



# Tom Farley

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*I am an experimental plasma physicist interested in the study of the tokamak scrape-off layer. I have experience analysing visible and infra-red camera data for the study of particle and energy transport respectively. I also have hands on experience working on small scale RF plasma experiments performing Langmuir probe measurements.*

## Education

*PhD*

**Fusion Centre for Doctoral Training (Fusion CDT),** **2013–**  
*University of Liverpool, PhD student.*

- Received a broad grounding in fusion research through taught courses at The University of York:
  - Courses included MCF and ICF relevant plasma physics, diagnostic techniques, data analysis, materials science, statistics, high performance computing and project management.
  - Will qualify for the FuseNet Certificate of Doctoral Training.

## *Integrated Masters*

**Masters in Physics with Industrial Experience (F305),** **2009–2013**  
*The University of Bristol, First Class Honours.*

- 12 month placement at the Culham Centre for Fusion Energy in IR thermography on JET.
- Masters project in density functional theory resulted in a publication.
- Received letters of commendation from the head of the School of Physics in 1<sup>st</sup> and 2<sup>nd</sup> years and a project commendation for my MSci project.

## Research Experience

*PhD*

**Visual camera measurements of filamentary transport in MAST,** **Jan 2016–**  
*Culham Centre for Fusion Energy.*

- Developed the Elzar suite of analysis tools for the identification, measurement and tracking of plasma filaments in fast camera data.
- Applied pseudo Langmuir probe techniques to fast camera analysis for like with like comparison to large body of literature.
- Joined trip to the HL-2A tokamak in Chengdu, China performing reciprocating probe measurements of the effects of fuelling on scrape-off layer profiles.
- Performed experiential work for PPCF paper [4] and assisted in [2].

**Measurements of negative ion surface production from diamond materials,** **Jan–March 2015**

*PIIM Laboratory, Aix-Marseilles University, Marseilles, France.*

- Measured negative ions produced upon positive ion bombardment of diamond surfaces with a mass spectrometer and energy analyser.
- Performed first of a kind measurements of monocrystalline diamond and extensively characterised temperature dependent properties of nanocrystalline diamond, contributing to publication [1].

## **Characterisation of Small Negative Ion Facility,**

**Sep–Dec 2014**

*Culham Centre for Fusion Energy.*

- Commissioned the Langmuir probe and high resolution visible spectrometer diagnostics on the Small Negative Ion Facility (SNIF).
- Identified and fixed RF earthing issues, improving performance of the plasma source.
- Performed spectroscopic measurements of the ion source plasma composition, contributing to publication [3].

## **Langmuir probe and laser photo-detachment measurements of electronegative plasmas,**

**March–Sep 2014**

*University of Liverpool.*

- Performed laser photo-detachment measurements of negative ion density in oxygen and hydrogen magnetron plasmas under various conditions.
- Performed langmuir probe measurements of plasma density and temperature in a weakly magnetised plasma.

## *Masters Project*

## **DFT calculations of the superconducting properties of the YIr<sub>2</sub>Si<sub>2</sub> polymorphs,**

**Sep 2012–Sep 2013**

*University of Bristol.*

- Performed Density Functional Theory (DFT) *ab initio* calculations of the band structure and Fermi surface properties of the polymorphs of YIr<sub>2</sub>Si<sub>2</sub>.
- Predicted a superconducting transition temperature of  $T_c = 2.58\text{K}$  explained by intermediate-strength conventional electron-phonon coupling, resulting in a publication [5].

## *Undergraduate*

## **Infra-red measurements of scrape-off layer power decay length in JET,**

**Aug 2011–Aug 2012**

*Culham Centre for Fusion Energy.*

- Developed the tools required to measure the plasma scrape-off layer power decay length from infra-red images of the interior of the JET tokamak.
- Analysed a large dedicated pulse database, the results of which led to a publication in Nuclear Fusion [6] and were presented by my supervisor at the 2012 IAEA conference [7].
- Tools are now used by others and have initiated similar measurements on the COMPASS tokamak.

## Publications

- [1] G. Cartry, D. Kogut, K. Achkasov, J.-M. Layet, T. Farley, A. Gicquel, J. Achard, O. Brinza, et al. *Alternative solutions to caesium in negative-ion sources: a study of negative-ion surface production on diamond in H<sub>2</sub>/D<sub>2</sub> plasmas*. New J. Phys., **19** (2):25010 (2017).
- [2] N. R. Walkden, F. Militello, J. Harrison, T. Farley, S. Silburn, and J. Young. *Identification of intermittent transport in the scrape-off layer of MAST through high speed imaging*. Nucl. Mater. Energy, **12**:175–180 (2017). ISSN 23521791. doi:10.1016/j.nme.2016.10.024.
- [3] J. Zacks, U. Fantz, T. Farley, I. Turner, R. McAdams, and D. Wunderlich. *Characterisation of the SNIF ion source*. AIP Conf. Proc., **1869** (1):30047 (2017). ISSN 15517616. doi:10.1063/1.4995767.
- [4] F. Militello, N. R. Walkden, T. Farley, W. A. Gracias, J. Olsen, F. Riva, L. Easy, N. Fedorczak, et al. *Multi-code analysis of scrape-off layer filament dynamics in MAST*. Plasma Phys. Control. Fusion, **58** (10):105002 (2016). ISSN 13616587. doi:10.1088/0741-3335/58/10/105002.
- [5] D. Billington, S. S. Nickau, T. Farley, J. J. Ward, R. Sperring, T. Millichamp, D. Ernsting, and S. Dugdale. *Electron-Phonon Coupling and Superconducting Critical Temperature of the YIr<sub>2</sub>Si<sub>2</sub> and LaIr<sub>2</sub>Si<sub>2</sub> High-Temperature Polymorphs from First-Principles*. J. Phys. Soc. Japan, **83** (4):1–5 (2014). ISSN 13474073 00319015. doi:10.7566/JPSJ.83.044710.
- [6] G. Arnoux, T. Farley, C. Silva, S. Devaux, M. Firdaouss, D. Frigione, R. J. Goldston, J. Gunn, et al. *Scrape-off layer properties of ITER-like limiter start-up plasmas in JET*. Nucl. Fusion, **53** (7) (2013). ISSN 00295515. doi:10.1088/0029-5515/53/7/073016.
- [7] G. Arnoux, T. Farley, C. Silva, S. Devaux, M. Firdaouss, D. Frigione, R. Goldston, J. Gunn, et al. *Scrape-off Layer Properties of ITER-like Limiter Start-up Plasmas at JET*. In *24th IAEA Fusion Energy Conf. Proc.*, pages EX/P5–37. San Diego, USA (2012).
- [8] I. Nunes, V. Riccardo, P. J. Lomas, P. D. Vries, D. Alves, G. Arnoux, S. Devaux, and T. Farley. *Be tile power handling and main wall protection*. In *24th IAEA Fusion Energy Conf.*, pages CN–197. San Diego, USA (2012).

## Conferences and Workshops

### Oral

**Fusion Frontiers and Interfaces Workshop, York,** **May 2017**  
Fast Camera Analysis of Plasma Filaments.

### Posters

**59th Annual Meeting of the APS Division of Plasma Physics,** **Oct 2017**  
*Milwaukee, Wisconsin, USA,*  
Fast Camera Analysis of Plasma Filaments.

**44th IOP Plasma Physics Conference, Oxford, UK,** **April 2017**  
An Algorithm for the Analysis of Filaments in Fast Camera Data.

**Fusion Frontiers and Interfaces Workshop, York, UK,** **May 2016**  
Pseudo Langmuir Probe Analysis of Filaments in MAST Using Fast Cameras.

**FuseNet PhD Workshop, Lisbon, Portugal,** **Nov 2014**  
The SNIFF Caesium Free Negative Ion Source.

**4th International Symposium on Negative Ions, Beams and Sources,** **Oct 2014**  
*IPP Garching, Germany,*  
Caesium Free Negative Ion Sources.

**Fusion Frontiers and Interfaces Workshop, York, UK,** **May 2014**  
Laser Photo-detachment Measurements of Negative Ion Density.

## Responsibilities

### Groups

**Software Developers Working Group**, *Member of the Culham Software Developers Working Group (SDWG).* **2017–**  
Site wide body responsible for coordinating resources for software developers.

### Meetings

**Coding Discussion Group**, *Founder and coordinator of the Culham Coding Discussion Group (CDG).* **2017–**  
Fortnightly meetings with online resources to share programming knowledge, expertise and resources.

### Supervision

**Masters student**, Supervised masters student from University of Rome, Italy **4 months**  
working on filament tracking for masters project.  
**Undergraduate project**, Supervised 3rd year undergraduate student from **3 months**  
University of Cagliari, Italy working on filament detection for BSc project.

### Outreach

**MAST-U tours**: Frequently lead MAST-U tours for visitors, open evening and open day attendees.  
**GCSE work experience**: Supervised GCSE work experience student on placement at CCFE.  
**Sun dome**: Helped with sun dome science workshop at local primary school.

## Key Competencies

- **Experimental experience**
  - Experience working with RF plasma sources, compressed gas, vacuum systems and pumps and lasers.
  - Experience performing plasma measurements with langmuir probes, mass spectrometers and visible spectrometers.
- **Programming experience**
  - Experienced python programmer, applying OOP, TDD and HPC principals.
  - Experience with C, IDL and MATLAB.
  - Familiarity with C++, Bash scripting, Perl, Visual Basic and Fortran.
  - Experienced user of git version control and the the  $\text{\LaTeX}$  typesetting language.
- **Organisational skills**
  - Excellent organisational skill, drawing up plans, maintaining detailed records and managing time effectively.
- **Communication skills**
  - Communicate technical information in a competent and accessible manner, both verbally and in writing.
  - Perform well in a team, integrating readily into different teams and environments.

## Affiliations

Member of the **Institute of Physics**. **2013–**  
Member of the **American Physical Society**. **2017–**

## References

### *Professor James Bradley*

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### *Dr James Harrison*

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