak Energy stand, engaging members of the public on the topic of fusion and the work the company does.

**Tokamak Energy tour host** **2021–present**
Regular host of tours of the Tokamak Energy ST40 experiment for external visitors, including high-profile delegations from UK and overseas governments.

**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

Project management of multiple concurrent work packages.
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 and around the world.
Numerous roles as Captain, President and Secretary of student clubs and societies.

## References

Available on request.